Rheology of Suspensions and the impact of Cellulose Nanocrystals as additives

by

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Author’s Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Suspensions, as complex fluids, embody a fascinating interplay of solid particles within a liquid medium, presenting a diverse range of viscosity behaviors. Unlike simple Newtonian fluids, suspensions exhibit non-linear responses to applied forces, owing to interactions between dispersed particles and the surrounding solvent. Their viscosity can vary significantly with factors such as shape and size of particle, surface chemistry and concentration. Understanding the rheological properties of suspensions is crucial across industries like pharmaceuticals, cosmetics, paints, and food processing, where their flow behavior dictates product quality and performance.

The research examines the consistent rheological characteristics of suspensions containing solid particles thickened by cellulose nanocrystals. Two distinct types and sizes of particles are utilized in preparing the suspensions: TG hollow spheres with a Sauter mean diameter of 69 μm and Solospheres S-32 with a Sauter mean diameter of 14 μm. The concentration of nanocrystals ranges from 0 to 3.5 wt%, while the particle concentration varies from 0 to 57.2 vol%. Additionally, the study investigates the impact of salt (NaCl) concentration upto 2 wt% and pH varying from 3 to 11 on suspension rheology. Generally, the suspensions display shear-thinning behavior, with a more pronounced effect observed in suspensions containing smaller particles. Experimental viscosity data conform well to a power-law model, with variations in flow behavior index and consistency index and under different conditions being thoroughly examined and discussed.

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Dedication

I would like to dedicate this thesis to my husband, Ajay Kumar, who made it possible for me to conduct my research. His unconditional love has been my cornerstone at every step. I am thankful for my babies, Vedant and Madhav Krishna, whose giggles made it easier to sail through hard days. I am eternally grateful to my parents, Prashanth Pattath and Raji Pattath, and my sister, Dr. Parvathi Pattath, for their innumerable sacrifices and constant encouragement. I would also like to express my deepest appreciation to my in-laws, Sasikumar and Lata Kumar, for their love and affection.

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Chapter 1

Introduction

1.1 Background

TG hollow spheres are microscopic spherical particles composed of a thermoplastic material made from biobased polymers, featuring a hollow cavity that can be filled with various substances or remain empty depending on the application. The shell of these hollow spheres is made from a thermoplastic polymer that can be melted and reshaped when heated and solidified upon cooling. Their diameter ranges from a few micrometers to several millimeters, depending on the intended use. Due to their hollow nature, these spheres are extremely lightweight, making them useful in applications where reducing weight is crucial. Adding TG hollow spheres to materials can improve mechanical properties, thermal insulation, and reduce weight without compromising strength.[1] [2]

Sphere One's Extendospheres which are the particles used in the study, are hollow ceramic spheres characterized by low density and high strength, enabling formulators to lower the weight and overall cost of finished products. Compatible with most resins and cements, Extendospheres offer several advantages, including enhanced material flow, resistance to sagging and slumping, reduced shrinkage and warpage, improved impact resistance, better sound and thermal insulation, and environmental friendliness.[3]

TG extendospheres serves as a cost-effective alternative to heavier components by offering a tightly controlled particle size distribution. Ideal for use in sealants, latex flooring, roofing compounds, adhesives, caulks, these spheres help lower raw material costs and reduce density on an equivalent volume basis.[3]

Sphere One Solospheres are robust ceramic microspheres designed to withstand high temperatures and resist corrosion, making them ideal for demanding applications requiring durability and strength. Their spherical morphology facilitates shear thinning in liquid formulations, helping to lower VOC content and increase filler capacity. Solospheres integrate effortlessly into plastics through high-intensity mixing or dispersion processes. Their distinctive properties make them versatile for numerous uses, including corrosion and abrasion resistance, flame retardant and refractory castings, coatings, self-leveling cements, and various other applications.

For optimal dispersion of Sphere One Solospheres, it is recommended to add them along with other aggregates during the mixing stage. In plastics, Solospheres disperse effectively in high intensity mixing or dispersion systems and should be introduced early in the process to ensure maximum dispersion.



Figure 1 Extendosphere TG



Figure 2 Solosphere

Since the particles in suspensions usually have a density that is different from the medium used for suspending, thickening the matrix is necessary to reduce separation. To achieve this, thickeners or substances are added which can modify the rheological properties of the matrix phase. As per Stokes' law, the settling velocity (UtU_tUt) of a particle can be found from:

$$U_t = \frac{(\rho_p - \rho) g d_p^2}{18\mu} \quad (1)$$

Where, ρ_p is the particle density U_t is the terminal settling velocity, , d_p is the particle diameter, g is the acceleration due to gravity and μ and ρ and are the viscosity and density of the fluid, respectively. Consequently, increasing the viscosity of the matrix fluid and decreasing the particle diameter can effectively reduce particle sedimentation, provided that the density difference between the matrix s and the fluid fluid remains constant. [4]

Recently, nanocrystalline cellulose (NCC) has gained significant attention as a rheology modifier or thickening agent for the matrix phase, owing to its surface charge and high aspect ratio of the nanocrystals. [5] Nanocrystalline cellulose, is an emerging, cost-effective nanomaterial with numerous applications.

1.2 Background on Cellulose Nanocrystals (CNC)

Cellulose nanocrystals (CNCs) are emerging as versatile nanomaterials derived from cellulose, the most abundant organic polymer on Earth sourced from plants like wood, cotton, and agricultural residues. These nanocrystals are typically produced through controlled acid hydrolysis of cellulose fibers, resulting in nanoparticles with diameters typically ranging from 3 to 50 nm and lengths up to several hundred nanometers. The nanocrystals exhibit a highly crystalline structure with glucose units aligned parallel along their longitudinal axis, imparting

exceptional mechanical properties such as high tensile strength and stiffness that rival or surpass many synthetic fibers and nanomaterials.[5] [6]

CNCs are notable for their biodegradability and biocompatibility, making them environmentally friendly alternatives to petroleum-based materials. Derived from renewable resources, they offer sustainable advantages across various industries. Their surface chemistry allows for facile functionalization, enabling attachment of different functional groups, polymers, or nanoparticles to tailor their properties for specific applications. This versatility extends their compatibility with diverse matrices and enhances their utility in fields ranging from biomedical to industrial applications. [19-21]

In applications, CNCs are widely employed as reinforcing agents in composite materials, enhancing mechanical performance in automotive, aerospace, and packaging sectors. They contribute to the development of lightweight, high-performance materials crucial for advanced technologies. Additionally, CNCs find use in biomedical applications such as drug delivery systems, tissue engineering scaffolds, and wound healing materials due to their biocompatibility and ability to facilitate controlled drug release. Their rheological properties, including shear-thinning behavior and stability in dispersions, further broaden their application scope in coatings, films, and other formulations requiring viscosity control and stability. [10] [11-13]

Ongoing research in CNCs continues to explore innovative synthesis methods, scalable production techniques, and novel applications in emerging technologies such as electronics, photonics, and energy storage. Furthermore, studies focus on evaluating their environmental impact and sustainability throughout their lifecycle, underscoring the importance of these renewable nanomaterials in advancing sustainable technologies and materials science.[14]

1.3 Methods of production of CNC

The production of cellulose nanocrystals (CNCs) typically involves several well-established methods, with acid hydrolysis being the most common. In acid hydrolysis, cellulose fibers are treated with strong acids, such as sulfuric or hydrochloric acid, which preferentially hydrolyze the amorphous regions of the cellulose, leaving behind the crystalline regions. This process results in the release of nanocrystals, which are then purified through processes such as centrifugation and dialysis to remove excess acid and other by-products. [15-17] Another method involves enzymatic hydrolysis, where specific enzymes are used to break down the amorphous regions of cellulose selectively. This method is milder and more environmentally friendly compared to acid hydrolysis. Additionally, mechanical processes like high-pressure homogenization and ultrasonic treatment can be employed to produce CNCs by breaking down cellulose fibers into nanoscale particles through intense mechanical forces. Each method offers distinct advantages and is chosen based on factors like desired CNC properties, cost, scalability, and environmental considerations. [18] [19]

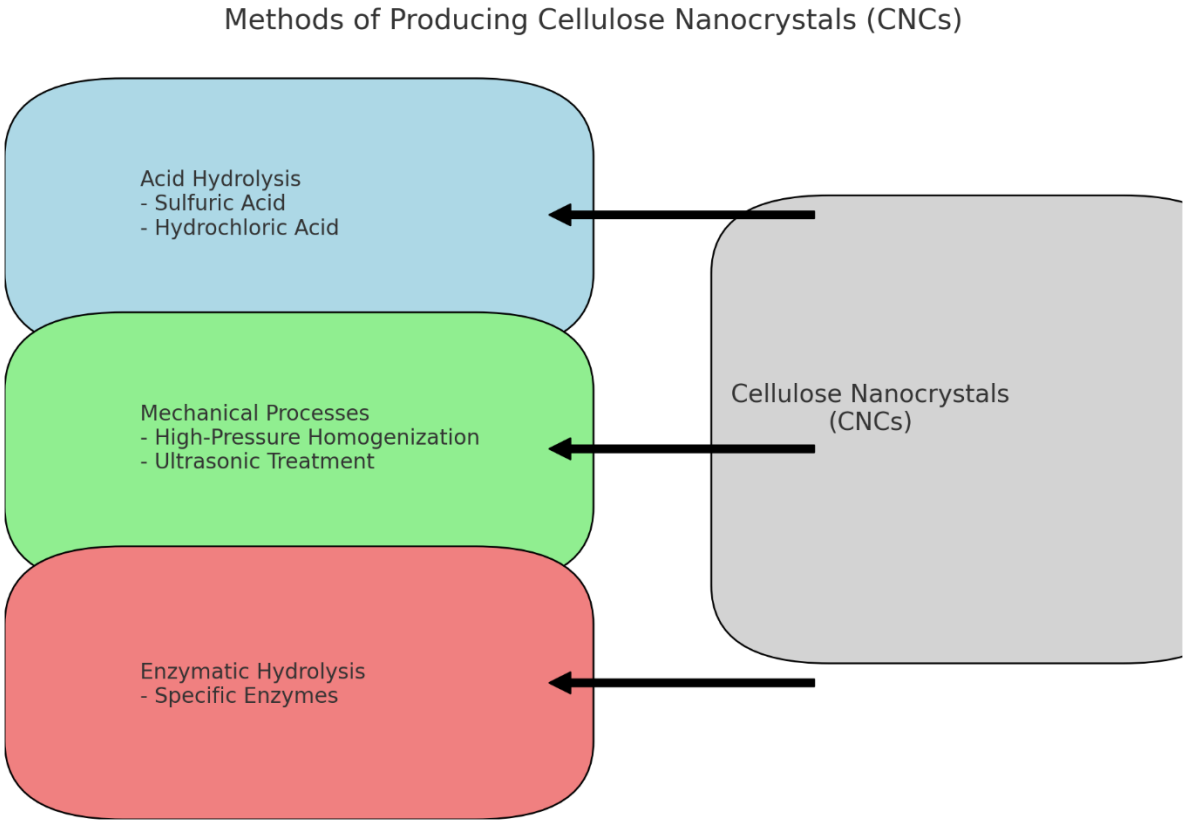


Figure 3 Production methods of CNC

Chapter 2

Literature Review

2.1 Study of Rheology and its importance

The study of rheology involves experimental techniques and instruments designed to characterize the flow and deformation behavior of materials. Rheometers and viscometers are primary tools used to measure rheological properties. Rheometers can apply different types of stress and strain to a material and measure its response, providing detailed insights into its flow and deformation characteristics. Viscometers specifically measure the viscosity of fluids under various conditions.[20]

Rheological studies often involve examining how materials behave under different shear rates, temperatures, and pressures. By understanding these behaviors, scientists and engineers can predict how materials will perform in real-world applications. Rheological measurements are crucial in formulating products and optimizing processes in various industries, including food, pharmaceuticals, cosmetics, and polymers. Advanced rheological techniques also explore the thixotropic (time-dependent shear thinning) and dilatant (shear thickening) properties of complex fluids.[21] [22]

Rheology plays a vital role in numerous industries and scientific disciplines. In the food industry, rheology is essential for developing products with desired textures and consistencies, such as sauces, dressings, and dairy products. It helps ensure that products have the right mouthfeel and stability during processing and storage. In pharmaceuticals, rheology is critical for the formulation of drugs, affecting how they are processed, administered, and how they release active ingredients. [23-25]

Rheology is also important in everyday consumer products. In cosmetics, rheological properties influence the application and feel of products like lotions, creams, and gels. Ensuring that these products spread easily and feel pleasant on the skin is a direct result of rheological studies. Overall, rheology is a critical field that bridges fundamental science and practical applications. By understanding the flow and deformation behavior of materials, scientists and engineers can design and optimize products and processes across a wide range of industries, enhancing performance, quality, and user experience.[26]

Suspensions, which consist of solid particles dispersed in a liquid medium, are ubiquitous in various industrial applications, including pharmaceuticals, food, cosmetics, and coatings. Understanding their rheological properties is crucial for optimizing their performance and stability. Recently, cellulose nanocrystals (CNCs) have emerged as effective additives to modify the rheological behavior of suspensions. Additionally, the incorporation of salts can further influence these properties, offering a versatile approach to tuning suspension characteristics.[2] [27]

CNCs are rod-like nanoparticles derived from cellulose, typically through acid hydrolysis. Their key properties include high crystallinity, which provides significant mechanical strength; surface functionalization, which allows for interaction with various matrices; a high aspect ratio, which facilitates the formation of a percolating network in suspensions; and biodegradability and biocompatibility, ensuring environmental sustainability and safety for biomedical applications.[19]

CNCs can significantly alter the viscosity of suspensions, often inducing shear-thinning behavior, where viscosity decreases with increasing shear rate. This property is beneficial for applications requiring easy processing and stable storage. [28] Due to their high aspect ratio and surface interactions, CNCs can form a network structure in suspensions, leading to gel-like behavior even at low concentrations. Additionally, CNCs improve the stability of suspensions by preventing particle settling and aggregation through steric hindrance and electrostatic repulsion. [29]

The addition of salts affects the ionic strength of the suspension, which in turn influences the Debye length, the scale over which charge screening occurs. Higher ionic strength can compress the electrical double layer around particles, altering interparticle interactions. Salt can modulate electrostatic interactions between CNCs and other particles in the suspension. Depending on the type and concentration of salt, these interactions can either enhance or reduce the stability and viscosity of the suspension. The presence of salts can affect the thixotropic behavior (time-dependent shear thinning) and gelation properties of CNC suspensions. Specific salts can induce or disrupt gel formation, depending on their concentration and valency.[30] [31]

The combination of CNCs and salts can produce synergistic effects, leading to more pronounced changes in rheological properties than either component alone. For example, salts can enhance the gelation properties of CNCs by promoting stronger interparticle interactions. By varying the concentration of CNCs and salts, formulators can precisely tune the viscosity, stability, and flow behavior of suspensions to meet specific application requirements. In pharmaceuticals, CNCs and salts can be used to optimize drug delivery systems, ensuring appropriate flow properties and stability. In the food industry, they can be used to modify texture and consistency, enhancing product quality and shelf-life.[32] [9]

Achieving uniform dispersion of CNCs and salts in various matrices remains a challenge, requiring advanced functionalization techniques. Developing cost-effective and scalable production methods for CNCs and their composites with salts is also crucial. Enhancing the ability to tailor the surface chemistry of CNCs for specific applications without compromising their inherent properties is another area of focus. Future research will likely address these challenges, with particular attention to scalable production, novel functionalization techniques, and expanding the range of applications in various industries.[33]

2.3 Flow Behaviour of suspension

The flow and rheology of suspensions are key topics in understanding the behavior of materials where solid particles are dispersed in a fluid medium. Rheology, the study of the flow of matter, is particularly concerned with the deformation and flow behavior of suspensions under applied forces. The flow behavior of suspensions can be categorized into Newtonian and non-Newtonian fluids. Newtonian fluids have a constant viscosity, regardless of the applied shear rate. In contrast, non-Newtonian fluids exhibit a viscosity that changes with the shear rate. Most suspensions exhibit non-Newtonian behavior due to the interactions between the dispersed particles and the fluid medium.[34]

At low particle concentrations, suspensions often behave like Newtonian fluids. However, as the particle concentration increases, particle-particle interactions become more significant, leading to complex flow behavior. This is often described using various rheological models.

The viscosity (η) of a suspension is a fundamental rheological property and is influenced by factors such as particle concentration, size, shape, and the viscosity of the suspending medium. For dilute suspensions, Einstein's equation can describe the viscosity:

$$\eta = \eta_o(1 + 2.5\phi) \quad (2)$$

where η denotes the suspension viscosity, $\eta_o$denotes the viscosity of the plain fluid, and ϕ is denoting the volume fraction of the dispersed particles.

For more concentrated suspensions, interactions between particles lead to deviations from Einstein's equation. In these cases, the Krieger-Dougherty equation is often used:

$$\eta = \eta_o(1 - \frac{\phi}{\phi_m})^{-2.5\phi_m} \quad (3)$$

where ϕ_m denotes maximum packing fraction of the particles. This equation accounts for the increased viscosity as particle concentration approaches the maximum packing fraction.

Shear-thinning and shear-thickening behaviors are common in suspensions. Shear-thinning is phenomenon where viscosity decreases with an increase in shear rate, this can be given by the power-law equation:

$$\eta = k\gamma^{n-1} \quad (4)$$

Where γ denotes the shear rate η denotes the viscosity, n denotes the flow behavior index, k denotes the consistency index, , and for shear-thinning η is less than 1.[36] [37]

Shear-thickening, where viscosity increases with increasing shear rate, is often observed in suspensions with high particle concentrations or specific particle interactions. The behavior can be complex and is less easily modeled by simple equations.

Table 2 Power- Law Index Values [7]

Power-Law Index (n)	**Flow Behavior**	**Description**
n<1	Shear-Thinning (Pseudoplastic)	Viscosity reduces with shear rate rising
n=1	Newtonian	Viscosity does not change even if the shear rate does
n>1	Shear-Thickening (Dilatant)	Viscosity rises with shear rate

2.3 Rheology of cellulose nanocrystal in the suspension

The nano sized cellulose crystals have a rod-like shape formed from hydrolysing the cellulose using acid. These nanocrystals have garnered plenty of attention due to their many special properties, such as strength, low density, and biodegradability. Among their many applications, one area that stands out is their impact on the rheological properties of suspensions. Rheology is crucial in understanding the behavior of CNC suspensions, which can influence their use in various industries, including pharmaceuticals, food, cosmetics, and materials science.[37]

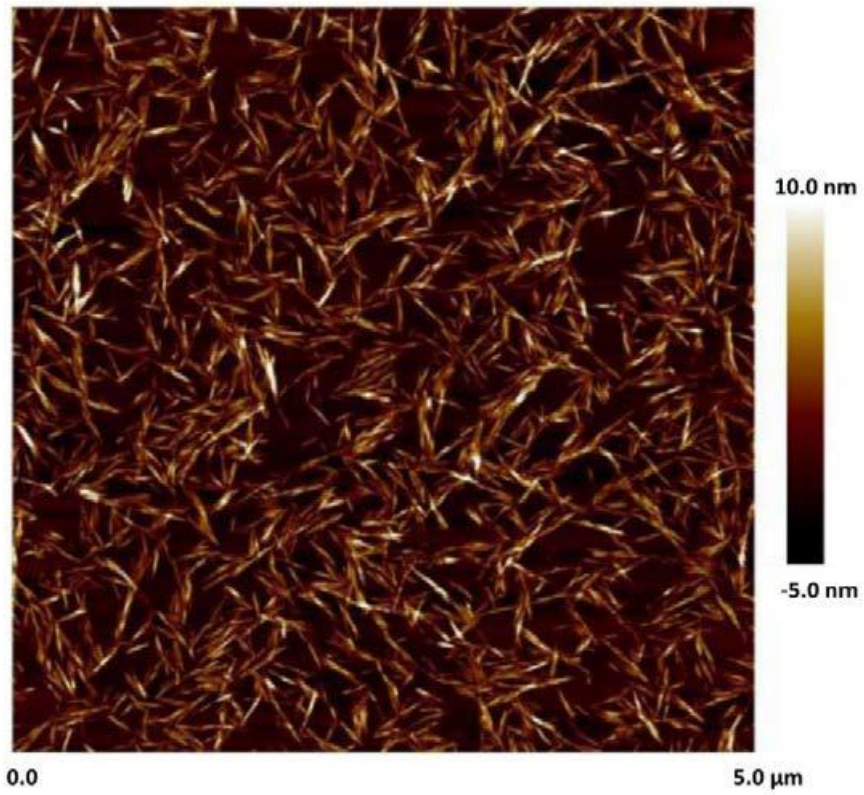


Figure 4 AFM image of NCC [2]

2.3.1 Rheological Behavior of CNC Suspensions

CNCs can dramatically alter the rheology of suspensions, primarily due to their high aspect ratio and surface chemistry. When dispersed in a solvent, CNCs can form a percolating network, significantly affecting the suspension's viscosity and viscoelastic properties. At low concentrations, CNC suspensions typically display Newtonian behavior, which is essentially the viscosity does not change regardless of the shear rate that is applied on it. However, as the concentration of CNCs increases, the suspension often transitions to shear-thinning behavior. This means that the viscosity comes down with higher shear rate, a desirable property in many applications such as coatings and inks, where ease of application and stability are crucial.

2.3.2 Influence of Concentration and Aspect Ratio

The concentration of CNCs in a suspension is a critical factor influencing its rheological properties. At low concentrations, CNCs are well-dispersed and do not interact significantly with each other. As the concentration increases, the nanocrystals begin to interact more frequently, leading to the network structure being formed. This network causes the viscosity to rise and the emergence of viscoelastic behavior, where the suspension exhibits both solid-like and liquid-like properties. The aspect ratio of CNCs also plays a significant role. Higher aspect ratio CNCs can form stronger and more extensive networks, leading to more pronounced changes in rheological behavior.[38]

2.3.3 Effect of Surface Chemistry

The surface chemistry of CNCs can be tailored to match their interactions with the surrounding medium and other particles in the suspension. For instance, surface modification with hydrophilic or hydrophobic groups can enhance the compatibility of CNCs with different solvents and polymers. Such modifications can either promote or hinder the formation of networks within the suspension, thereby altering its rheological properties. For example, CNCs modified with carboxyl or sulfate groups tend to have enhanced dispersion stability in aqueous media, leading to more pronounced shear-thinning behavior and higher viscosities at given concentrations compared to unmodified CNCs.[39]

2.3.4 Temperature and Ionic Strength

Temperature and ionic strength are external factors that can significantly influence the rheology of CNC suspensions. Temperature changes can affect the solubility and interaction of CNCs with the solvent, leading to variations in viscosity. Generally, increasing temperature reduces the viscosity of CNC suspensions by decreasing the interaction forces between the nanocrystals. Ionic strength, on the other hand, can screen electrostatic interactions between charged CNCs, thereby affecting their dispersion and network formation. High ionic strength can lead to aggregation of CNCs, resulting in increased viscosity and gel-like behavior, while low ionic strength maintains better dispersion and lower viscosity.[40]

2.3.5 Implications

The tunable rheological properties of CNC suspensions have numerous practical implications. In the food industry, CNCs can be used as thickeners or stabilizers in products like sauces and dressings, where specific flow characteristics are desired. In pharmaceuticals, CNC suspensions can enhance the delivery and stability of drugs by controlling the release profiles and improving the suspension stability of active ingredients. In materials science, CNCs can be introduced into polymer composites to enhance their mechanical properties and processability. Understanding and controlling the rheology of CNC suspensions is therefore important for improving their performance in these applications.

Cellulose nanocrystals significantly influence the rheological properties of suspensions, offering the ability to tailor viscosity, viscoelasticity, and flow behavior through careful control of concentration, aspect ratio, surface chemistry, temperature, and ionic strength. The unique properties of CNCs make them valuable in various industrial applications, where precise control over suspension behavior is essential. As research continues to advance in this field, the potential for CNCs to revolutionize materials and processes across multiple industries remains vast and promising.[41]

2.4 Effect of Salt on CNC dispersions

When salt is added to a CNC suspension, it dissociates into ions that interact with the charged surfaces of the CNCs. This process, known as electrostatic screening, reduces the repulsive forces between CNCs by compressing the electrical double layer. As a result, CNCs can approach each other more closely, leading to changes in suspension stability and behavior. [42]

2.4.1 Electrostatic Stabilization of CNC Suspensions

CNCs typically carry a negative surface charge, which arises from sulfate or carboxylate groups introduced during the hydrolysis process. This surface charge generates an electrical double layer around each CNC, consisting of a tightly bound layer of counter-ions and a diffuse layer of more loosely associated ions. The repulsive electrostatic forces between these charged layers help to stabilize the suspension by preventing CNCs from coming too close and aggregating. [43]

2.4.2 Phenomenon of Critical Coagulation Concentration

The salt content at which significant aggregation of CNCs occurs is termed the critical coagulation concentration (CCC). Below the CCC, the electrostatic repulsion between CNCs is sufficient to maintain a stable suspension. As the salt concentration approaches the CCC, the electrostatic repulsion is reduced and Van der waals forces causes aggregation. [43]

2.4.3 DLVO Theory and CNC Suspensions

The behavior of CNC suspensions in the presence of salt can be explained using the Derjaguin-Landau-Verwey-Overbeek theory also called DLVO. According to this theory, the total interactive energy between particles in a suspension is the total sum of repulsive electrostatic forces and attractive van der Waals forces. In the presence of salt, the electrostatic repulsion is weakened, reducing the energy barrier that prevents aggregation. Once this barrier is sufficiently low, CNCs can aggregate, leading to destabilization of the suspension.[44]

2.4.4 Impact on Rheological Properties

The addition of salt to CNC suspensions can also impact their rheological properties. At low salt concentrations, the CNCs remain well-dispersed, and the suspension exhibits typical colloidal behavior with low viscosity. As the salt concentration increases and approaches the CCC, the CNCs begin to aggregate, forming larger clusters. This aggregation increases the suspension's viscosity and can lead to a gel-like network, causing shear-thinning behavior.[2]

2.4.5 Self-Assembly and Liquid Crystalline Phases

CNCs have a propensity to form liquid crystalline phases due to their charge on surface and high aspect ratio. The addition of salt can influence this self-assembly process by altering the electrostatic interactions between CNCs. At low salt concentrations, CNCs can form stable chiral nematic phases, characterized by a helical arrangement. As the salt concentration increases, the reduced electrostatic repulsion can disrupt this ordered structure, leading to the formation of isotropic or disordered phases.[38]

2.4.6 Practical Implications

Understanding the effect of salt on CNC suspensions is necessary for various applications. In the field of nanocomposites, controlling the dispersion and stability of CNCs is essential for achieving desired mechanical properties. In biomedical applications, where CNCs are used for drug delivery or as scaffolds, maintaining stable suspensions is critical for their performance. Additionally, in the food and cosmetic industries, the rheological properties of CNC suspensions can be tailored by adjusting the salt concentration to achieve specific textures and stability. The addition of salt to cellulose nanocrystal suspensions has a profound impact on their stability, rheological properties, and self-assembly behavior. By reducing the electrostatic repulsion between CNCs, salt promotes aggregation and changes in the suspension's structure and viscosity. Learning about these effects is essential for optimizing the effectiveness of CNC suspensions in several industrial and scientific applications.[45]

Chapter 3

Materials and Methods

3.1 Materials

In this study two types of particles were used. One is hollow and spherical and has low-density, and it is called Extendosphere. The Sauter mean diameter of Extendosphere is measured at 69 μm. The other is solid and spherical particles. It is called Solosphere S-32. The mean Sauter mean diameter of this was measured 14 μm. These materials were procured from Sphere One, Inc., at Chattanooga, Tennessee. The Extendospheres TG hollow particles are lightweight yet strong ceramic particles commonly employed in latex flooring sealants, caulks, roofing materials, adhesives, etc. In contrast, Solospheres S-32 are generally used in the production of gaskets, anti-skid floor coatings, insulative roof coatings, cementitious coatings, naval cements, chemical resistance coatings, etc.

CelluForce Inc., based in Windsor, Canada, supplied Cellulose nanocrystals. They have trade name NCC NCV100-NASD90. The images of these crystals can be seen in Figure 4. The crystals are obtained from wood pulp. A hydrolysis process is undergone with sulfuric acid. The rod shape of crystals are evident in these AFM images. [3]

3.2 Making of the Dispersions of Cellulose Nanocrystals

Cellulose nanocrystal (NCC) dispersions were formulated at ambient temperature (approximately 23°C) by gradually adding a measured quantity of NCC to a specific volume of deionized water. The mixture was continuously stirred using a homogenizer set at a constant speed. This process ensured thorough dispersion and homogenization of the nanocrystals, which required a minimum of 60 minutes.

A total of six NCC dispersions with varying concentrations (0.25, 0.50, 1.0, 1.5, 2.5, and 3.5 wt%) were prepared.



Figure 5 Preparation of CNC Dispersion using Homogenization

3.3 Making of Suspensions of Solid Particles in CNC Dispersion

Suspensions are made at 23 degree Celsius by mixing a known quantity of both particles and CNC dispersion. The fluids were gently stirred using a homogenizer during the particle addition process to ensure consistent mixing. After the particles were fully integrated into the CNC dispersion, the suspension underwent high-speed homogenization for a minimum of 30 minutes.

Salt was added to the aqueous phase with CNC and water, after measuring the quantity required to achieve a desirable weight percentage. This was again mixed for a minimum of 30 minutes using the homogenizer. The solid particles were added considering the salt and CNC in water mixture as the aqueous phase. Every mixture is thoroughly mixed using the homogenizer as shown in the Figure 5.

To elevate the particle concentration in the suspension, an additional measured quantity of particles was gradually added to an already lower concentration suspension. This mixture was then homogenized at high speed for another 30 minutes, ensuring thorough and uniform dispersion of the particles throughout the suspension.

3.4 Measurements

The size distribution of cellulose nanocrystals (NCC) was assessed. This was done by using Dynamic Light Scattering (DLS) method with a Zetasizer Nano ZS90. These systems are from from Malvern Instruments Ltd, Worcester, UK. Measurements were performed on samples comprising a highly dilute dispersion of NCC in water, tested in ZEN0112 low-volume disposable sizing cuvettes at 25°C. Each sample underwent a 120-second of time for equilibration period before analysis commenced.

The rheological data was using Fann and Hakke Viscometer. Fann visometer is the Figure 6. It has 2 coaxial cylinders with different spring constants. Hakke Viscometer has 2 different bobs. Haake allows more range of viscosity range measurements. More information about the viscometers are detailed in Table 2. All viscosity measurements were conducted at room temperature (approximately 23°C).

The Fann Viscometer (Model 35A), depicted in Figure 6, operates as a coaxial cylindrical viscometer with a setup that includes both an inner and an outer cylinder submerged in the fluid solution. The inner cylinder remains fixed, while the outer cylinder rotates at 12 selectable speeds, ranging from 0.9 to 600 rpm. When the outer cylinder rotates, it generates a drag force on the fluid confined between the two cylinders, which is registered as torque on the bob. This torque is then read on an analog dial, representing the shear stress. Using this dial reading and known shear rate values, the velocity of the fluid can be calculated.



Figure 6 Fann Viscometer

The Haake Viscometer (Rotovisco® The viscometer, illustrated in Figure 7, features a coaxial cylindrical configuration with a bob comprising inner and outer cylinders arranged in an annular space filled with the solution. In this design, the outer cylinder is stationary, while the inner cylinder rotates at 30 selectable speeds from 0.01 to 512 rpm. As it rotates, the inner cylinder transfers momentum to the fluid, creating torque that reflects the fluid's flow resistance. This torque, which is proportional to viscosity, is used to determine viscosity, shear rate, and shear stress based on the bob's geometry, set speed, and measured torque. Equipped with a digital screen for display, the viscometer supports various bobs; in this study, two specific bobs—MV I and MV III—were used to measure viscosity under varying conditions and sample types.



Figure 7 Haake Viscometer

Table 3 Dimensions of the viscometers utilized in this study [7]

Viscometer	**Inner cylinder radius, R_i**	**Outer cylinder radius, R_o**	**Length of inner cylinder**	**Gap-width**
Fann 35A/SR-12 (low torsion spring constant)	1.72 cm	1.84 cm	3.8 cm	0.12 cm
Fann 35A (high torsion spring constant)	1.72 cm	1.84 cm	3.8 cm	0.12 cm
Haake Roto-visco RV 12 with MV I	2.00 cm	2.1 cm	6.0 cm	0.10 cm
Haake Roto-visco RV 12 with MV II	1.84 cm	2.1 cm	6.0 cm	0.26 cm

Using a Zeiss optical microscope with transmitted light, photomicrographs of TG hollow spheres and Solospheres S-32 particles were captured to analyze particle size distribution and mean diameter. For imaging, a dilute suspension of the particles was prepared in deionized water and examined under the microscope. Meanwhile, pH measurements were taken with a Fisher Scientific accumet AE150 pH meter, which was equipped with both a pH temperature

electrode. This configuration enabled simultaneous pH and temperature readings, as illustrated in Figure 8.



Figure 8 Fisher scientific accumet AE150 pH meter

Chapter 4

Results and Discussion

4.1 Physical Appearance of Particle suspensions

The suspensions were prepared by homogenizing the solid particles in the aqueous phase. The Extendospheres were seen to sediment with slight creaming when its suspension was made in water. As the concentration increased to over 50 wt%, the suspension presented a thick consistency with very little fluidity. However, with Cellulose Nanocrystals in water aqueous phase, the suspension was more stable, and sedimentation is absent. When salt is added to this suspension, it presents a stable suspension with more fluidity than seen with same concentrations in water or CNC in water.

Similarly, for Solospheres in water, sedimentation is more distinct with no creaming. With CNC. There is no sedimentation observed, and the suspension stabilises. With salt, we can see the fluidity improves for solosphere suspension.

4.2 Rheology of CNC Dispersions

Once all the suspensions were made, the viscosity was measured using the viscometers and the data was analysed. From the analysis it was evident that at CNC concentration less than 0.5 wt% the suspension acted like a Newtonian fluid with a constant viscosity, see Figure 9.

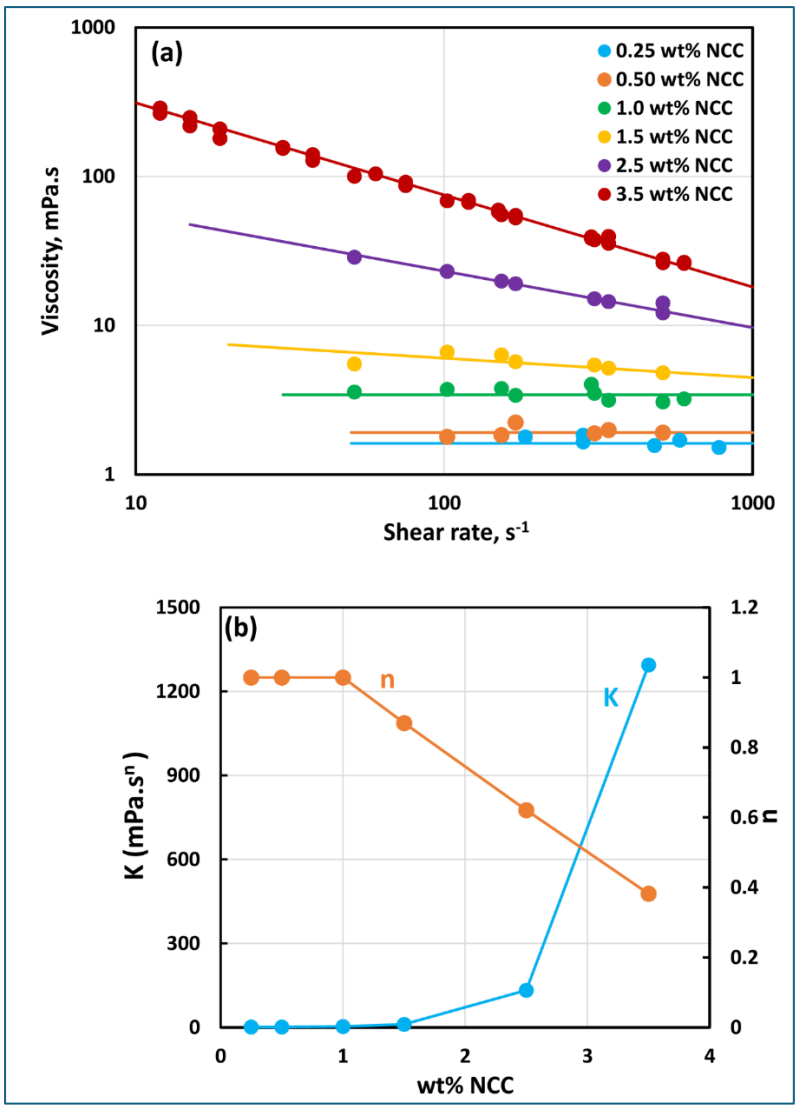


Figure 9 Analysis of CNC Dispersion

But as the CNC concentration was increased in the particle suspensions, shear thinning, which is a Non-Newtonian concept, could be observed.

$$\tau = K\dot{\gamma}^{n} \tag{5}$$

$$\mu = \frac{\tau}{\dot{\gamma}} = K\dot{\gamma}^{n-1} \tag{6}$$

where τ represents shear stress, $\dot{\gamma}$ denotes shear rate, K is the consistency index, and n indicates the flow behavior index.

If a logarithmic graph between shear rate and viscosity was plotted based on Equation 6, we would get a straight line, this is observed in Figure 9. The value of K is seen to increase as the CNC wt % increases. K is called consistency index, at the same time, n which is flow behavior index has values less than 1. As explained previously in table 1, n less than 1 signifies shear

thinning behavior. In addition to this, as the concentration of CNC goes up, the value of n keeps becoming smaller showing a very evident enhancement of shear thinning phenomena.

Shear thinning in this occurs due to the disintegration of the CNC clusters, along with the re positioning of the cellulose nanocrystals in the direction of the flow. It is crystals shaped like rods are aligned with the flow. Brownian motion, also known as Brownian movement, is the random, erratic movement of small particles suspended in a fluid (liquid or gas) resulting from their collision with the fast-moving molecules of the fluid. And CNC nanocrystals tend to form an aggregate due to this phenomenon.

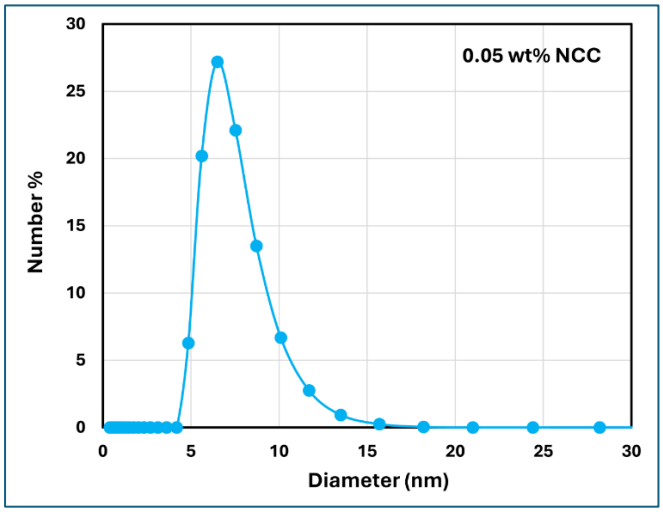


Figure 10 Size distribution of CNC [2]

Figure 10 shows the distribution of size of CNC obtained from Dynamic light Scattering method (DLS). The hydrodynamic diameter, a measure of how a particle diffuses in a fluid, was calculated to 6.6 nm. This is shown in figure 11. The number average of this varies as the CNC concentration varies.

However, it is undeniable that getting the exact measurement is tedious due to a number of reasons. To mention a few:

(i) The characteristic shape of cellulose nanocrystal which is rod like. When the particles are not spherical, the light scattered by them are impacted and therefore this technique.
(ii) The CNC particles tend to aggregate which will affect the distribution of the size.
(iii) They consist of wide variation of size and length.

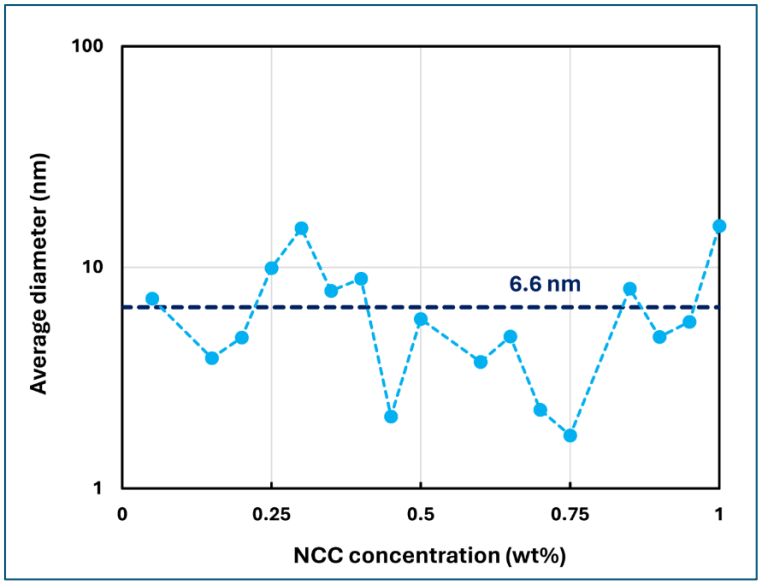


Figure 11 Variation of number averaged hydrodynamic diameter [2]

4.3 Rheology of suspensions of Large Particles (TG)

Extensdosphere suspension of various concentrations were made, its compositions are mentioned in the table 3. These are the concentrations of the suspension used for the measurements.

The photomicrographs were also studied for the particles. This can be seen in Figure 13. The particle size was measured at a minimum of 10 micrometers and a maximum of 140 micrometres. Therefore, the Sauter mean diameter was found to be 69 micrometers.

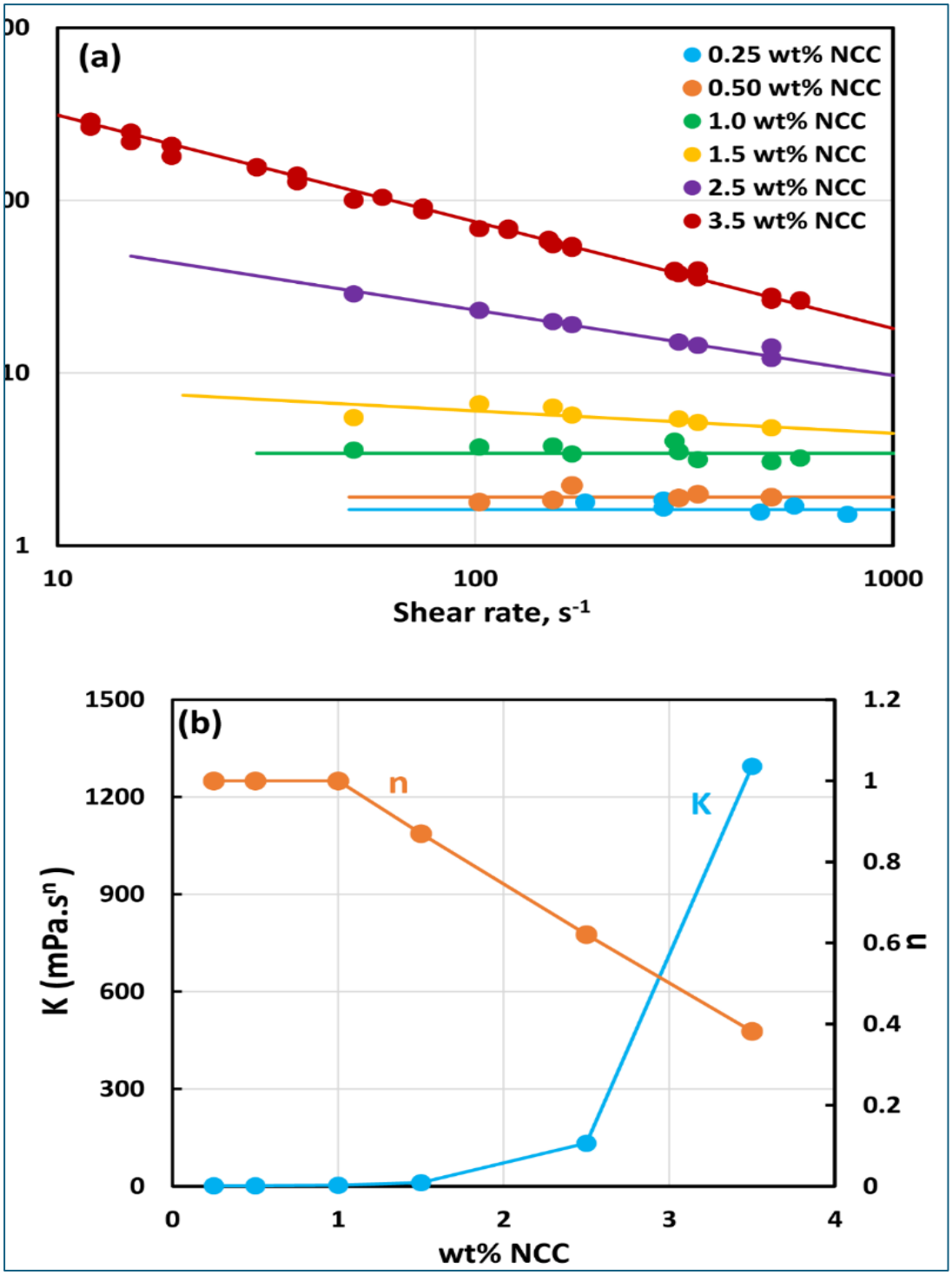


Figure 12 Rheological behavior of CNC dispersions.

Table 4 Composition of Extendospheres

CNC Concentration of Matrix Phase (wt%)	**Solids Concentration of Suspension (wt%)**	**Solids Concentration of Suspension (vol%)**
0	Ten concentrations: 5, 9.8, 14.4, 19.4, 24.4, 29.8, 34.8, 39.8, 44.8, 49.8	Ten concentrations: 6.6, 12.7, 18.3, 24.4, 30.2, 36.2, 41.7, 47.0, 52.1, 57.1
0.25	Twelve concentrations: 5, 10, 15, 20, 25, 30, 35, 38, 41, 44, 47, 50	Twelve concentrations: 6.6, 13.0, 19.1, 25.1, 30.9, 36.5, 41.9, 45.1, 48.2, 51.3, 54.3, 57.2
0.50	Fifteen concentrations: 5, 8, 11, 14, 17, 20, 23, 26, 29, 31, 34, 37, 40, 43,46	Fifteen concentrations: 6.6, 10.4, 14.2, 17.9, 21.5, 25.1, 28.6, 32, 35.4, 37.6, 40.8, 44, 47.2, 50.3, 53.3
1.0	Nine concentrations: 5, 10, 15, 20, 25, 28, 31, 34, 37	Nine concentrations: 6.6, 13.0, 19.1, 25.1, 30.9, 34.3, 37.6, 40.9, 44.1
1.5	Twelve concentrations: 5, 8, 11, 14, 17, 20, 23, 26, 29, 31, 34, 37	Twelve concentrations: 6.6, 10.5, 14.3, 18.0, 21.6, 25.2, 28.7, 32.1, 35.5, 37.7, 40.9, 44.1
2.5	Eleven concentrations: 5, 8, 11, 14, 17, 20, 23, 26, 29.1, 32.1, 35	Eleven concentrations: 6.6, 10.5, 14.3, 18.0, 21.7, 25.2, 28.7, 32.2, 35.6, 38.9, 42.1
3.5	Ten concentrations: 5, 11, 14, 17, 20, 23, 26, 29, 32, 35	Ten concentrations: 6.7, 14.3, 18.1, 21.7, 25.3, 28.8, 32.3, 35.6, 38.9, 42.2

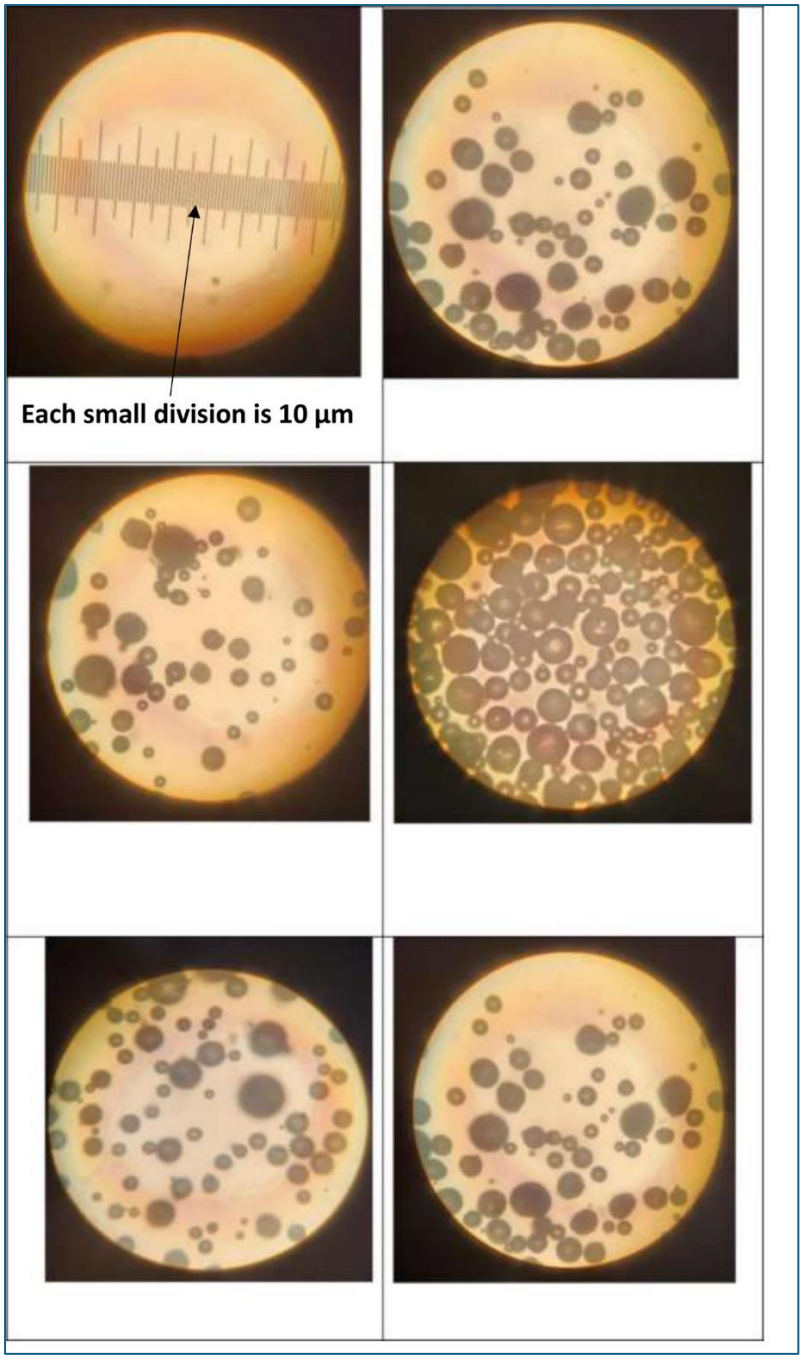


Figure 13 Photomicrograph of Extendosphere

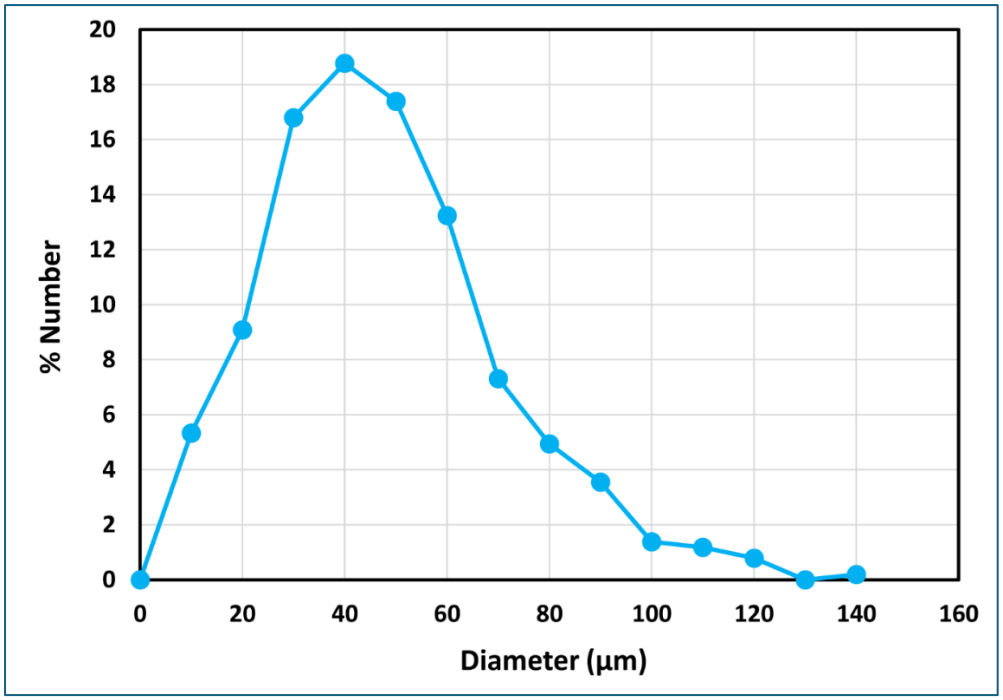


Figure 14 Size distribution of Extensdosphere

Viscosity was measured for varies concentration of the particles at a specific CNC concentration. For this study, concentration of Cellulose Nanocrystals were kept at a minimum of 0.25 and a maximum of 3.5 wt%. From the analysis following key observations can be noted:

(i) When the CNC content is low, the suspension behaves like a Newtonian fluid. This can be observed for CNC concentrations less than 1 wt%. When the CNC content goes above this point, the phenomenon of shear thinning is evident.

(ii) When the CNC wt % crosses 1.5% the suspensions regardless of the particle concentrations, exhibit shear thinning.

(iii) Interestingly, as the extendosphere content increase, the shear thinning becomes more prevalent at a given CNC wt %. Therefore, it can be said that degree of shear thinning is directly proportional to the concentration of the extendospheres.

(iv) At any given concentration, Extendosphere suspension behave in syn with the power law equation and we do get a straight line when the logarithmic graph is plotted.

See the figure 14 to 20 from which these observations are made.

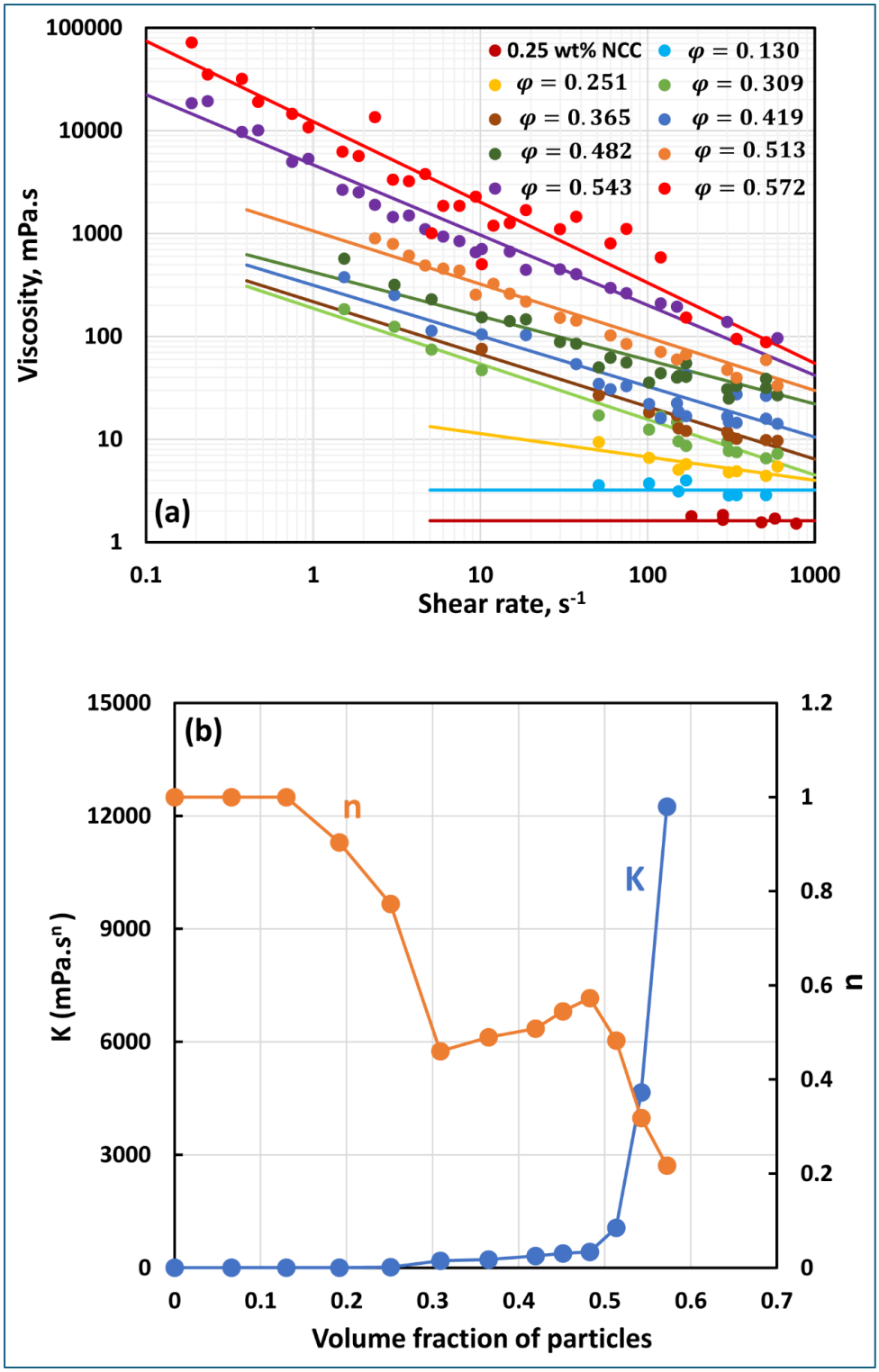


Figure 15 Rheological behaviour of Extendosphere at CNC concentration of 0.25 wt%

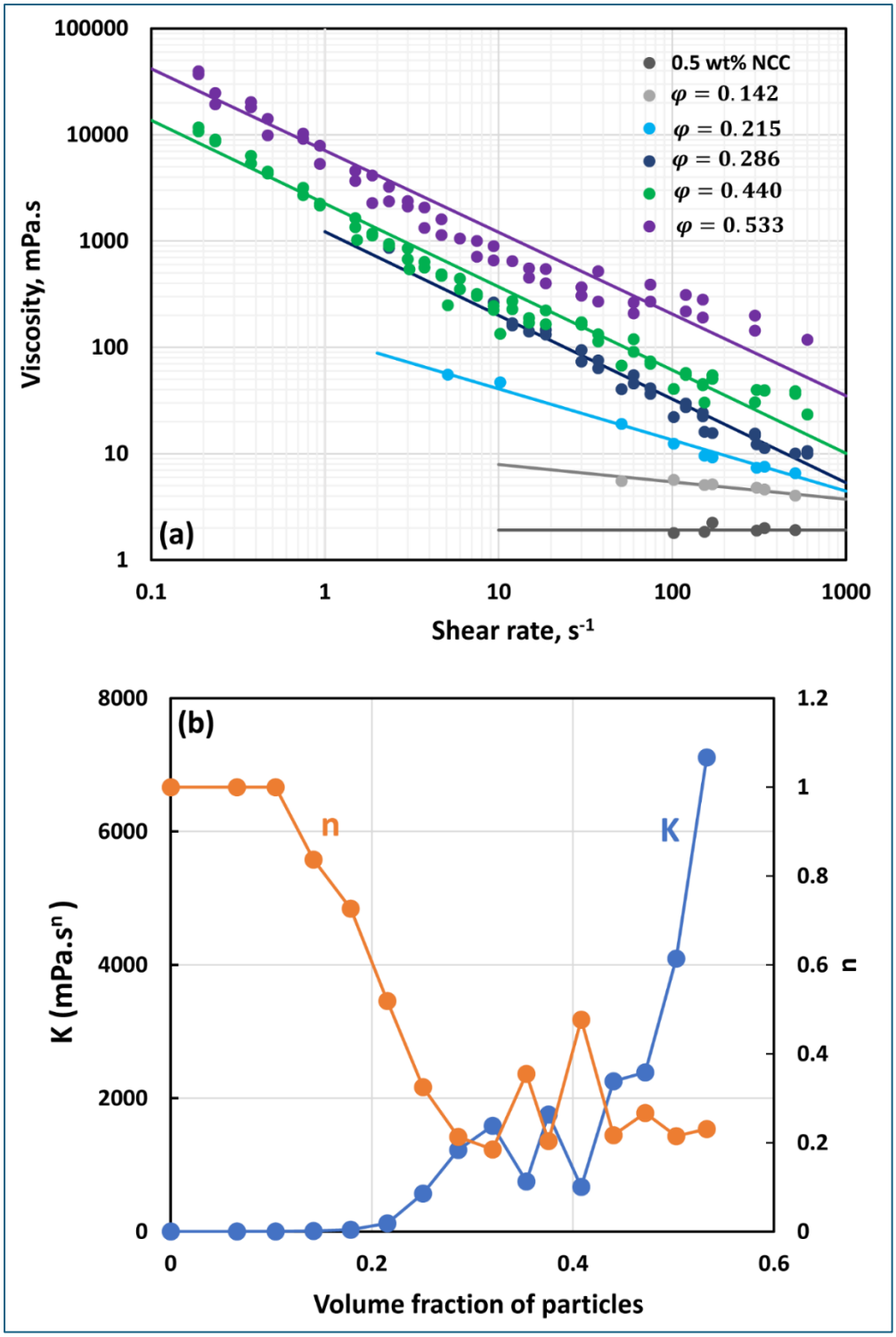
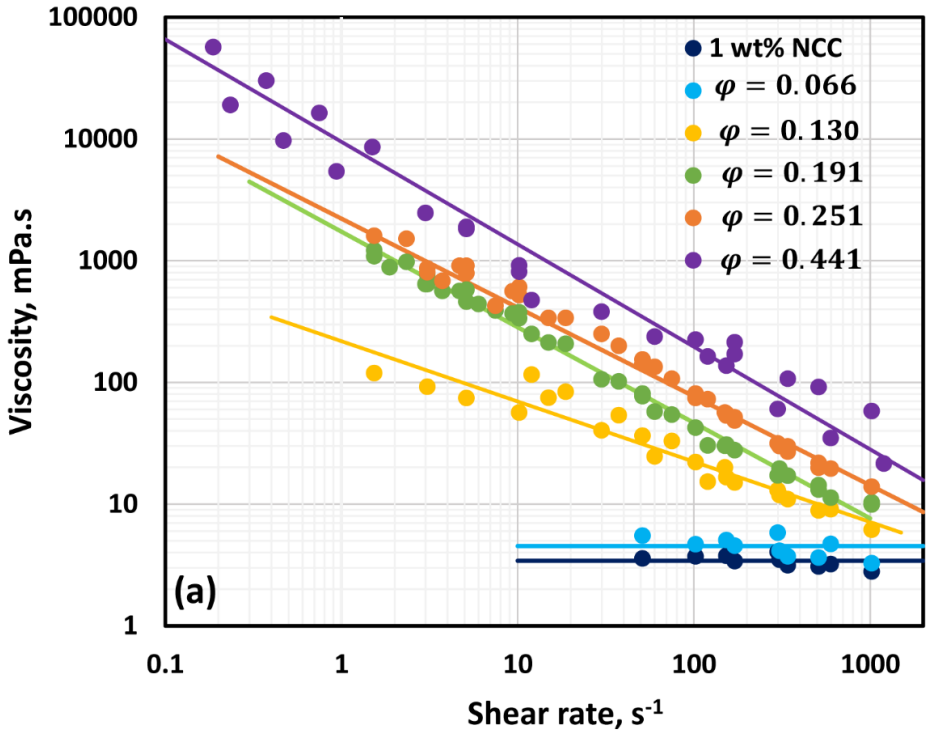


Figure 16 Rheological behaviour of Extendosphere at CNC concentration of 0.5 wt%



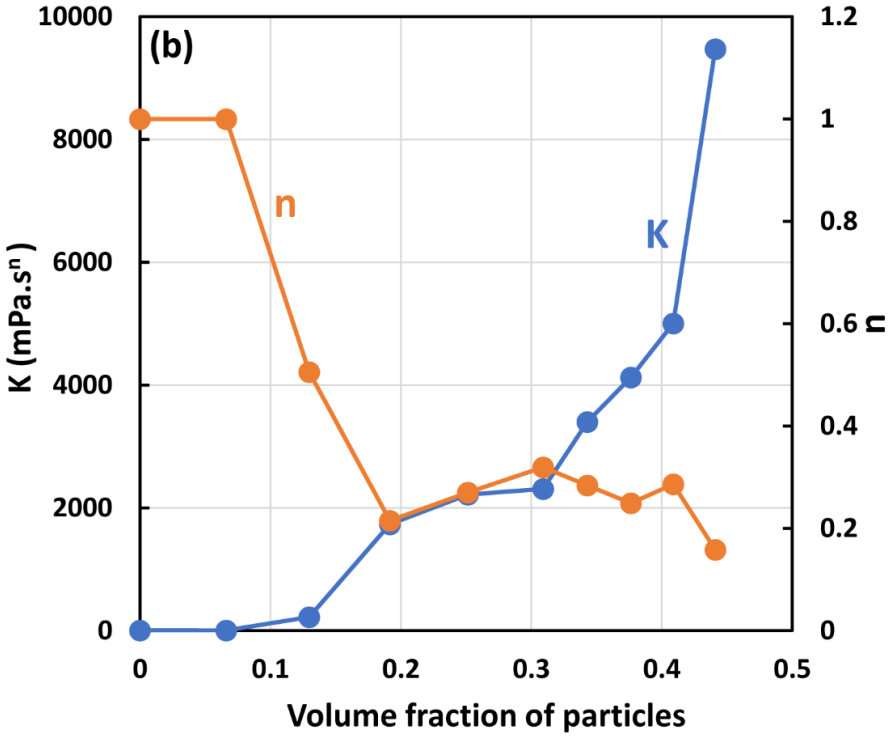


Figure 17 Rheological behaviour of Extendosphere at CNC concentration of 1 wt%

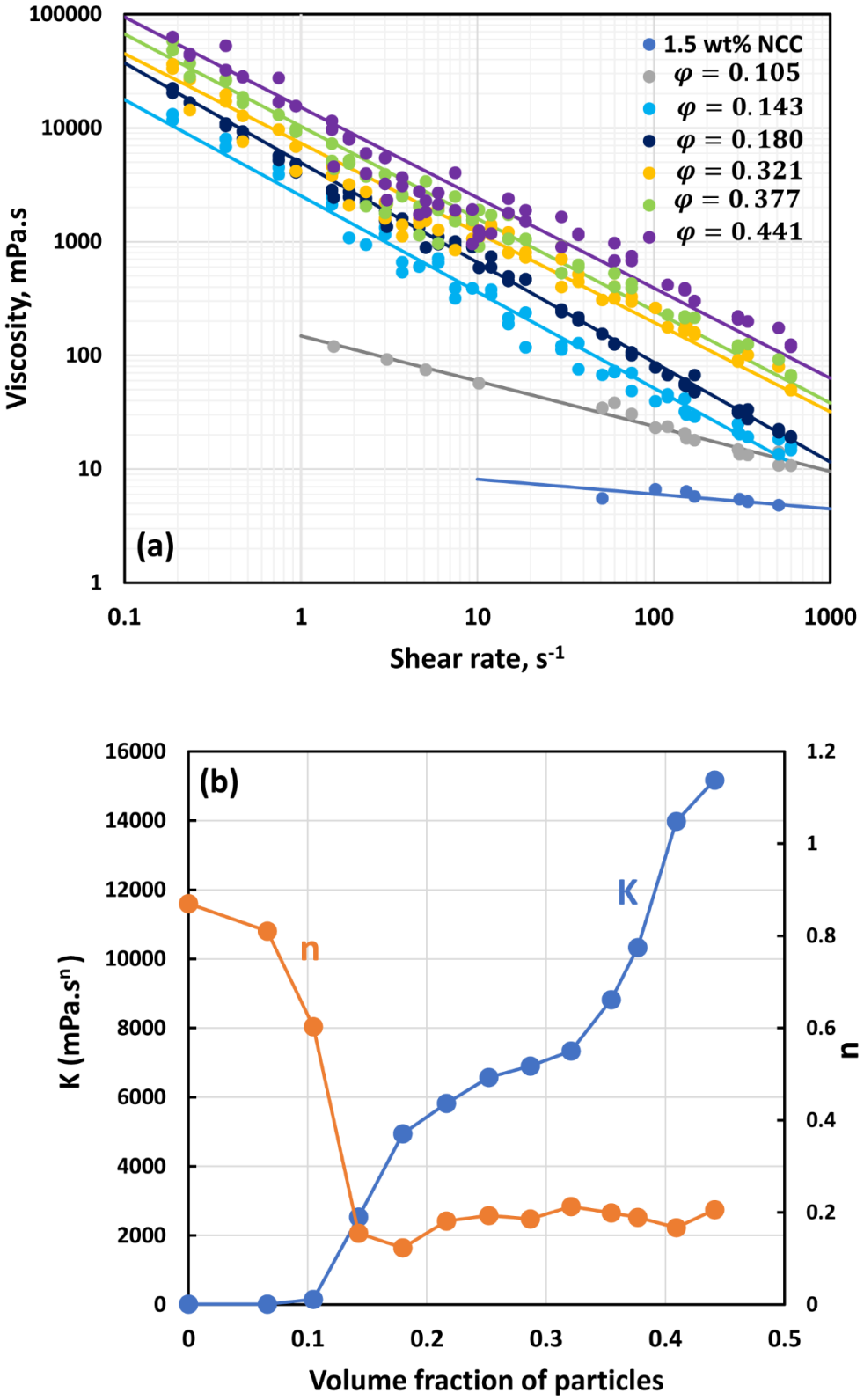


Figure 18 Rheological behaviour of Extendosphere at CNC concentration of 1.5 wt%

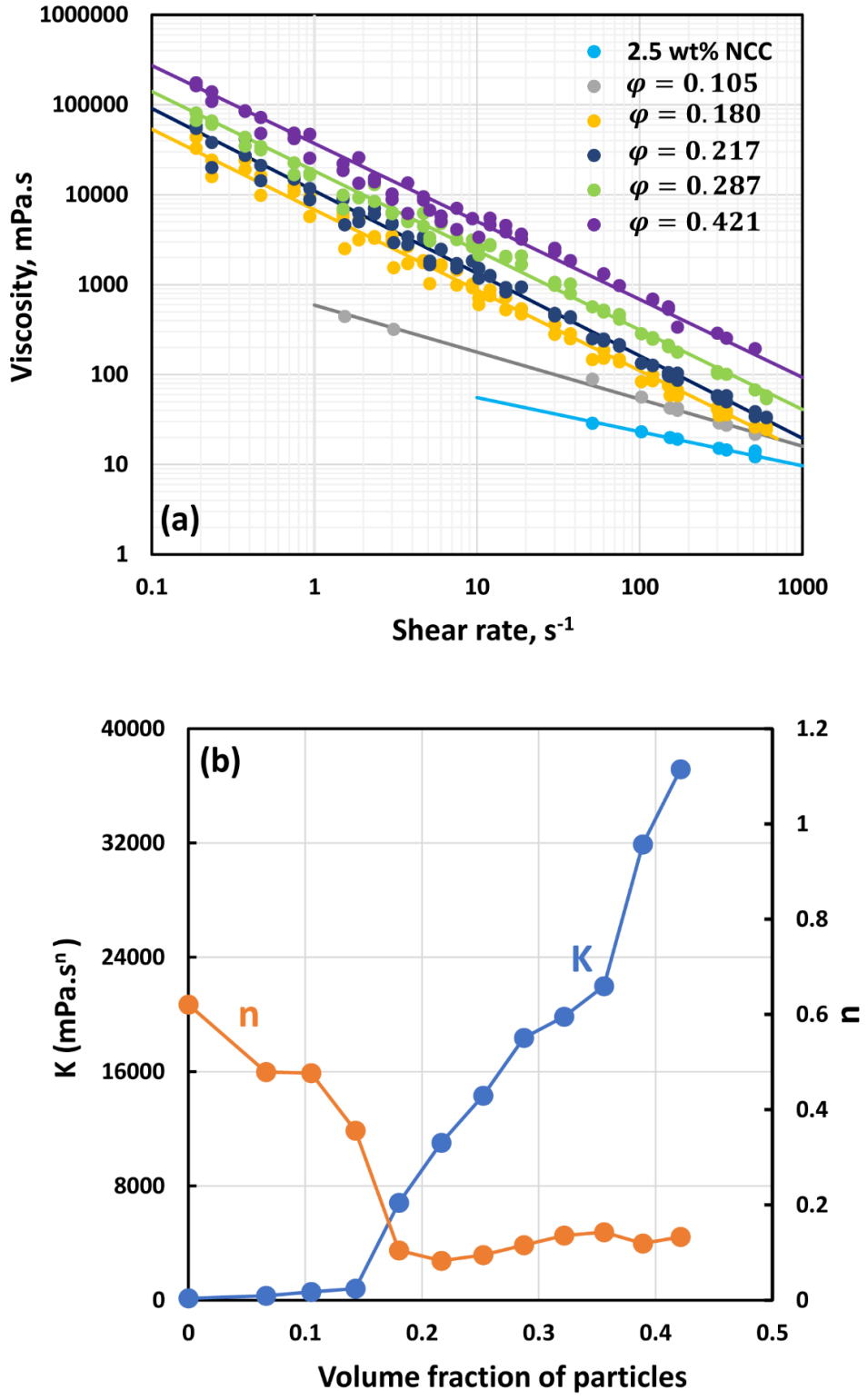


Figure 19 Rheological behaviour of Extendosphere at CNC concentration of 2.5 wt%

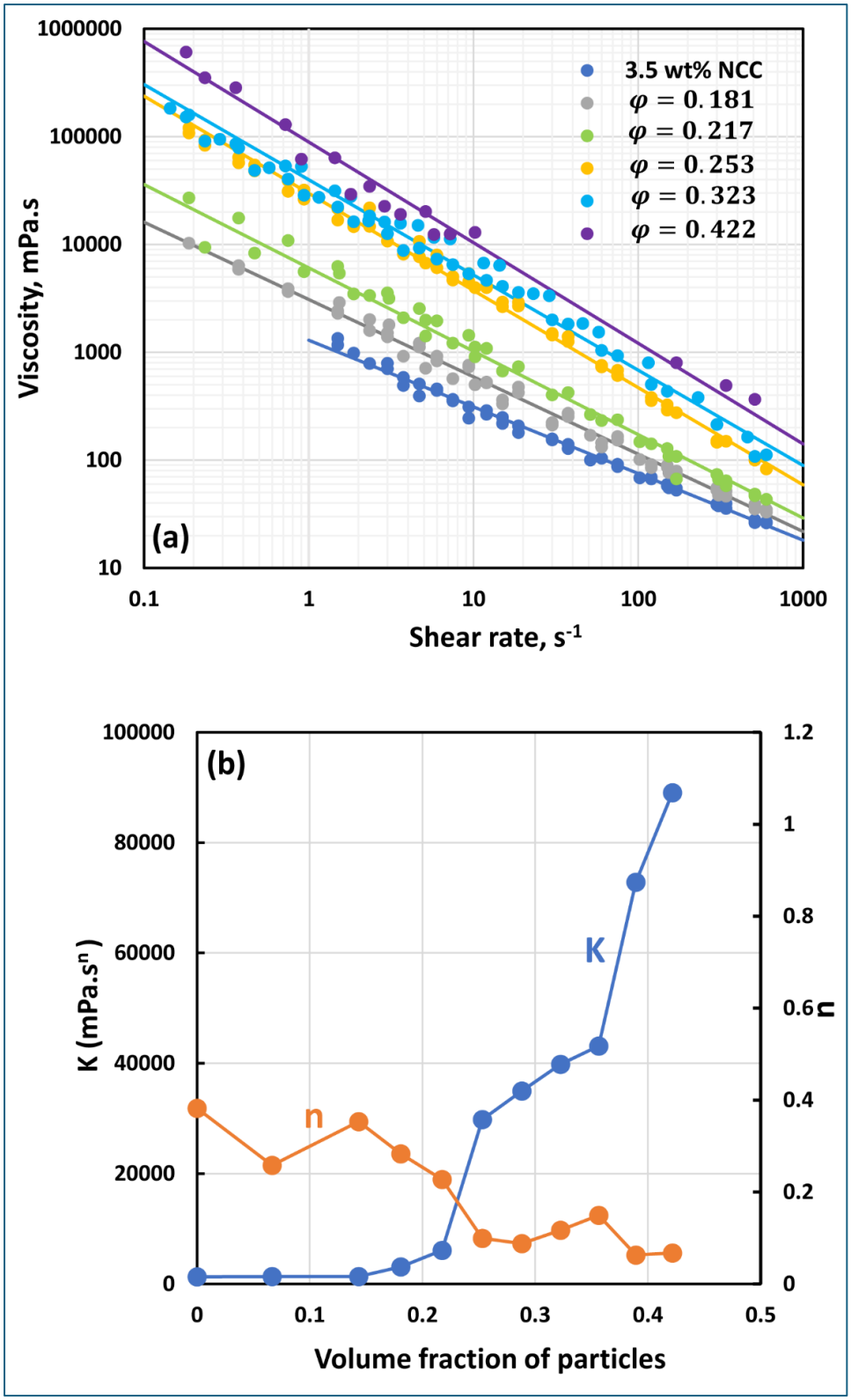


Figure 20 Rheological behaviour of Extendosphere at CNC concentration of 3.5 wt%

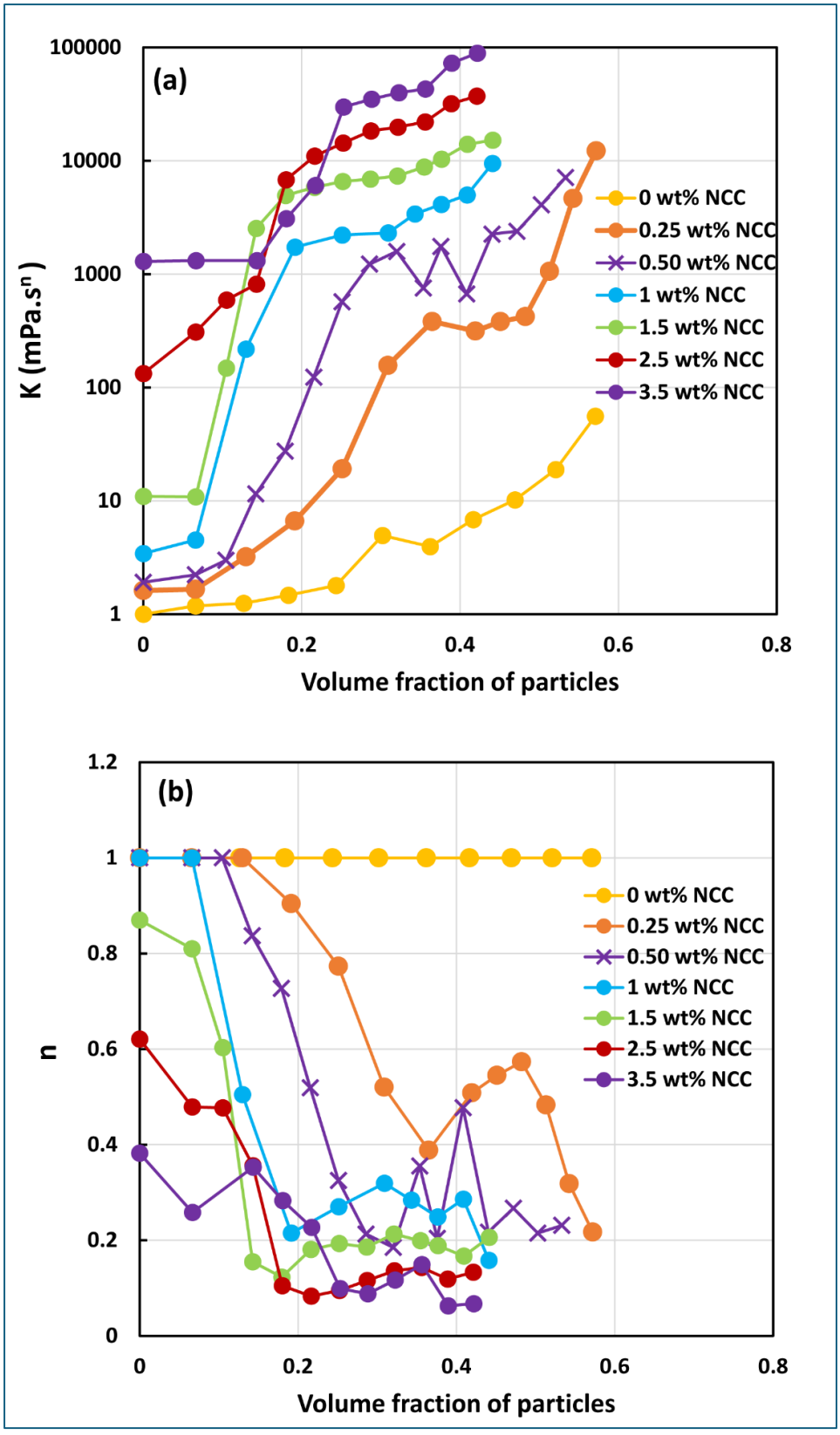


Figure 21 Power-law constants of Extendosphere suspension at various CNC concentrations: (a) Consistency index K, and (b) Flow behavior index n.

4.3 Rheology of Suspensions of Small Particles (Solospheres S-32)

Solosphere suspension of various concentrations were made, its compositions are mentioned in the table 4. These are the concentrations of the suspension used for the measurements.

Table 5 Composition of Solospheres [2]

CNC Concentration of Matrix Phase (wt%)	**Solids Concentration of Suspension (wt%)**	**Solids Concentration of Suspension (vol%)**
0	Thirteen concentrations: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65	Thirteen concentrations: 2.4, 5.0, 7.7, 10.5, 13.6, 16.8, 20.2, 23.9, 27.8, 32, 36.5, 41.4, 46.6
0.25	Thirteen concentrations: 5.9, 10.9, 15.8, 20.8, 25.7, 30.7, 35.6, 40.6, 45.5, 50.5, 56.2, 61.6, 65.3	Thirteen concentrations: 2.9, 5.4, 8.1, 11.0, 14.0, 17.3, 20.7, 24.4, 28.3, 32.5, 37.7, 43.1, 47
0.50	Thirteen concentrations: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65	Thirteen concentrations: 2.4, 5.0, 7.7, 10.5, 13.6, 16.8, 20.3, 23.9, 27.8, 32.0, 36.6, 41.4, 46.7
1.0	Thirteen concentrations: 4.9, 10, 15, 19.9, 24.8, 29.9, 39.7, 44.7, 49.6, 53.7, 56.1, 59.1, 64.9	Thirteen concentrations: 2.4, 5, 7.7, 10.5, 13.5, 16.8, 23.7, 27.6, 31.8, 35.4, 37.7, 40.6, 46.6
1.5	Ten concentrations: 4.7, 9.7, 14.7, 20.1, 25.4, 30.7, 36, 41.4, 45.9, 50.1	Ten concentrations: 2.3, 4.8, 7.6, 10.6, 13.9, 17.3, 21.1, 25, 28.6, 32.1
2.5	Nine concentrations: 5.6, 10.6, 15.6, 21.1, 26, 31, 35.4, 40.4, 45.4	Nine concentrations: 2.8, 5.3, 8.1, 11.3, 14.3, 17.6, 20.7, 24.4, 28.3

3.5	Five concentrations: 5.1, 10.1, 15, 20.1, 25.1	Five concentrations: 2.5, 5.1, 7.8, 10.7, 13.8

The photomicrographs were also studied for the particles. This can be seen in Figure 22. The particle size was measured at a minimum of 2 micrometers and a maximum of 20 micrometres. Therefore, the Sauter mean diameter was found to be 14 micrometers. Thus, it can be very evidently inferred that the Solospheres are 5 times smaller than Extendospheres.

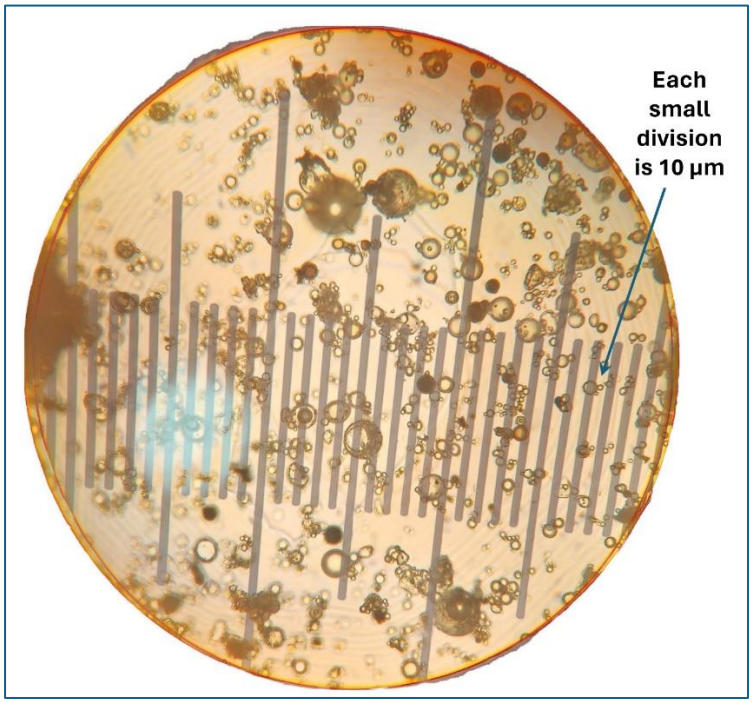


Figure 22 Photomicrograph of Solospheres

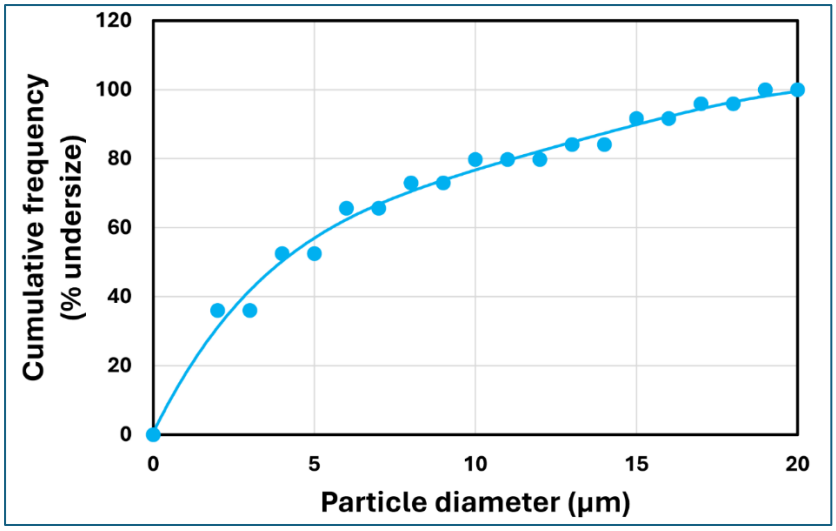


Figure 23 Distribution of size for Solospheres

Suspensions made from Solospheres are also seen to be abiding by the power law equation, same as Extendospheres i.e., the logarithmic graph of viscosity vs shear rate is a straight line. The data obtained aligns into the equation of power law.

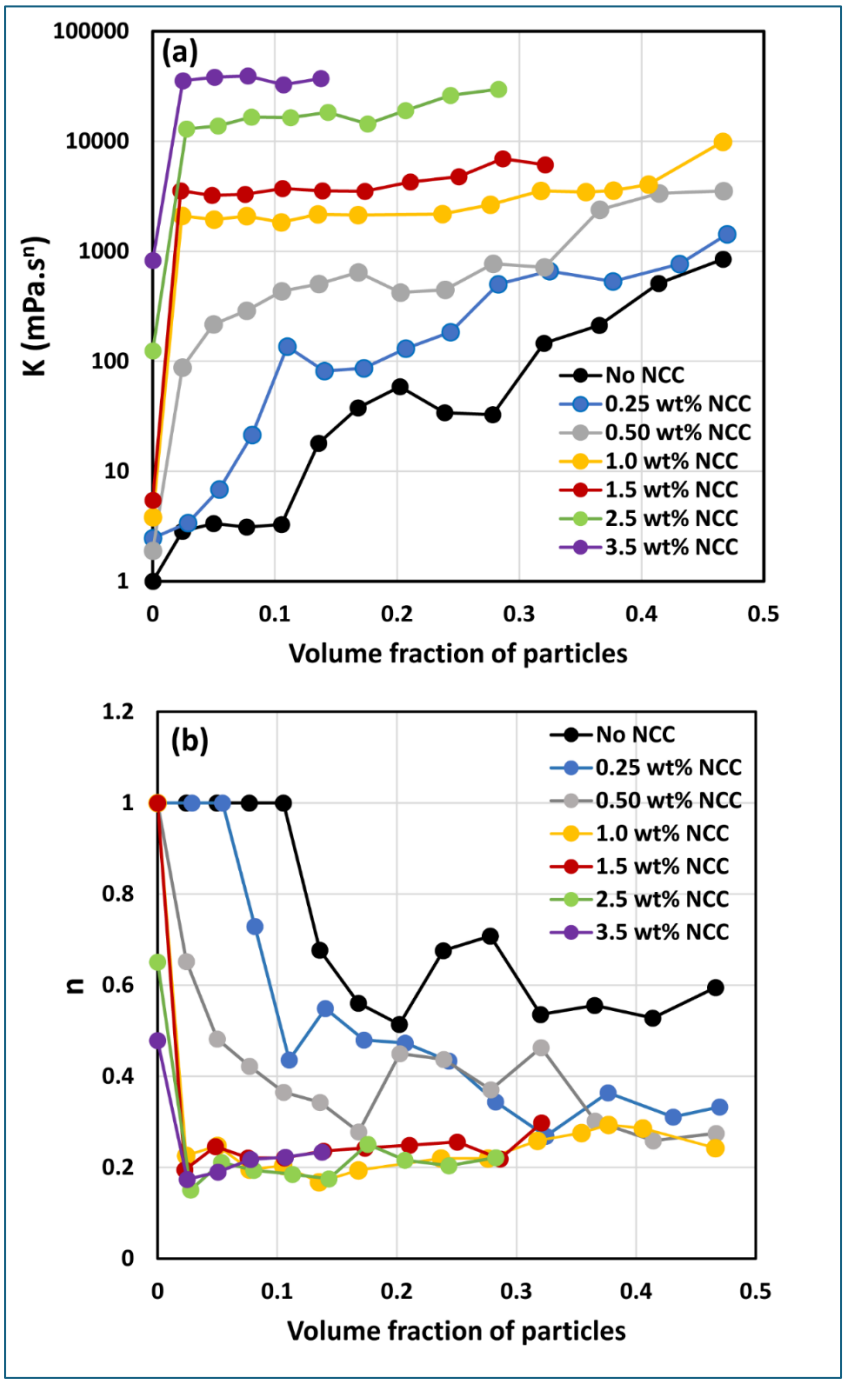


Figure 24 a) Consistency index K, and (b) Flow behavior index n. This is for Solosphere suspension at different NCC concentration [2]

As seen in the analysis, the consistency index K increases as the concentration of the particles increase at a specific CNC volume fraction. And for the same particle concentration, if the CNC content increases then the value of K also goes up. The solosphere suspension exhibits shea thinning behavior at higher concentrations ie, n<1. And also an important observationservation made was that the degree of shear thinning was directly proportional to the volume fraction of the particles. Most of this change is evident only at lower concentration, at higher concentration the constants tend to stabilize.

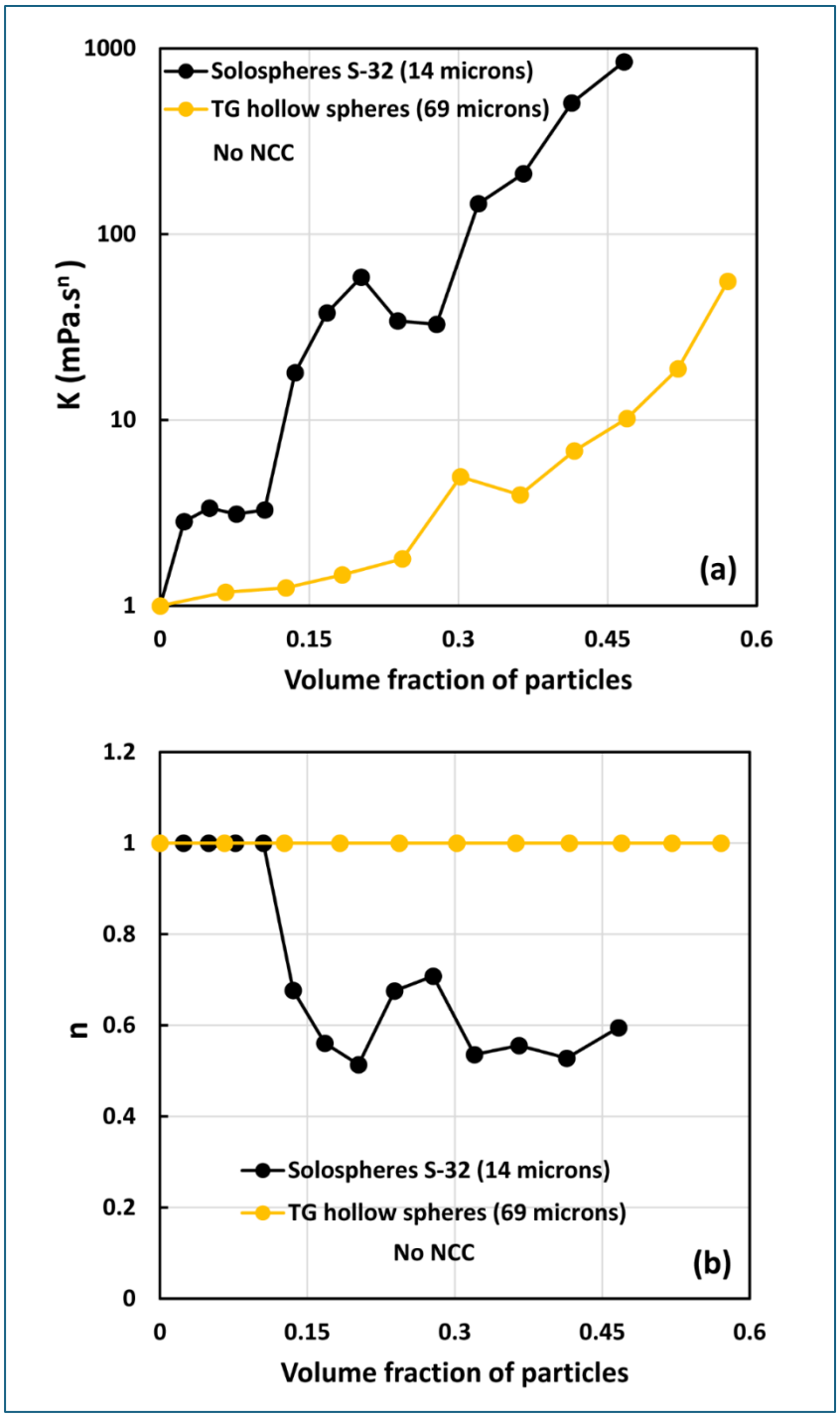
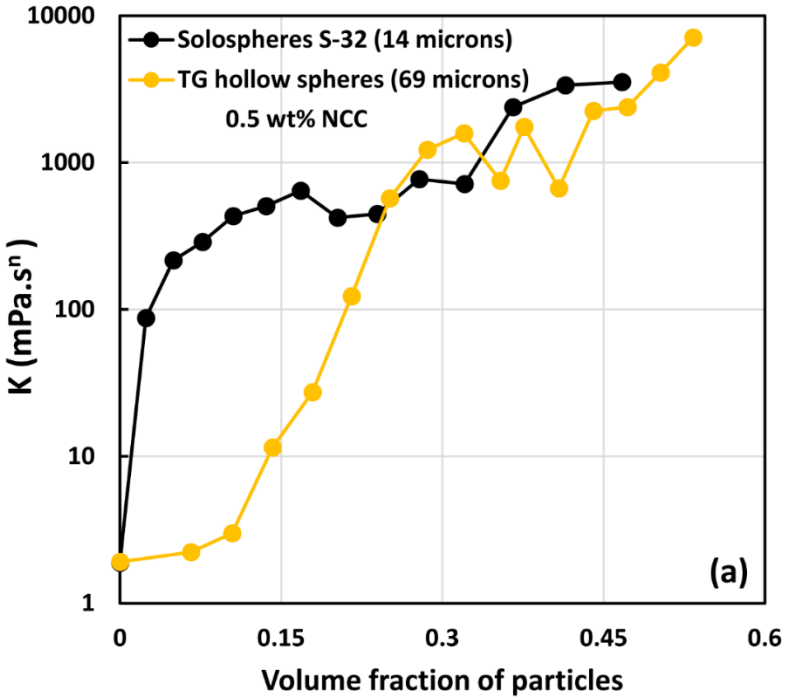


Figure 25 Comparison between Solosphere and Extendosphere

In Figure 25, a comparison study is conducted for the two particles, Solosphere and Extendosphere for their K and n values without the presence of CNC in them. The suspension of the Extendospheres which are large particles is less viscous than the suspensions of Solospheres which are smaller particles. Another important observation is the large particle suspensions are Newtonian at all the concentrations, while the small particle suspensions behave like No Newtonian shear thinning at the volume fractions used. This is clearly due to the aggregation of particles in Solosphere suspension whereas the Extendosphere suspension has its particles dispersed thoroughly with little to zero aggregation.

A detailed comparison of K and n values was made for suspensions of Extendospheres and Solospheres with CNC at various concentrations. At smaller concentrations, the Solosphere S 32 is still more viscous and the degree of shear thinning is higher than the suspensions made from same concentration of Extendospheres.

At higher concentrations, the values of K and n for both the particles cross over indicating the role of CNC in aggregation of particles. Aggregation of particles, be it in large sized particle suspension or small sized particle suspension has a huge impact on its rheological parameters. These observations an be deduced from Figures 26 to 28.



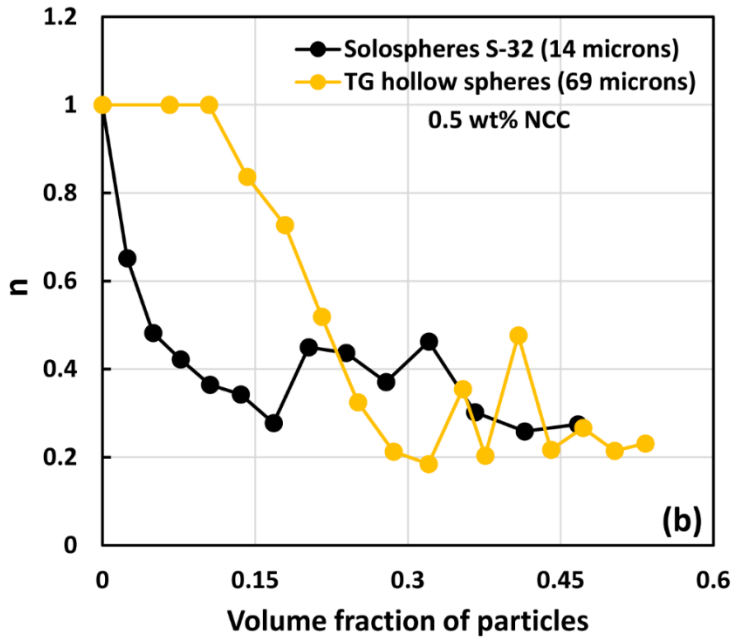


Figure 26 Rheological behavior of Solosphere and TG at 0.5 wt % CNC

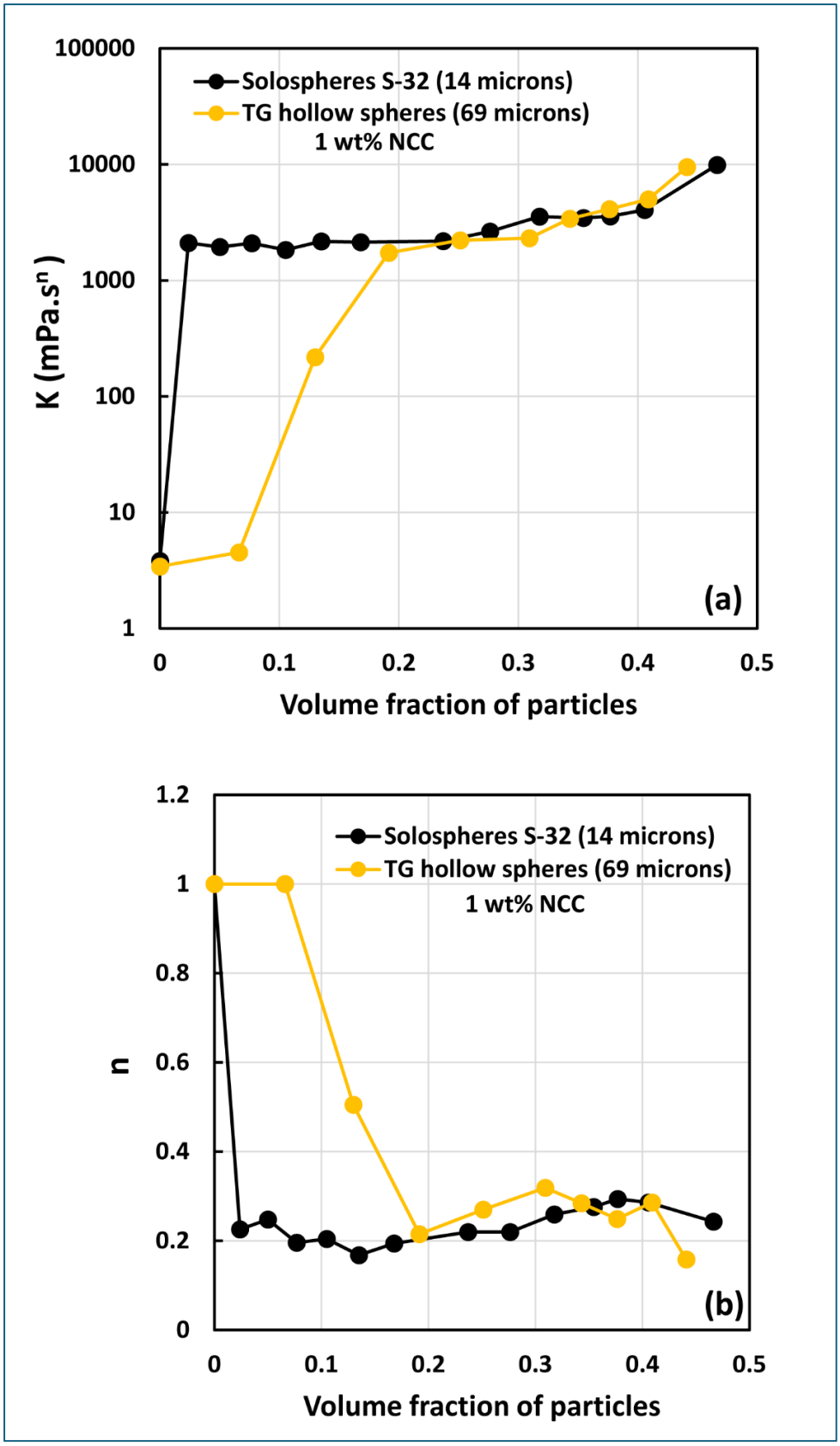


Figure 27 Rheological behavior of Solosphere and TG at 1 wt % CNC

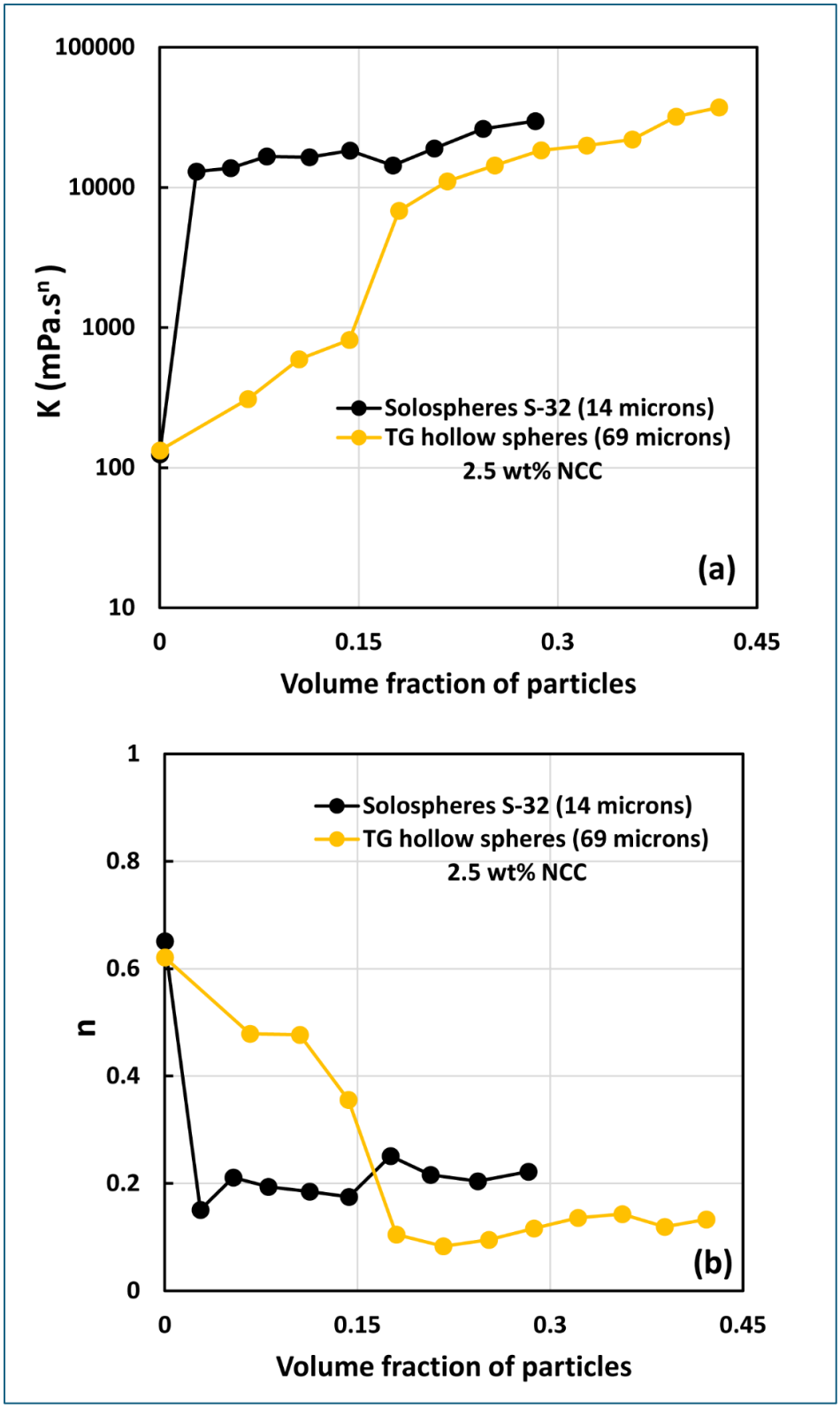


Figure 28 Rheological behavior of Solosphere and TG at 2.5 wt % CNC

4.5 Effect of Salt on the rheology of the suspensions

A study was performed to understand the effect of salt which is NaCl on the suspensions. The concentration of CNC was kept at 1.5 wt%. The CNC suspension was seen to become highly viscous and the behavior was becoming extremely shear thinning as the salt was added. As seen in figure 29. When 0.25 wt% of salt was added, there is a steep rise in the viscosity, and as the salt was added the rheological parameters tend to stabilize. The figure shows the impact of salt on K and n values. Initially there is a sudden increase in the value of K and decrease in n when salt is first added, which later achieve a stable value.

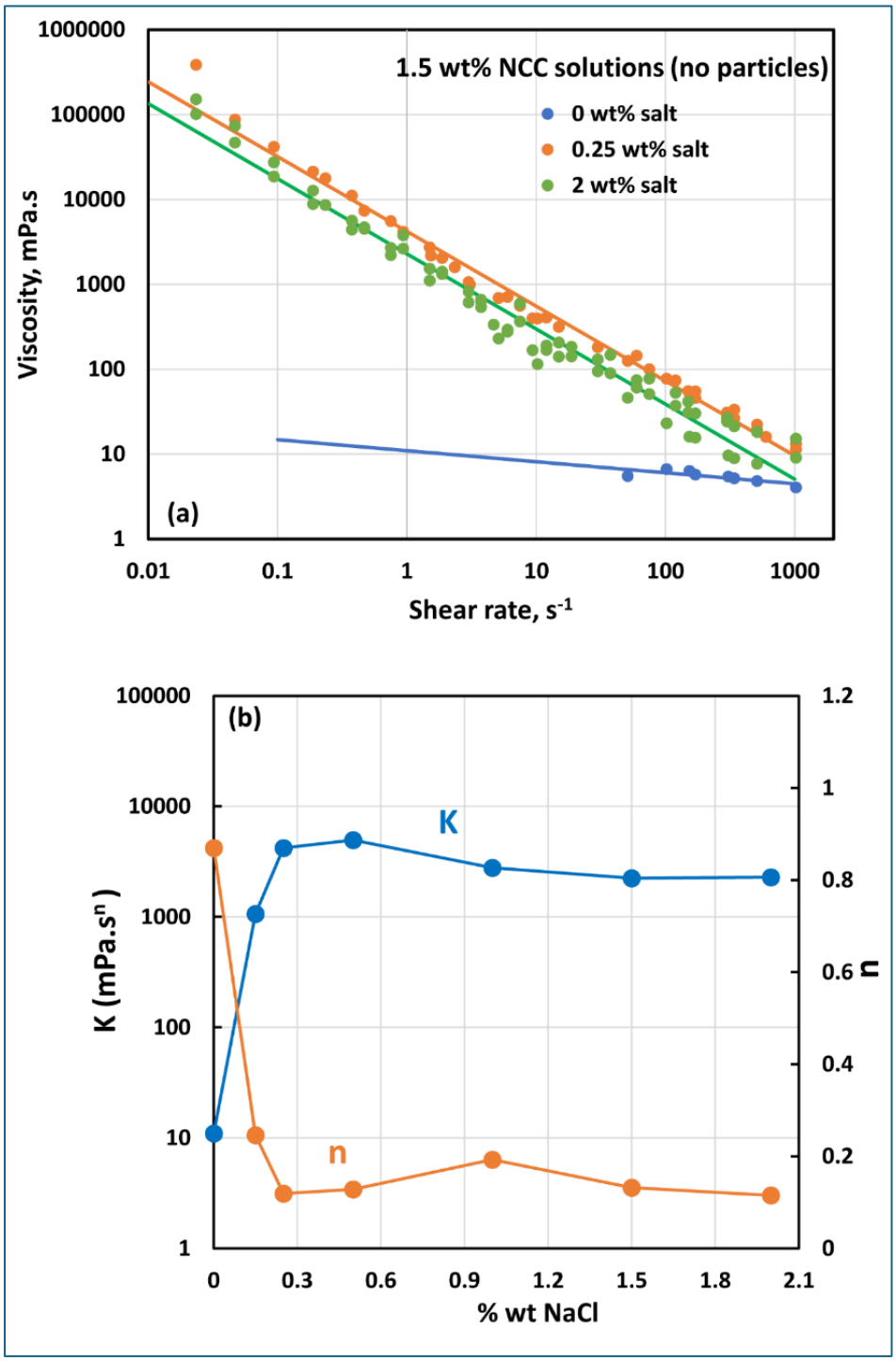


Figure 29 Rheological behaviour of 1.5 wt% CNC suspension with salt (NaCl)

As NaCl is added to CNC suspension, it becomes like a gel. As seen in figure 30, at 0% NaCl, the suspension is clear, where as, as the wt% of NaCl increases the color becomes milky. This occurs because the CNC aggregates.



Figure 30 CNC suspension with NACl at 1.5 wt% CNC

In the below figure to we can see the impact of salt on Extensdosphere suspension at 12 wt% and 25 wt%. The plots are wt % of NaCl vs K and n. For better understanding, plot has been shown for particle concentration at 0 wt% as well. It is evident that the rheology is primarily dependant on the CNC at salt content above 0.3 wt%. The constants K and n are the same as that of the CNC suspensions without any particles.

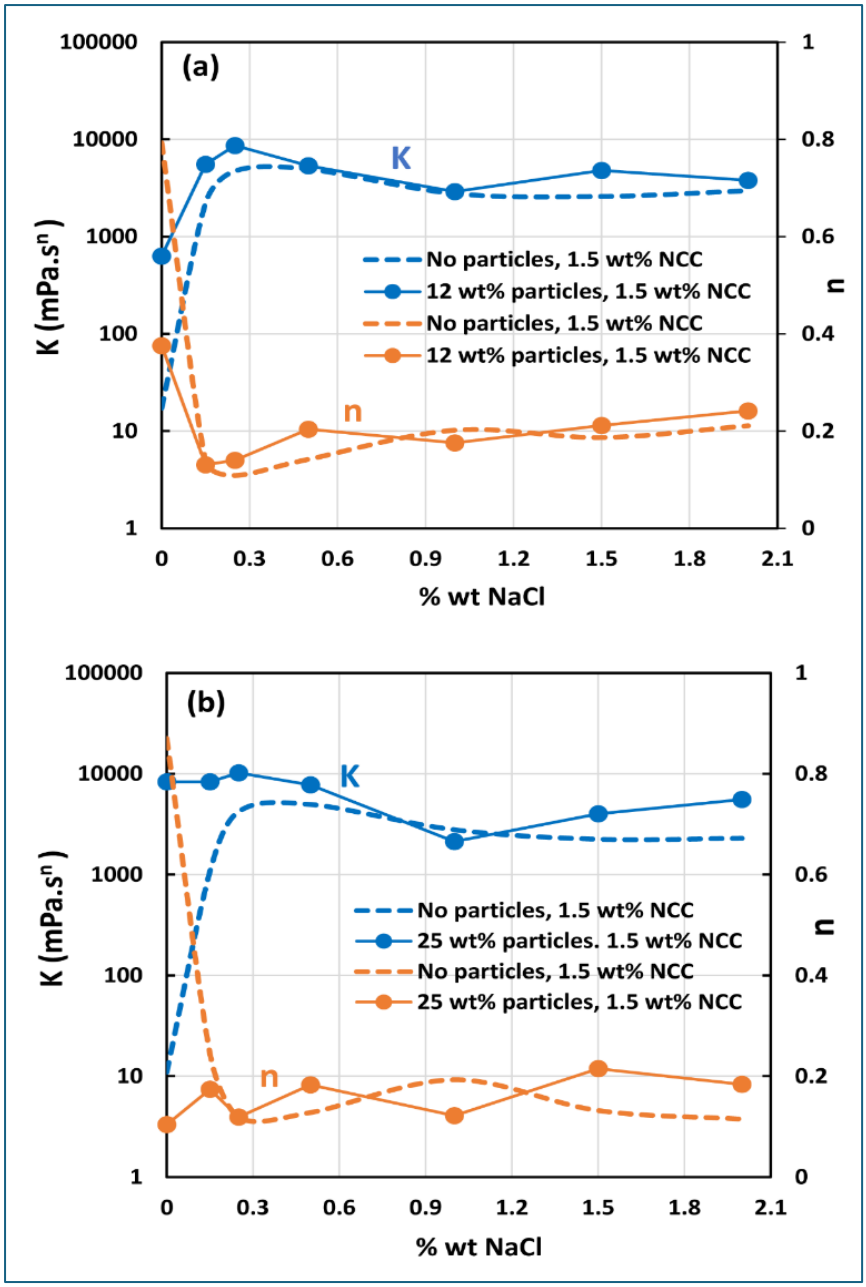


Figure 31 Impact of salt on Extendosphere suspensions

A similar pattern can be seen in solospheres as well.

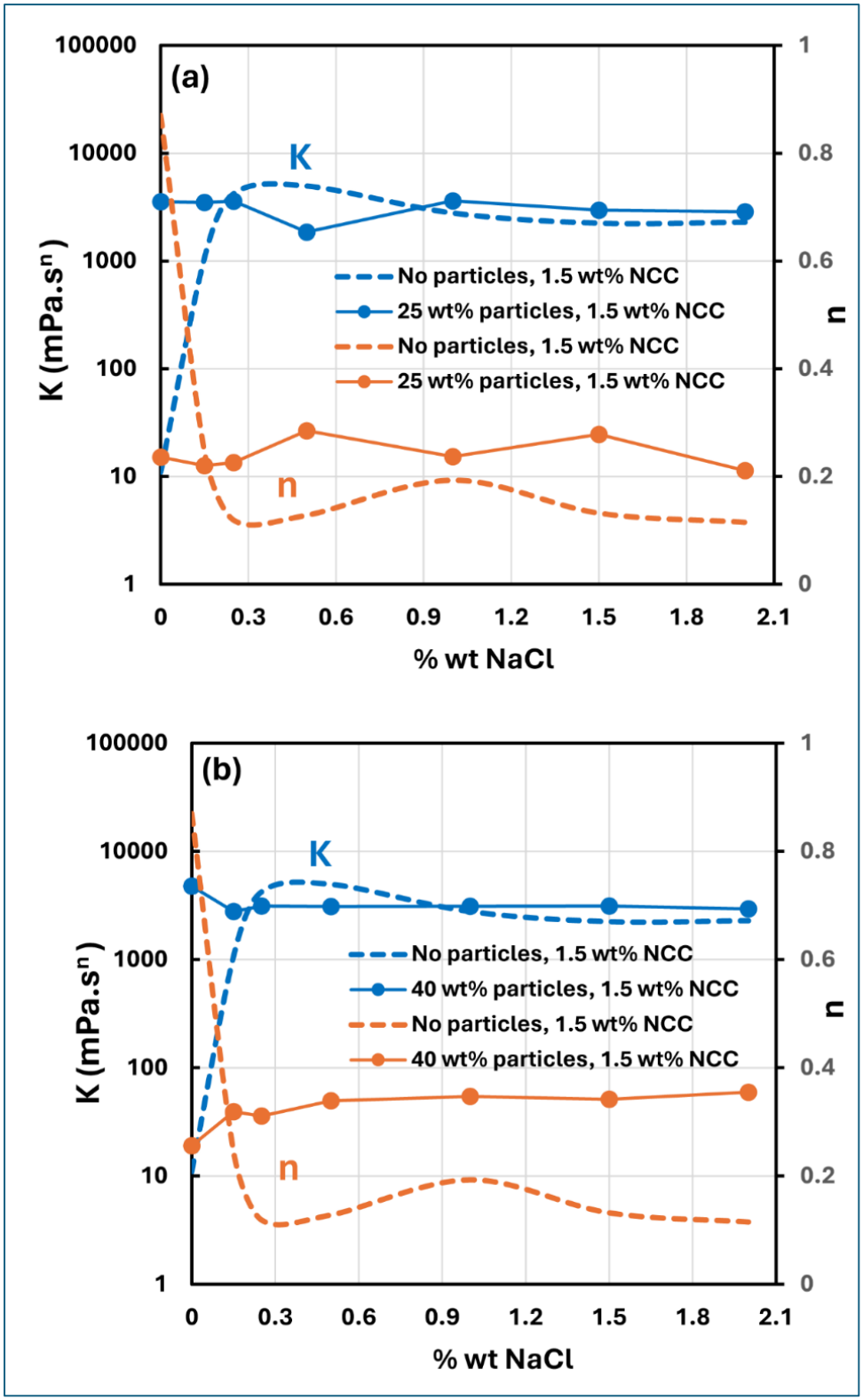


Figure 32 Impact of salt on Solosphere suspensions

4.6 Effect of pH on the rheology of the suspensions

The effect of pH was studied on both the particle suspensions as seen in figure 33. When pH is 7 and the suspensions are neutral, the power law constant K shows a minimum. This was observed in both Extendospheres and Solospheres. This deduction is in sync with study done by Qi et al. [32] who studied Cellulose nanocrystals. The cellulose nanocrystals undergo aggregation when the pH is changed to acidic or basic showing a sudden jump in the viscosity of these suspensions

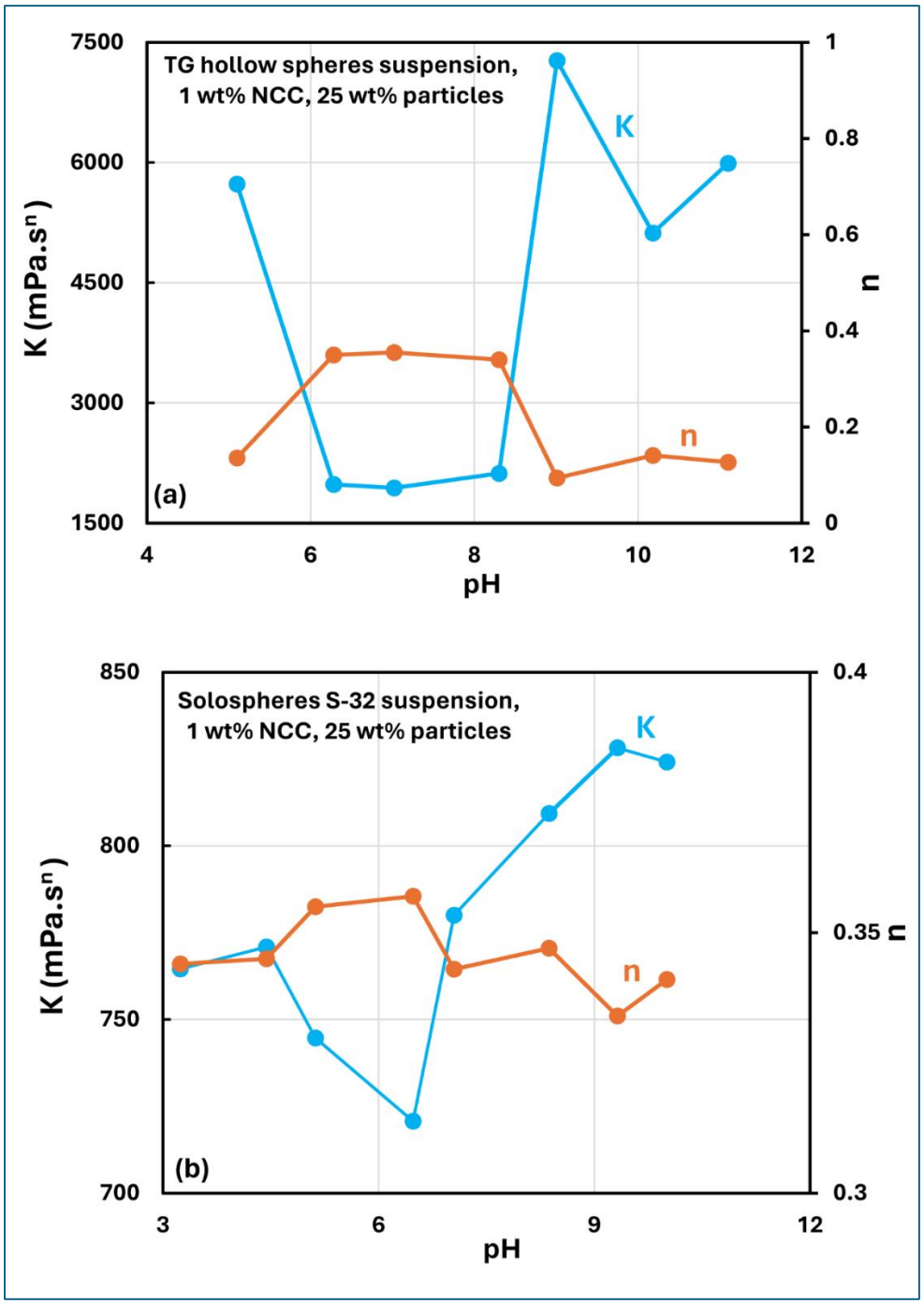


Figure 33 Effect of pH on the power-law parameters of suspensions on extendosphere suspension and Solosphere suspensi

Chapter 5

Conclusions

The rheology of suspensions made from hollow spheres and CNC was studied. The impact of cellulose nanocrystal concentrations on the suspension, the size of particles, the impact of salt (NaCl), the impact of changing pH on the suspension rheology was determined. The following conclusions can be drawn from the experiments:

(i) The suspension of CNC when its concentration is greater than 1 wt% exhibits shear thinning behavior. This is due to disaggregation of particles and the orientation of nanocrystals with shear.

(ii) The suspension made from large particles which is the Extendospheres whose Sauter mean diameter is 69 micrometer behaves like a Newtonian fluid without the CNC. The addition of CNC allows them to behave like a shear thinning fluid and its degree is directly proportional to the concentration of CNC and particles.

(iii) The suspension made from small particles which is the Solospheres whose Sauter mean diameter is 14 micrometer behaves like shear thinning even without the CNC. This is true for particle concentration greater than 0.1 volume fraction. The CNC just adds to the shear thinning effect and its viscosity.

(iv) Salt has a huge impact on the rheology of CNC suspension. A sudden increase in consistency index and a dip in flow behavior index is seen with presence of salt.

(v) At pH $\cong$ 7 the suspensions with cellulose nanocrystal show a minimum value of consistency index and this slowly rises as pH value is increased.

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Appendix A: Rheological Data

Appendix A1 Composition Data

This table consists of planned and actual composition used in study for Extendosphere TG suspensions without any additives. It was briefly stated in Table 3.

Table 6 Actual Concentration of Extendosphere in suspension without any additives

Wt% of Extendosphere	Actual Mass Fraction of Extendosphere	Actual Volume Fraction of Extendosphere
0	0	0
5	0.0500026	0.0657825
10	0.0977585	0.1266007
15	0.1435819	0.1831985
20	0.193968	0.2435337
25	0.2443513	0.3019684
30	0.2978717	0.362062
35	0.3479995	0.416583
40	0.3981156	0.4694643
45	0.4483186	0.5208782
50	0.4984715	0.5707504

Table 7 Actual concentration of Extendospheres used in the study with 0.25 wt% CNC

Wt% of Extendosphere	**Actual Mass Fraction of Extendosphere**	**Actual Volume Fraction of Extendosphere**
0	0	0
5	0.0500074	0.0658402
10	0.100152	0.1296935
15	0.1501476	0.191301
20	0.2002133	0.2510356
25	0.25024	0.3088571
30	0.3002431	0.364873
35	0.3504476	0.4194072
38	0.3804344	0.4511959
41	0.4104134	0.4824093
44	0.4403924	0.5130708
46	0.4697227	0.5425487

Table 8 Actual concentration of Extendospheres used in the study with 0.5 wt% CNC

Wt% of Extendosphere	Actual Mass Fraction of Extendosphere	Actual Volume Fraction of Extendosphere
0	0	0
5	0.05	0.0658821
8	0.0800085	0.1043752
11	0.1100116	0.1421045
14	0.1400166	0.1791011
`7	0.1700228	0.2153855
20	0.2000244	0.2509713
23	0.2300235	0.2858806
26	0.260031	0.3201452
29	0.2900203	0.353753
31	0.3100198	0.375821
34	0.3400012	0.4083994
37	0.3700227	0.4404301
40	0.4000754	0.4719176
43	0.4300648	0.5027789
46	0.4600755	0.5331174

Table 9 Actual concentration of Extendospheres used in the study with 1 wt% CNC

Wt% of Extendosphere	Actual Mass Fraction of Extendosphere	Actual Volume Fraction of Extendosphere
0	0	0
5	0.04999651	0.065981
10	0.09998946	0.129774
15	0.14998702	0.191495
20	0.19999042	0.251247
25	0.25000238	0.309124
28	0.28001344	0.342986
31	0.31001889	0.376214
34	0.3400095	0.408814
37	0.37013717	0.440964

Table 10 Actual concentration of Extendospheres used in the study with 1.5 wt% CNC

Wt% of Extendosphere	Actual Mass Fraction of Extendosphere	Actual Volume Fraction of Extendosphere
0	0	0
5	0.050035	0.066134
8	0.08007	0.104768
11	0.110068	0.142585
14	0.140077	0.179669
17	0.170272	0.216252
20	0.200262	0.251883
23	0.230117	0.286675
26	0.260112	0.320968
29	0.290108	0.354619
31	0.310106	0.376703
34	0.340088	0.409305
37	0.370089	0.441328

Table 11 Actual concentration of Extendospheres used in study with 2.5 wt% CNC

Wt% of Extendosphere	Actual Mass Fraction of Extendosphere	Actual Volume Fraction of Extendosphere
0	0	0
5	0.05	0.066297
8	0.079996	0.10499
11	0.109997	0.142909
14	0.140031	0.18011
17	0.170082	0.216595
20	0.200036	0.252252
23	0.230004	0.287233
26	0.260004	0.321581
29	0.290538	0.355868
32	0.320515	0.388891
35	0.350492	0.421298

Table 12 Actual concentration of Extendosphere used in the study with 3.5 wt% CNC

Wt% of Extendosphere	**Actual Mass Fraction of Extendosphere**	**Actual Volume Fraction of Extendosphere**
0	0	0
5	0.050001	0.066508
11	0.110001	0.143327
14	0.140022	0.180599
17	0.170155	0.217258
20	0.20015	0.253024
23	0.230219	0.288175
26	0.260212	0.322554
29	0.290209	0.356277
32	0.32025	0.389405
35	0.350239	0.421851

Table 13 Actual concentration of Solospheres used in the study with 0 wt% CNC

Wt% of Solosphere	**Actual Mass Fraction of Solosphere**	**Actual Volume Fraction of Solosphere**
65	0.649943	0.466487
60	0.599928	0.413897
55	0.549912	0.365232
59	0.499891	0.320065
45	0.44988	0.278042
40	0.399869	0.23884
35	0.349858	0.202183
30	0.299841	0.167829
25	0.249824	0.135569
20	0.199814	0.105222
15	0.15006	0.076762
10	0.099991	0.049719
5	0.049997	0.024185

Table 14 Actual concentration of Solospheres used in the study with 0.25 wt% CNC

Wt% of Solosphere	Actual Mass Fraction of Solosphere	Actual Volume Fraction of Solosphere
0	0	0
5.919885885	0.059199	0.028803
10.87147444	0.108715	0.054365
15.82304954	0.15823	0.081386
20.77463487	0.207746	0.109997
25.72621727	0.257262	0.140342
30.67780162	0.306778	0.172583
35.62938386	0.356294	0.206904
40.58096539	0.40581	0.243512
45.53254954	0.455325	0.282645
50.48413595	0.504841	0.324572
56.16383531	0.561638	0.37651
61.64335107	0.616434	0.431002
65.28307686	0.652831	0.469862

Table 15 Actual concentration of Solospheres used in the study with 0.5 wt% CNC

Wt% of Solosphere	**Actual Mass Fraction of Solosphere**	**Actual Volume Fraction of Solosphere**
0	0	0
4.99472789	0.049947	0.0242
9.99432486	0.099943	0.049773
14.994638	0.149946	0.076818
19.9949477	0.199949	0.10546
24.9952599	0.249953	0.135846
29.9955745	0.299956	0.168139
34.9958906	0.349959	0.202525
39.9962067	0.399962	0.239215
44.9965222	0.449965	0.278447
49.9968383	0.499968	0.320496
54.9971527	0.549972	0.365676
59.997469	0.599975	0.414351
64.9977645	0.649978	0.466942

Table 16 Actual concentration of Solospheres used in the study with 1 wt% CNC

Wt% of Solosphere	**Actual Mass Fraction of Solosphere**	**Actual Volume Fraction of Solosphere**
0	0	0
4.9187	0.049187	0.023861

10.0489	0.100489	0.05014
14.977	0.14977	0.076839
19.8973	0.198973	0.105042
24.8221	0.248221	0.134958
29.9227	0.299227	0.167888
39.6563	0.396563	0.236946
44.6791	0.446791	0.276211
49.6151	0.496151	0.317543
53.7344	0.537344	0.354335
56.1397	0.561397	0.37687
59.0851	0.590851	0.405595
64.897	0.64897	0.466258

Table 17 Actual concentration of Solospheres used in the study with 1.5 wt% CNC

Wt% of Solosphere	**Actual Mass Fraction of Solosphere**	**Actual Volume Fraction of Solosphere**
0	0	0
4.688802	0.04688802	0.022754
9.705174	0.09705174	0.04841
14.72155	0.1472155	0.075535
20.05145	0.2005145	0.106112
25.38135	0.2538135	0.13867
30.71709	0.3071709	0.173448
36.04783	0.3604783	0.210603
41.37718	0.4137718	0.250414
45.8845	0.458845	0.286386
49.97748	0.4997748	0.321059

Table 18 Actual concentration of Solospheres used in the study with 2.5 wt% CNC

Wt% of Solosphere	**Actual Mass Fraction of Solosphere**	**Actual Volume Fraction of Solosphere**
0	0	0
5.64923	0.0564923	0.027649
10.61501	0.1061501	0.053387
15.58185	0.1558185	0.080593
21.11391	0.2111391	0.112774
26.042	0.26042	0.143266
30.97264	0.3097264	0.175659
35.43996	0.3543996	0.206788
40.40611	0.4040611	0.243569

45.36771	0.4536771	0.282831

Appendix B Rheological Data

Avg. is the average viscosity used in the plots

Table 19 Rheological Data of 5% extendosphere suspension in water without CNC

Shear Rate (s^{-1})	**Viscosity (mPas.s)**
153.207	1.1945929
3	1.2431873
170.23	1.0751336
340.46	1.1188686
510.69	1.1334469
1021.38	1.3417925
153.207	1.1945929
306.414	1.2431873
170.23	1.0751336
340.46	1.1188686
510.69	1.1334469
1021.38	1.3417925

Avg.= 1.184503645

Table 20 Rheological data of 10 wt% Extendosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPas.s)**
153.207	1.1945929
306.414	1.2431873
170.23	1.0751336
340.46	1.4095195
510.69	1.3272142
153.207	1.1945929
306.414	1.2431873
170.23	1.0751336
340.46	1.4095195
510.69	1.3272142

Table 21 Rheological data of 15 wt% Extendospheres suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**

153.207	1.1945929
306.414	1.2431873
170.23	1.0751336
340.46	1.1188686
510.69	1.7147487
1021.38	2.2137451
153.207	1.1945929
306.414	1.2431873
170.23	1.6564354
340.46	1.4095195
510.69	1.7147487
1021.38	1.8262106

Table 22 Rheological Data of 20 wt% Extendosphere in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
153.207	1.8404838
306.414	1.5661327
170.23	1.6564354
340.46	1.9908212
510.69	1.9085159
1021.38	2.4075124
153.207	1.1945929
306.414	1.5661327
170.23	1.6564354
340.46	1.4095195
510.69	1.9085159
1021.38	2.4075124

Table 23 Rheological Data of 25 wt% Extendosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	5.5214514
102.138	5.6672345
153.207	8.2993923
306.414	4.795587
170.23	3.9816425
340.46	3.7347265
510.69	3.8461885
1021.38	4.3451849

51.069	5.5214514
102.138	5.6672345
153.207	7.0076106
306.414	5.1185324

Table 24 Rheological Data of 30 wt% Extendosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	3.58377881
102.138	3.72956197
153.207	3.1322655
306.414	3.18085988
170.23	3.98164248
340.46	3.73472655
510.69	4.03995575
1021.38	5.41090485
51.069	3.58377881
102.138	3.72956197
153.207	4.4240472
306.414	3.50380531
170.23	3.98164248
340.46	4.02537743
510.69	4.03995575
1021.38	5.2171376

Table 25 Rheological Data of 35 wt% Extendosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	5.52145137
102.138	4.69839825
153.207	5.06993806
306.414	6.08736872
170.23	8.05075486
340.46	6.64123539
510.69	8.10906812
1021.38	8.89871546
51.069	5.52145137
102.138	5.66723453
153.207	6.36171976
306.414	6.08736872
170.23	8.63205663
340.46	6.64123539
510.69	8.10906812

1021.38	9.09248272

Table 26 Rheological Data of 40 wt% Extendosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	5.52145137
102.138	4.69839825
153.207	5.71582891
306.414	10.9315501
170.23	8.05075486
340.46	13.0355548
510.69	12.565715
1021.38	15.6805694
51.069	7.45912393
102.138	6.63607081
153.207	5.71582891
306.414	10.9315501
170.23	8.05075486
340.46	13.0355548
510.69	12.3719478
1021.38	15.3899185
510.69	14.1717284
1021.38	13.2187433

Table 27 Rheological Data of 45 wt% Extendosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	13.2721416
102.138	13.4179248
153.207	13.4665192
306.414	19.0051858
170.23	13.2824708
340.46	22.3363831
510.69	25.5481212
1021.38	23.5281433
51.069	15.2098142
102.138	16.3244336
153.207	14.11241
306.414	18.6822404
170.23	11.5385655
340.46	21.1737796
510.69	26.7107247
1021.38	24.1094451

340.46	21.2575927
510.69	22.3489005
1021.38	23.4402083

Table 28 Rheological Data of 50 wt% Extendosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
3.06414	27.4351041
51.069	67.5269733
102.138	61.8597388
153.207	45.7610618
306.414	59.6963096
10.2138	27.6072568
170.23	42.3475592
340.46	53.4360277
1.53207	54.8702083
3.06414	59.7296468
51.069	57.8386105
102.138	57.9843937
153.207	45.7610618
306.414	51.2997285
10.2138	27.6072568
170.23	39.4410503
340.46	47.9136609
510.69	56.7446494
510.69	26.4374865
1021.38	29.5730874
37.44	99.5101496
74.88	104.924973
149.76	103.434675
299.52	71.8063769
599.04	68.885193
59.904	57.6962974

Table 29 Rheological Data of 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
183.02	1.791889
281.975	1.840484
479.885	1.566133
281.975	1.656435
578.84	1.70017

776.75	1.520981
1271.525	1.244909

Table 30 Rheological Data of 5 wt% Extendosphere thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	1.646106
102.138	1.791889
153.207	1.840484
306.414	1.566133
170.23	1.656435
340.46	1.70017
510.69	1.520981
1021.38	1.53556

Table 31 Rheological Data of 10 wt% Extendosphere thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	3.583779
102.138	3.729562
153.207	3.132265
306.414	2.857914
170.23	3.981642
340.46	2.862774
510.69	2.877352
1021.38	2.698163

Table 32 Rheological Data of 15 wt% Extendosphere thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	5.521451
102.138	3.729562
153.207	3.778156
306.414	3.503805
170.23	3.981642
340.46	3.444076
510.69	3.071119
1021.38	3.182581
599.04	5.76963

Table 33 Rheological Data of 20 wt% Extendosphere thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
51.069	9.396796
102.138	6.636071
153.207	5.069938
306.414	4.795587
170.23	5.725548
340.46	4.89733
510.69	4.42749
1021.38	4.151418
599.04	5.469793

Table 34 Rheological Data of 25 wt% Extendosphere thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	184.0484
3.06414	124.3187
51.069	17.14749
102.138	12.44909
153.207	9.591174
306.414	7.702096
5.1069	74.59124
10.2138	46.98398
170.23	8.632057
340.46	7.513188
510.69	6.55893
1021.38	6.476625
149.76	14.6831
299.52	9.440405
599.04	7.268812
119.808	16.85469

Table 35 Rheological Data of 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
102.138	1.791889
153.207	1.840484
306.414	1.889078
170.23	2.237737
340.46	1.990821
510.69	1.908516
1021.38	1.729327

Table 36 Rheological Data of 5 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
102.138	1.791889
153.207	2.486375
306.414	1.889078
170.23	2.819039
340.46	1.990821
510.69	2.489818
1021.38	2.116862

Table 37 Rheological Data of 11 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
51.069	3.583779
102.138	2.760726
153.207	3.132265
306.414	2.857914
170.23	3.400341
340.46	2.862774
510.69	2.683585
1021.38	2.698163

Table 38 Rheological Data of 14 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
51.069	5.521451
102.138	5.667235
153.207	5.069938
306.414	4.795587
170.23	5.144246
340.46	4.606679
510.69	4.039956
1021.38	3.473232

Table 39 Rheological Data of 17 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
51.069	9.396796
102.138	7.604907
153.207	7.007611
306.414	5.764423
170.23	6.888151

340.46	5.478632
510.69	5.008792
1021.38	4.151418

Table 40 Rheological Data of 20 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	19.08516
102.138	12.44909
153.207	9.591174
306.414	7.37915
5.1069	55.21451
10.2138	46.98398
170.23	9.213358
340.46	7.513188
510.69	6.55893
1021.38	5.217138

Table 41 Rheological Data of 23 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	377.8156
3.06414	253.4969
51.069	38.46188
102.138	22.13745
153.207	15.40419
306.414	11.2545
5.1069	190.8516
10.2138	124.4909
170.23	14.44507
340.46	10.12905
510.69	9.077904
1021.38	6.767276
37.44	51.53632
74.88	28.16685
149.76	17.08179
299.52	11.23942
599.04	8.018403
59.904	32.2102
119.808	19.85306
18.72	117.4648
37.44	58.7324
74.88	31.76489

149.76	19.48048
299.52	12.43877
599.04	8.618076
29.952	70.41713
59.904	39.70611
119.808	23.60101

Table 42 Rheological Data of 26 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	40.39956
102.138	22.13745
153.207	16.05008
306.414	12.22333
10.2138	134.1792
170.23	15.60768
340.46	11.29165
510.69	10.04674
1021.38	7.832996
18.72	131.8569
37.44	63.52978
74.88	36.56227
149.76	22.47885
299.52	14.83746
599.04	9.967339
29.952	73.4155
59.904	45.70284
119.808	27.34897
11.9808	161.051
2.34	862.9603
4.68	489.0487
9.36	263.7139
18.72	146.2491
37.44	75.52324
74.88	41.35966
149.76	24.27786
299.52	15.43713
599.04	10.56701
14.976	140.8343
29.952	94.40405
59.904	54.69793
119.808	29.59774
11.9808	168.5469

Table 43 Rheological Data of 29 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	46.21258
102.138	26.0128
153.207	19.27954
306.414	14.48395
5.1069	287.7352
10.2138	192.3094
170.23	17.35158
340.46	12.45425
510.69	11.79065
1021.38	10.25509
2.34	978.0974
4.68	508.2382
9.36	273.3087
18.72	151.0465
37.44	77.92193
74.88	40.16031
149.76	24.27786
299.52	15.73697
599.04	11.16669
3.744	539.3502
7.488	305.6554
14.976	182.8114
29.952	112.3942
59.904	57.6963
119.808	31.09692
0.7488	2576.816
1.4976	1408.343
2.9952	764.1386
5.9904	412.053
11.9808	236.0101
2.34	824.5812
4.68	450.6697
9.36	244.5244
18.72	141.4517
37.44	80.32062
74.88	41.35966
149.76	24.87754
299.52	16.33664
599.04	11.61644

7.488	281.6685
14.976	158.8245
29.952	109.3959
59.904	54.69793
119.808	31.09692
2.9952	644.2041
5.9904	337.0939
11.9808	213.5224

Table 44 Rheological Data of 29 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	506.9938
3.06414	285.7914
51.069	63.65163
102.138	33.76349
153.207	27.03023
306.414	19.00519
5.1069	307.1119
10.2138	201.9978
170.23	24.3272
340.46	17.39532
510.69	14.30962
1021.38	11.99899
18.72	131.8569
37.44	75.52324
74.88	43.75835
149.76	27.27623
299.52	18.73533
599.04	13.71529
29.952	76.41386
59.904	56.19712
119.808	31.84651
37.44	80.32062
74.88	41.35966
149.76	24.87754
299.52	16.33664
599.04	11.61644
14.976	146.831
29.952	94.40405
59.904	54.69793
119.808	31.09692
11.9808	183.5387

Table 45 Rheological Data of 31 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	571.5829
3.06414	318.086
51.069	65.5893
102.138	42.48301
153.207	28.9679
306.414	20.61991
5.1069	326.4887
10.2138	201.9978
170.23	26.65241
340.46	18.84857
510.69	16.63483
1021.38	13.54913
510.69	22.3489
1021.38	15.26304
37.44	75.52324
74.88	42.559
149.76	26.67656
299.52	18.4355
599.04	13.41546
14.976	140.8343
29.952	91.40568
59.904	48.70121
119.808	28.84815
2.34	1093.235
4.68	546.6173
9.36	273.3087
18.72	146.2491
37.44	75.52324
74.88	43.75835
149.76	27.8759
299.52	19.03517
599.04	13.86521
0.234	8629.603
0.468	4314.801
0.936	2157.401
1.872	1078.7
3.744	539.3502
7.488	293.662
14.976	200.8015

29.952	118.391
59.904	63.69303
119.808	36.34406
0.0936	20614.53
0.1872	10787
0.3744	5393.502
0.7488	2696.751
1.4976	1408.343
2.9952	734.155
5.9904	472.0202
11.9808	273.4897

Table 46 Rheological Data of 34 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	829.9392
3.06414	673.326
51.069	96.59206
102.138	51.20254
153.207	40.59394
306.414	33.53773
5.1069	190.8516
10.2138	134.1792
170.23	41.76626
340.46	29.60266
510.69	26.90449
1021.38	20.13722
170.23	54.78094
340.46	39.65623
510.69	34.61466
1021.38	25.4845
37.44	94.71277
74.88	56.95115
149.76	43.46739
299.52	30.12912
599.04	21.36112
14.976	140.8343
29.952	115.3926
59.904	68.19057
119.808	43.09038

Table 47 Rheological Data of 37 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1023.706
3.06414	544.1478
51.069	67.52697
102.138	40.54534
153.207	30.25968
306.414	39.67369
5.1069	248.9818
10.2138	134.1792
170.23	50.48578
340.46	39.19413
510.69	36.59285
170.23	54.78094
340.46	39.65623
510.69	38.70324
1021.38	25.4845
2.34	901.3393
4.68	489.0487
9.36	244.5244
18.72	223.0072
37.44	113.9023
74.88	70.14395
149.76	45.26641
299.52	30.42895
599.04	23.45998
0.234	9013.393
0.468	4506.697
0.936	2253.348
1.872	1126.674
3.744	563.3371
7.488	317.6489
14.976	188.8081
29.952	163.3664
59.904	90.6783
119.808	55.08383
0.0234	93971.84
0.0468	46985.92
0.0936	23492.96
0.1872	11746.48
0.3744	6352.978
0.7488	3176.489

1.4976	1648.212
2.9952	854.0895
5.9904	442.0366
11.9808	228.5142
2.34	939.7184
4.68	469.8592
9.36	225.3348
18.72	165.4386
37.44	133.0918
74.88	73.74199
149.76	44.06707
299.52	30.42895
599.04	23.31006
0.234	8629.603
0.468	4314.801
0.936	2157.401
1.872	1174.648
3.744	635.2978
7.488	305.6554
14.976	170.8179
29.952	172.3615
59.904	119.1628
119.808	57.33261
0.0234	86296.03
0.0468	43148.01
0.0936	21574.01
0.1872	10787
0.3744	5393.502
0.7488	2696.751
1.4976	1348.375
2.9952	674.1877
5.9904	352.0857
11.9808	273.4897

Table 48 Rheological Data of 40 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
9.36	398.0406
18.72	256.5889
37.44	193.0591
74.88	127.7125
149.76	80.04744
299.52	61.01227

599.04	49.24591
1198.08	40.13949
0.936	1965.505
1.872	1030.726
3.744	539.3502
7.488	329.6424
14.976	218.7917
29.952	178.3582
59.904	116.1644
119.808	87.31625
0.0234	90133.93
0.0468	46985.92
0.0936	23492.96
0.1872	11746.48
0.3744	5873.24
0.7488	2936.62
1.4976	1468.31
2.9952	644.2041
5.9904	382.0693
11.9808	228.5142
2.34	862.9603
4.68	431.4801
9.36	215.7401
18.72	304.5627
37.44	205.0526
74.88	115.7191
149.76	79.44776
299.52	58.91341
599.04	43.24918
1.872	982.7527
3.744	563.3371
7.488	269.6751
14.976	170.8179
29.952	172.3615
59.904	132.6554
119.808	86.56666
0.0234	82458.12
0.0468	41229.06
0.0936	20614.53
0.1872	10307.26
0.3744	5153.632
0.7488	2696.751

1.4976	1348.375
2.9952	674.1877
5.9904	367.0775
11.9808	228.5142

Table 49 Rheological Data of 43 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
2.34	1208.372
4.68	565.8068
9.36	417.2301
18.72	256.5889
37.44	190.6604
74.88	158.8955
149.76	114.2288
299.52	87.09803
599.04	53.14378
1198.08	42.53818
0.234	11316.14
0.468	5849.964
0.936	3212.825
1.872	1510.465
3.744	755.2324
7.488	473.5638
14.976	272.7623
29.952	259.3141
59.904	195.621
119.808	129.2933
0.0234	209109
0.0468	104554.5
0.0936	50358.3
0.1872	25658.89
0.3744	10910.49
0.7488	5335.311
1.4976	2427.786
2.9952	1303.844
5.9904	726.8812
11.9808	228.5142
2.34	1323.509
4.68	661.7545
9.36	455.6092
18.72	285.3732
37.44	197.8565

74.88	164.8923
149.76	112.4298
299.52	86.49836
599.04	56.5919
1198.08	42.91297
0.234	10164.76
0.468	5082.382
0.936	2637.139
1.872	1558.439
3.744	827.1931
7.488	461.5704
14.976	494.6412
29.952	271.3075
59.904	137.1529
119.808	91.0642
0.0234	201433.2
0.0468	100716.6
0.0936	50358.3
0.1872	25179.15
0.3744	12589.58
0.7488	6294.788
1.4976	3147.394
2.9952	1573.697
5.9904	786.8485
11.9808	513.3588

Table 50 Rheological Data of 46 wt% Extendosphere thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
2.34	3242.462
4.68	1602.041
9.36	896.9684
18.72	544.4318
37.44	519.2811
74.88	390.3692
149.76	282.1372
299.52	198.6372
599.04	118.0584
1198.08	71.84719
0.234	19375.74
0.468	9879.765
0.936	5323.673
1.872	2278.046

3.744	1330.918
7.488	713.433
14.976	452.6641
29.952	307.2879
59.904	264.5834
119.808	312.1936
0.0234	331922
0.0468	165961
0.0936	82021.03
0.1872	39571.3
0.3744	20265.39
0.7488	10252.63
1.4976	3687.099
2.9952	2113.402
5.9904	1056.701
11.9808	648.2852
2.34	2359.744
4.68	1141.493
9.36	657.0993
18.72	400.5104
37.44	269.8172
74.88	269.2353
149.76	190.3872
299.52	143.7671
599.04	117.7585
1198.08	82.2665
0.234	24748.81
0.468	14101.46
0.936	7914.26
1.872	4149.025
3.744	2074.513
7.488	1001.276
14.976	554.6085
29.952	367.2552
59.904	209.1137
119.808	218.4947
0.0234	285867.1
0.0468	144852.5
0.0936	72426.26
0.1872	37172.61
0.3744	18106.57
0.7488	9173.217

1.4976	4586.609
2.9952	2383.255
5.9904	1056.701
11.9808	648.2852

Table 51 Rheological Data of 1wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	3.583779
102.138	3.729562
153.207	3.778156
306.414	3.503805
170.23	3.400341
340.46	3.153425
510.69	3.071119
1021.38	2.795047
299.52	4.043349
599.04	3.22102

Table 52 Rheological Data of 5 wt% Extendosphere thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
102.138	4.698398
153.207	5.069938
306.414	4.149696
170.23	4.562944
340.46	3.734727
510.69	3.652421
1021.38	3.279465
299.52	5.842368
599.04	4.720202

Table 53 Rheological Data of 10 wt% Extendosphere thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	119.4593
3.06414	92.02419
51.069	36.52421
102.138	22.13745
153.207	16.69597
306.414	11.90039
5.1069	74.59124
10.2138	56.67235
170.23	15.02638

340.46	11.001
510.69	8.884137
1021.38	6.185974
18.7	83.88312
37.4	53.93502
74.9	32.96424
149.8	20.08015
299.5	13.03844
599.0	9.06783
14.976	74.87026
29.952	40.43349
59.904	24.71429
119.808	15.35551
11.9808	116.0756

Table 54 Rheological Data of 15 wt% Extendosphere thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1217.474
3.06414	770.2096
51.069	81.09068
102.138	42.48301
153.207	30.90557
306.414	18.35929
5.1069	578.3861
10.2138	376.3883
170.23	27.81501
340.46	17.10467
510.69	13.14702
1021.38	9.964435
1.53207	1088.296
3.06414	641.0314
51.069	77.21534
102.138	42.48301
153.207	30.90557
306.414	19.65108
5.1069	462.1258
10.2138	337.6349
170.23	27.81501
340.46	17.10467
510.69	14.30962
1021.38	10.35197
2.34	978.0974

4.68	565.8068
9.36	369.2563
18.72	208.6151
37.44	101.9088
74.88	54.55246
149.76	30.27459
299.52	17.23615
599.04	11.3166
1.872	886.805
3.744	563.3371
7.488	389.6096
14.976	212.795
29.952	106.3975
59.904	57.6963
119.808	30.34733
2.9952	644.2041
5.9904	442.0366
11.9808	251.0019

Table 55 Rheological Data of 20 wt% Extendosphere thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1605.008
3.06414	867.0932
51.069	154.7222
102.138	81.23646
153.207	55.44942
306.414	29.98533
5.1069	791.5301
10.2138	608.909
170.23	48.74188
340.46	26.9868
510.69	19.92887
1021.38	13.93666
1.53207	1605.008
3.06414	802.5041
51.069	143.0962
102.138	74.45461
153.207	53.51175
306.414	30.30828
5.1069	907.7904
10.2138	521.7138
170.23	51.64839

340.46	29.89331
510.69	21.86654
1021.38	13.93666
2.34	1515.404
4.68	911.2184
9.36	561.1516
18.72	338.1444
37.44	200.2552
74.88	107.3237
149.76	56.6602
299.52	31.6283
599.04	19.5621
3.744	683.3
7.488	425.6
14.976	338.7
29.952	250.3
59.904	134.2
119.808	73.1
1.4976	1228.441
2.9952	674.1877
5.9904	352.0857
11.9808	183.5387

Table 56 Rheological Data of 25 wt% Extendosphere thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1411.241
3.06414	705.6205
51.069	203.1641
102.138	106.4262
153.207	78.0556
306.414	44.19493
5.1069	985.2973
10.2138	628.2858
170.23	72.57525
340.46	39.77544
510.69	29.61723
1021.38	19.16838
5.1069	1417.173
10.2138	708.5864
170.23	91.57822
340.46	51.92199
510.69	38.70324

1021.38	21.39592
2.34	1592.162
4.68	949.5974
9.36	724.2626
18.72	371.7261
37.44	190.6604
74.88	96.52955
149.76	57.85954
299.52	36.72552
599.04	24.05965
1.872	1030.726
3.744	995.1015
7.488	557.518
14.976	416.6838
29.952	235.3272
59.904	119.1628
119.808	67.82688
0.7488	1737.274
1.4976	1348.375
2.9952	1093.959
5.9904	651.9221
11.9808	400.9201

Table 57 Rheological Dtt5ata of 28 wt% Extendosphere thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1282.063
3.06414	1157.744
51.069	267.1072
102.138	145.1797
153.207	102.5995
306.414	57.75864
5.1069	1101.558
10.2138	831.7414
170.23	88.8517
340.46	53.14538
510.69	40.85573
1021.38	25.07828
5.1069	1826.031
10.2138	913.0157
170.23	116.1097
340.46	64.18775
510.69	50.969

1021.38	27.52879
2.34	2858.671
4.68	1621.231
9.36	887.3736
18.72	477.2685
37.44	248.229
74.88	128.9119
149.76	77.04907
299.52	48.1193
599.04	31.8554
1198.08	37.59088
0.234	12083.72
0.468	5849.964
0.936	3212.825
1.872	1846.282
3.744	1067.062
7.488	569.5115
14.976	374.7067
29.952	280.3026
59.904	149.1464
119.808	97.06093
0.0234	105485.6
0.0468	52742.78
0.0936	26371.39
0.1872	12705.96
0.3744	6592.847
0.7488	2576.816
1.4976	1288.408
2.9952	644.2041
5.9904	322.102
11.9808	415.912

Table 58 Rheological Data of 31 wt% Extendosphere thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	226.4161
102.138	128.7094
153.207	131.0187
306.414	78.42714
5.1069	733.3999
10.2138	579.8439
170.23	127.7989
340.46	77.56005

510.69	56.74465
5.1069	1826.031
10.2138	913.0157
170.23	140.6413
340.46	76.4535
510.69	59.14617
1021.38	31.61738
2.34	2781.913
4.68	1410.146
9.36	714.6678
18.72	357.3339
37.44	185.863
74.88	96.52955
149.76	50.0638
299.52	26.23124
599.04	18.6626
1198.08	10.6056
0.234	13618.88
0.468	6425.65
0.936	3116.877
1.872	1510.465
3.744	683.2716
7.488	605.4919
14.976	818.4645
29.952	523.1701
59.904	273.5785
119.808	168.2721
0.0234	128512.8
0.0468	64256.5
0.0936	33087.72
0.1872	16543.86
0.3744	7792.193
0.7488	3896.096
1.4976	2008.015
2.9952	1004.008
5.9904	966.7503
11.9808	963.1134

Table 59 Rheological Data of 34 wt% Extendosphere thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	311.6737
102.138	170.3694

153.207	139.4152
306.414	87.79256
170.23	143.4941
340.46	77.8507
510.69	57.13218
5.1069	1826.031
10.2138	913.0157
170.23	116.1097
340.46	70.32063
510.69	59.14617
1021.38	41.83885
18.72	625.9873
37.44	339.3793
74.88	211.6667
149.76	137.616
299.52	83.5
599.04	52.09435

Table 60 Rheological Data of 37 wt% Extendosphere thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
102.138	225.5931
153.207	137.4776
5.1069	1896.003
10.2138	812.3646
170.23	170.8152
5.1069	1826.031
10.2138	913.0157
170.23	214.2358
340.46	107.1179
510.69	91.85486
1021.38	58.19319
299.52	60.41259
599.04	35.00368
1198.08	21.54963
0.234	18991.95
0.468	9687.87
0.936	5419.621
29.952	382.247
59.904	237.5981
119.808	163.7745
0.0234	408680.1
0.0468	221610.6

0.0936	111764.8
0.1872	56841.88
0.3744	30100.02
0.7488	16369.29
1.4976	8604.416
2.9952	2473.206
11.9808	475.8792

Table 61 Rheological Data of 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	5.521451
102.138	6.636071
153.207	6.36172
306.414	5.441478
170.23	5.725548
340.46	5.187981
510.69	4.815025
1021.38	4.054534

Table 62 Rheological Data of 5 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	5.521451
102.138	4.698398
153.207	3.778156
306.414	3.503805
170.23	3.981642
340.46	3.444076
510.69	3.264887
1021.38	3.182581

Table 63 Rheological Data of 8 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	119.4593
3.06414	92.02419
51.069	34.58654
102.138	23.10629
153.207	18.63365
306.414	13.51511
5.1069	74.59124
10.2138	56.67235
170.23	17.93288

340.46	13.32621
510.69	10.82181
1021.38	11.12704
510.69	14.17173
1021.38	9.130157
74.88	30.56554
149.76	20.67983
299.52	14.83746
599.04	10.71693
59.904	38.20693
119.808	23.60101

Table 64 Rheological Data of 11 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	67.52697
102.138	39.5765
153.207	30.25968
306.414	20.29697
170.23	28.97762
340.46	19.13922
510.69	13.53455
1021.38	10.25509
510.69	18.26031
1021.38	11.17445
18.72	117.4648
37.44	75.52324
74.88	48.55573
149.76	32.07361
299.52	21.13402
599.04	14.76472
1.872	1078.7
3.744	659.2847
7.488	389.6096
14.976	212.795
29.952	121.3893
59.904	72.68812
119.808	45.33915
0.1872	11746.48
0.3744	6832.716
0.7488	3896.096
1.4976	2127.95
2.9952	1153.926

5.9904	651.9221
11.9808	340.9529
2.34	939.7184
4.68	604.1859
9.36	388.4458
18.72	237.3994
37.44	128.2944
74.88	70.14395
149.76	41.66838
299.52	25.0319
599.04	15.81415
3.744	539.3502
7.488	317.6489
14.976	188.8081
29.952	112.3942
59.904	71.18894
119.808	43.09038
0.1872	13185.69
0.3744	8032.062
0.7488	4495.769
1.4976	2487.754
2.9952	1333.828
5.9904	711.8894
11.9808	378.4324

Table 65 Rheological Data of 14 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	2444.666
3.06414	1351.511
51.069	154.7222
102.138	78.32996
153.207	53.51175
306.414	32.89184
5.1069	888.4137
10.2138	589.5323
170.23	47.57928
340.46	27.5681
510.69	21.09147
1021.38	12.96783
170.23	67.0467
340.46	33.52335
510.69	22.3489

1021.38	17.30733
2.34	2206.227
4.68	1333.388
9.36	916.1579
18.72	462.8763
37.44	217.046
74.88	100.1276
149.76	54.86118
299.52	31.32846
599.04	18.96243
0.234	14386.46
0.468	7960.812
0.936	4076.354
1.872	2469.941
3.744	1402.879
7.488	929.3152
14.976	452.6641
29.952	241.3239
59.904	125.1595
0.0234	193757.4
0.0468	91121.84
0.0936	41723.01
0.1872	20381.77
0.3744	10430.75
0.7488	5215.377
1.4976	2787.59
2.9952	1843.55
5.9904	1101.677
11.9808	738.2361
2.34	2398.123
4.68	1448.525
9.36	896.9684
18.72	467.6737
37.44	202.6539
74.88	106.1243
149.76	56.6602
299.52	32.52781
599.04	19.41219
0.234	16689.21
0.468	9304.079
0.936	4843.935
1.872	2757.784

3.744	1594.774
7.488	1001.276
14.976	494.6412
29.952	253.3173
59.904	126.6587
119.808	67.07729
0.0234	201433.2
0.0468	100716.6
0.0936	43641.97
0.1872	22300.72
0.3744	10910.49
0.7488	5695.115
1.4976	2847.557
2.9952	1543.713
5.9904	951.7585
11.9808	595.8138

Table 66 Rheological Data of 17 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	3478.092
3.06414	1803.635
51.069	282.6086
102.138	148.0862
153.207	101.3077
306.414	54.52918
5.1069	1217.818
10.2138	822.053
170.23	94.08342
340.46	50.23887
510.69	36.39909
1021.38	20.62163
5.1069	1417.173
10.2138	913.0157
170.23	103.844
340.46	58.05487
510.69	38.70324
1021.38	23.44021
2.34	2973.809
4.68	1563.662
9.36	935.3474
18.72	563.6214
37.44	334.5819

74.88	182.8824
149.76	96.2386
299.52	50.81783
599.04	28.70711
0.234	15154.04
0.468	7577.021
0.936	4076.354
1.872	2182.098
3.744	1234.971
7.488	797.3872
14.976	776.4874
29.952	418.2274
59.904	225.6047
0.0234	212946.9
0.0468	106473.5
0.0936	53236.73
0.1872	26618.37
0.3744	13788.92
0.7488	6774.526
1.4976	3207.361
2.9952	1693.631
5.9904	1056.701
11.9808	858.1707
2.34	2973.809
4.68	1602.041
9.36	935.3474
18.72	563.6214
37.44	336.9806
74.88	190.0785
149.76	95.03926
299.52	50.51799
599.04	28.70711
0.234	17456.79
0.468	9304.079
0.936	5227.725
1.872	2949.679
3.744	1690.722
7.488	1097.224
14.976	836.4547
29.952	430.2208
59.904	231.6014
119.808	122.547

0.0234	201433.2
0.0468	100716.6
0.0936	49398.82
0.1872	25658.89
0.3744	12829.44
0.7488	6654.591
1.4976	3387.263
2.9952	1963.484
5.9904	1311.562
11.9808	858.1707

Table 67 Rheological Data of 20 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	4188.572
3.06414	2255.759
51.069	265.1696
102.138	160.681
153.207	125.8515
306.414	68.09289
5.1069	1527.846
10.2138	1132.081
170.23	108.616
340.46	63.31816
510.69	52.09424
10.2138	1117.445
170.23	128.3755
340.46	70.32063
510.69	46.88042
1021.38	27.52879
2.34	3664.632
4.68	1870.695
9.36	973.7265
18.72	702.7455
37.44	408.9413
74.88	217.6635
149.76	122.0245
299.52	66.70916
599.04	37.70221
0.234	20143.32
0.468	11031.14
0.936	5995.307
1.872	3189.549

3.744	1954.578
7.488	1373.073
14.976	1112.304
29.952	583.1374
59.904	305.0613
0.0234	232136.5
0.0468	116068.2
0.0936	57074.64
0.1872	28537.32
0.3744	15468
0.7488	8453.61
1.4976	4286.772
2.9952	2143.386
5.9904	1236.603
11.9808	805.6993
2.34	3703.011
4.68	1889.884
9.36	1127.243
18.72	712.3402
37.44	360.9675
74.88	234.4543
149.76	117.2272
299.52	63.71079
599.04	36.50286
0.234	18991.95
0.468	9879.765
0.936	5323.673
1.872	2853.732
3.744	1354.905
7.488	917.3217
14.976	674.5431
29.952	556.1521
59.904	291.5687
119.808	197.5061
0.0234	232136.5
0.0468	116068.2
0.0936	56115.16
0.1872	28537.32
0.3744	14268.66
0.7488	7134.33
1.4976	2667.656
2.9952	1363.811

5.9904	711.8894
11.9808	430.9038

Table 68 Rheological Data of 23 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	4059.394
3.06414	2094.286
51.069	286.484
102.138	184.9019
153.207	126.4974
306.414	67.12405
5.1069	1508.469
10.2138	1103.016
170.23	114.429
340.46	62.44621
510.69	57.32595
5.1069	1417.173
10.2138	913.0157
170.23	103.844
340.46	58.05487
510.69	42.79183
1021.38	25.4845
2.34	4048.422
4.68	2139.348
9.36	1184.811
18.72	693.1507
37.44	399.3466
74.88	222.4608
149.76	120.2255
299.52	64.01063
599.04	36.65278
0.234	17073
0.468	9495.974
0.936	5419.621
1.872	3093.601
3.744	2146.473
7.488	1636.929
14.976	1112.304
29.952	580.139
59.904	300.5638
0.0234	251326
0.0468	127581.9

0.0936	59953.07
0.1872	29496.79
0.3744	14748.4
0.7488	7374.199
1.4976	3926.968
2.9952	1963.484
5.9904	1236.603
11.9808	925.6338
2.34	2705.155
4.68	1621.231
9.36	1136.838
18.72	779.5036
37.44	418.5361
74.88	236.853
149.76	118.4265
299.52	63.41096
599.04	36.50286
0.234	18224.37
0.468	9495.974
0.936	5323.673
1.872	2901.706
3.744	1594.774
7.488	1097.224
14.976	764.494
29.952	556.1521
59.904	290.0695
119.808	148.7827
0.0234	262839.7
0.0468	129500.9
0.0936	63790.97
0.1872	32375.22
0.3744	14748.4
0.7488	7254.264
1.4976	3867.001
2.9952	2023.452
5.9904	2001.186
11.9808	1038.072

Table 69 Rheological Data of 26 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	4253.161
3.06414	2158.875

51.069	307.7984
102.138	261.44
153.207	189.7947
5.1069	1527.846
10.2138	1093.327
170.23	158.6079
5.1069	1826.031
10.2138	913.0157
170.23	152.907
340.46	100.985
510.69	79.5891
1021.38	43.88314
2.34	2743.534
4.68	1448.525
9.36	1060.079
18.72	803.4905
37.44	516.8824
74.88	298.0196
149.76	167
299.52	90.39623
599.04	49.84558
0.234	14386.46
0.468	7577.021
0.936	4172.301
1.872	2086.151
3.744	1115.036
7.488	1636.929
14.976	1208.252
29.952	706.0703
59.904	402.5082
0.0234	331922
0.0468	141014.6
0.0936	70507.31
0.1872	33334.7
0.3744	17147.09
0.7488	9652.955
1.4976	3807.034
2.9952	1603.681
5.9904	1266.587
11.9808	1405.372
2.34	2052.711
4.68	1582.852

9.36	1424.68
18.72	726.7324
37.44	444.9217
74.88	328.0033
149.76	164.0016
299.52	88.29738
599.04	49.39583
0.234	26667.76
0.468	12758.19
0.936	6858.835
1.872	3189.549
3.744	1402.879
7.488	845.361
14.976	800.4744
29.952	400.2372
59.904	317.0548
119.808	176.5176
0.0234	335759.9
0.0468	164042.1
0.0936	77223.64
0.1872	36213.13
0.3744	19545.78
0.7488	9652.955
1.4976	4646.576
2.9952	2233.337
5.9904	2001.186
11.9808	1345.405

Table 70 Rheological Data of 29 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	3930.215
3.06414	1997.402
51.069	195.4134
102.138	288.5674
5.1069	3291.128
10.2138	1916.838
5.1069	1826.031
10.2138	913.0157
170.23	140.6413
340.46	88.71926
510.69	71.41193
1021.38	43.88314

2.34	3165.704
4.68	2024.211
9.36	1674.144
18.72	957.0067
37.44	586.4445
74.88	363.9836
149.76	207.1781
299.52	111.3848
599.04	61.98896
0.234	28202.92
0.468	11223.03
0.936	5323.673
1.872	2901.706
3.744	3681.636
7.488	2572.419
14.976	1490.098
29.952	840.9967
59.904	508.9501
0.0234	412518
0.0468	204340.1
0.0936	104089
0.1872	53003.97
0.3744	26262.12
0.7488	12651.32
1.4976	6325.66
2.9952	1483.746
5.9904	726.8812
2.34	1899.195
4.68	987.9765
9.36	1424.68
18.72	1153.699
37.44	725.5686
74.88	440.7417
149.76	220.3709
299.52	115.8823
599.04	62.73855
0.234	30889.46
0.468	15636.62
0.936	8681.841
1.872	2661.837
3.744	1378.892
7.488	1313.106

14.976	1316.193
29.952	658.0965
59.904	387.5163
119.808	216.9955
0.0234	385652.7
0.0468	139095.7
0.0936	80102.07
0.1872	40530.77
0.3744	21464.73
0.7488	10012.76
1.4976	5066.347
2.9952	2023.452
5.9904	1071.693

Table 71 Rheological Data of 31 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	4382.339
3.06414	2191.169
5.1069	3388.011
10.2138	1897.461
5.1069	1826.031
10.2138	913.0157
170.23	214.2358
340.46	125.5165
510.69	91.85486
1021.38	56.1489
2.34	3741.39
4.68	2043.401
9.36	1674.144
18.72	1057.752
37.44	624.8235
74.88	390.3692
149.76	220.3709
299.52	122.1789
599.04	66.93626
0.234	28202.92
0.468	16596.1
0.936	9257.527
1.872	4868.632
3.744	2506.277
7.488	2488.464
14.976	1717.974

29.952	903.9623
59.904	526.9403
0.0234	393328.5
0.0468	202421.1
0.0936	94494.22
0.1872	48206.59
0.3744	26741.85
0.7488	13011.12
1.4976	5126.314
2.9952	1783.582
5.9904	966.7503
2.34	2052.711
4.68	1141.493
9.36	1549.412
18.72	1043.36
37.44	600.8366
74.88	427.5489
149.76	213.7745
299.52	116.482
599.04	64.23773
0.234	37030.11
0.468	18706.95
0.936	9833.213
1.872	5204.449
3.744	2602.225
7.488	1516.995
14.976	1058.334
29.952	529.1668
59.904	401.009
119.808	227.4898
0.0234	466248.7
0.0468	233124.4
0.0936	117521.7
0.1872	58281.09
0.3744	26022.25
0.7488	13011.12
1.4976	7285.136
2.9952	3912.421
5.9904	1896.243
11.9808	1712.704

Table 72 Rheological Data of 34 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53	4576.106
3.06	2320.348
5.11	3388.011
10.21	1781.201
5.1069	1826.031
10.2138	1117.445
170.23	152.907
340.46	137.7823
510.69	140.9179
1021.38	82.72471
2.34	3626.253
4.68	1179.872
9.36	848.9946
18.72	1407.961
37.44	802.3267
74.88	474.3234
149.76	271.3431
299.52	150.3635
599.04	86.12579
0.234	44705.92
0.468	28109.82
0.936	10408.9
1.872	6451.769
3.744	3537.714
7.488	3268.039
14.976	2011.813
29.952	1197.802
59.904	657.3691
0.0234	708036.8
0.0468	296449.8
0.0936	146306
0.1872	71234.02
0.3744	38495.44
0.7488	24644.78
1.4976	12682.19
2.9952	4662.012
5.9904	2480.924
11.9808	1757.68
2.34	3703.011
4.68	1602.041

9.36	1952.393
18.72	1244.85
37.44	838.3071
74.88	539.0881
149.76	269.544
299.52	148.2647
599.04	83.87701
1198.08	40.43932
0.234	41635.59
0.468	21585.38
0.936	11656.22
1.872	6020.004
3.744	2938.041
7.488	1864.805
14.976	1777.941
29.952	888.9705
59.904	532.937
119.808	308.4456
0.0234	742577.9
0.0468	371289
0.0936	185644.5
0.1872	68835.33
0.3744	34897.4
0.7488	18408.18
1.4976	11123.04
2.9952	3792.486
5.9904	2540.891
11.9808	2057.516

Table 73 Rheological Data of 37 wt% Extendosphere thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	4576.106
3.06414	2320.348
5.1069	2283.538
10.2138	1248.341
5.1069	1826.031
10.2138	1117.445
170.23	300.0961
340.46	199.1111
510.69	173.6266
1021.38	101.1233
2.34	3971.664

4.68	1736.368
9.36	954.537
18.72	1508.706
37.44	1147.738
74.88	677.0128
149.76	389.4786
299.52	220.5252
599.04	124.205
1198.08	64.57616
0.234	43554.55
0.468	28301.71
0.936	15590.07
1.872	7938.957
3.744	3657.649
7.488	4035.62
14.976	2383.611
29.952	1653.553
59.904	972.1973
0.0234	531493.1
0.0468	263827.6
0.0936	130954.3
0.1872	63078.47
0.3744	32258.84
0.7488	16849.03
1.4976	9683.827
2.9952	3222.797
5.9904	2121.12
11.9808	1180.495
2.34	5967.375
4.68	2753.413
9.36	1914.013
18.72	1887.699
37.44	1171.725
74.88	747.7742
149.76	373.8871
299.52	207.6323
599.04	119.1078
1198.08	67.12476
0.234	44705.92
0.468	27917.92
0.936	15590.07
1.872	8322.748

3.744	3081.963
7.488	1888.792
14.976	1789.934
29.952	894.9672
59.904	682.8552
119.808	415.6371
0.0234	899932.1
0.0468	448047.1
0.0936	224983
0.1872	105775.2
0.3744	52647.72
0.7488	27523.21
1.4976	11542.81
2.9952	5441.587
5.9904	2690.81
11.9808	2417.32

Table 74 Rheological Data of 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	28.77352
102.138	23.10629
153.207	19.92543
306.414	15.12984
170.23	19.09549
340.46	14.48881
510.69	12.17818
1021.38	9.28625
510.69	14.17173
1021.38	9.130157

Table 75 Rheological Data of 5 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
37.44	46.73894
74.88	31.76489
149.76	21.87917
299.52	15.73697
599.04	11.46652
59.904	35.20857
119.808	24.3506
37.44	49.13763

74.88	32.96424
149.76	21.87917
299.52	15.43713
599.04	11.61644
29.952	55.42531
59.904	36.70775
119.808	25.10019

Table 76 Rheological Data of 8 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	442.4047
3.06414	318.086
51.069	88.84137
102.138	56.04672
153.207	42.53161
306.414	29.01649
170.23	40.02235
340.46	27.5681
510.69	21.67278
1021.38	13.83978
170.23	42.51519
340.46	27.39047
510.69	26.43749
1021.38	15.26304

Table 77 Rheological Data of 11 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
9.36	196.5505
18.72	131.8569
37.44	85.118
74.88	55.7518
149.76	35.07198
299.52	21.7337
599.04	14.01513
14.976	128.8408
29.952	76.41386
59.904	50.20039
119.808	33.34569
11.9808	168.5469
9.36	206.1453
18.72	127.0596

37.44	77.92193
74.88	49.75507
149.76	32.07361
299.52	21.7337
599.04	14.46489
14.976	134.8375
29.952	82.41059
59.904	54.69793
119.808	34.84488
5.9904	307.1102
11.9808	176.0428

Table 78 Rheological Data of 14 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	2509.26
3.06414	1545.28
51.069	146.97
102.138	83.17
153.207	58.68
306.414	35.15
5.1069	1024.05
10.2138	599.22
170.23	58.04
340.46	35.71
510.69	26.13
1021.38	15.87
10.2138	708.5864
170.23	67.0467
340.46	39.65623
510.69	26.43749
1021.38	17.30733
2.34	3434.357
4.68	1755.558
9.36	925.7527
18.72	472.4711
37.44	250.6277
74.88	138.5067
149.76	75.25005
299.52	41.22306
599.04	24.50941
0.234	15921.62
0.468	9879.765

0.936	5707.464
1.872	3141.575
3.744	1714.709
7.488	989.2825
14.976	524.6249
29.952	280.3026
59.904	152.1448
119.808	85.06747
0.0234	220622.7
0.0468	150609.4
0.0936	80102.07
0.1872	43888.94
0.3744	24343.16
0.7488	12411.45
1.4976	6385.627
2.9952	3462.666
5.9904	1671.366
11.9808	753.2279
2.34	3280.841
4.68	1851.505
9.36	1012.106
18.72	539.6345
37.44	284.2094
74.88	148.1014
149.76	77.64874
299.52	43.32192
599.04	26.00859
0.234	24365.02
0.468	16404.21
0.936	9545.37
1.872	5252.423
3.744	2650.198
7.488	1445.034
14.976	728.5136
29.952	358.2601
59.904	186.626
119.808	98.56011
0.0234	90133.93
0.0468	68094.4
0.0936	54196.21
0.1872	32854.96
0.3744	19066.04

0.7488	10852.3
1.4976	5725.987
2.9952	3102.863
5.9904	1626.39
11.9808	873.1625

Table 79 Rheological Data of 17 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	4640.695
3.06414	2933.944
51.069	249.6682
102.138	133.5536
153.207	95.49466
306.414	53.56035
5.1069	1663.483
10.2138	1180.522
170.23	86.52649
340.46	49.94822
510.69	34.07388
1021.38	19.84657
5.1069	1826.031
10.2138	1526.304
170.23	103.844
340.46	58.05487
510.69	38.70324
1021.38	23.44021
2.34	7003.61
4.68	3405.857
9.36	1837.255
18.72	942.6146
37.44	440.1243
74.88	215.2648
149.76	97.43795
299.52	56.21488
599.04	33.20466
0.234	20143.32
0.468	14293.36
0.936	8777.788
1.872	5012.554
3.744	2794.12
7.488	1528.988
14.976	830.458

29.952	448.211
59.904	236.099
119.808	125.5454
0.0234	339597.8
0.0468	194745.3
0.0936	103129.5
0.1872	54443.18
0.3744	27461.46
0.7488	14930.08
1.4976	8844.286
2.9952	4691.996
5.9904	2435.949
11.9808	1240.462
2.34	6120.891
4.68	3309.91
9.36	1827.661
18.72	933.0198
37.44	428.1308
74.88	206.8694
149.76	105.2337
299.52	58.31374
599.04	33.65442
0.234	38181.48
0.468	21201.59
0.936	11752.17
1.872	6211.9
3.744	3393.793
7.488	1720.883
14.976	926.4056
29.952	478.1946
59.904	248.0924
119.808	127.0446
0.0234	331922
0.0468	215853.8
0.0936	111764.8
0.1872	57801.35
0.3744	42333.35
0.7488	16129.42
1.4976	9383.991
2.9952	4841.914
5.9904	2480.924
11.9808	1270.446

Table 80 Rheological Data of 20 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	5351.175
3.06414	3063.122
51.069	393.056
102.138	194.5903
153.207	129.7269
306.414	70.35351
5.1069	3097.36
10.2138	1790.889
170.23	120.8233
340.46	64.77141
510.69	46.66875
1021.38	25.75647
5.1069	1826.031
10.2138	1321.874
170.23	128.3755
340.46	70.32063
510.69	46.88042
1021.38	27.52879
2.34	8423.635
4.68	4576.419
9.36	2614.431
18.72	1240.052
37.44	593.6405
74.88	287.2255
149.76	140.6144
299.52	73.00572
599.04	40.25082
1198.08	39.98957
0.234	48927.62
0.468	26574.66
0.936	14630.6
1.872	7699.088
3.744	4952.942
7.488	2548.432
14.976	1388.154
29.952	688.0801
59.904	324.5507
119.808	167.5225
0.0234	612089.1

0.0468	292611.9
0.0936	148224.9
0.1872	64997.43
0.3744	34177.8
0.7488	16369.29
1.4976	9024.187
2.9952	5681.456
5.9904	3485.376
11.9808	2005.045
2.34	8999.321
4.68	4845.072
9.36	2345.778
18.72	1264.039
37.44	574.451
74.88	271.634
149.76	137.0164
299.52	69.70752
599.04	40.1009
1198.08	40.73916
0.234	44705.92
0.468	26190.87
0.936	12615.69
1.872	6979.481
3.744	4065.426
7.488	2752.321
14.976	1394.15
29.952	685.0818
59.904	326.0499
119.808	164.5241
0.0234	404842.2
0.0468	206259
0.0936	107926.9
0.1872	66916.38
0.3744	35377.14
0.7488	18168.31
1.4976	9443.958
2.9952	5171.734
5.9904	3185.54
11.9808	1832.639

Table 81 Rheological Data of 23 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**

51.069	565.5088
102.138	284.6921
5.1069	3349.258
10.2138	2527.205
5.1069	3052.607
10.2138	2139.592
170.23	177.4385
340.46	100.985
510.69	67.32335
1021.38	37.75026
2.34	8423.635
4.68	4461.281
9.36	2643.216
18.72	2089.189
37.44	1015.81
74.88	465.928
149.76	212.5751
299.52	108.0866
599.04	57.64133
0.234	66198.19
0.468	34250.47
0.936	17317.13
1.872	9330.198
3.744	5024.903
7.488	3939.673
14.976	2077.777
29.952	1059.877
59.904	520.9435
119.808	257.4734
0.0234	677333.5
0.0468	325234.1
0.0936	157819.7
0.1872	80828.79
0.3744	43532.69
0.7488	22605.89
1.4976	9923.697
2.9952	6401.063
5.9904	4789.664
11.9808	2792.115
2.34	12952.36
4.68	6245.908
9.36	3151.738

18.72	1676.614
37.44	795.1306
74.88	413.1568
149.76	203.58
299.52	103.2892
599.04	53.89337
0.234	60825.12
0.468	31563.93
0.936	16645.5
1.872	9234.251
3.744	5384.706
7.488	3160.098
14.976	1993.823
29.952	981.9198
59.904	495.4574
119.808	246.9791
0.0234	619765
0.0468	283017.1
0.0936	130954.3
0.1872	66916.38
0.3744	34897.4
0.7488	16729.09
1.4976	6925.333
2.9952	6131.21
5.9904	5194.444
11.9808	2717.156

Table 82 Rheological Data of 26 wt% Extendosphere thickened by 2.5 wt% CNC

5.1069	4492.485
5.1069	3870.324
10.2138	2344.021
170.23	214.2358
340.46	119.3837
510.69	87.76628
1021.38	47.97172
2.34	11340.44
4.68	5804.549
9.36	3007.817
18.72	1930.875
37.44	1195.712
74.88	585.8626
149.76	289.3332
299.52	150.9632

599.04	75.03184
1198.08	42.16338
0.234	45857.29
0.468	19090.74
0.936	10312.95
1.872	8994.381
3.744	4113.4
7.488	3387.974
14.976	2239.689
29.952	1350.719
59.904	651.3724
119.808	322.6878
0.0234	704198.9
0.0468	359775.3
0.0936	169333.4
0.1872	80349.05
0.3744	36816.36
0.7488	19847.39
1.4976	13221.9
2.9952	6011.276
5.9904	3800.204
11.9808	3241.87
2.34	13259.4
4.68	7627.554
9.36	3861.751
18.72	1974.052
37.44	996.6207
74.88	510.3038
149.76	260.549
299.52	130.5743
599.04	70.98405
1198.08	33.99284
0.234	63127.87
0.468	29261.19
0.936	18180.66
1.872	10001.83
3.744	5120.85
7.488	3363.987
14.976	2245.686
29.952	1458.66
59.904	634.8814
119.808	318.1903
0.0234	777119.1
0.0468	388559.6
0.0936	187563.4
0.1872	93781.72

0.3744	48330.07
0.7488	25724.19
1.4976	13821.57
2.9952	6491.014
5.9904	3530.352
11.9808	2582.23

Table 83 Rheological Data of 29 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
5.1069	3052.607
10.2138	2139.592
170.23	214.2358
340.46	131.6494
510.69	95.94345
1021.38	62.28178
2.34	14257.25
4.68	5842.928
9.36	3295.66
18.72	2415.411
37.44	1181.32
74.88	629.039
149.76	328.9117
299.52	171.6519
599.04	89.42399
1198.08	45.38663
0.234	71187.47
0.468	39815.43
0.936	22786.15
1.872	9857.91
3.744	5360.72
7.488	3663.823
14.976	2959.296
29.952	1494.64
59.904	772.8061
119.808	396.8973
0.0234	792470.7
0.0468	346342.6
0.0936	168373.9
0.1872	83707.22
0.3744	44971.91
0.7488	29801.96
1.4976	11482.85

2.9952	9039.623
5.9904	4609.763
11.9808	2919.546
2.34	13144.26
4.68	6802.404
9.36	3794.587
18.72	2425.006
37.44	1248.483
74.88	632.637
149.76	322.9149
299.52	168.0539
599.04	90.17358
1198.08	42.46322
0.234	71955.05
0.468	30796.35
0.936	13287.33
1.872	7171.376
3.744	4880.981
7.488	3148.105
14.976	3055.244
29.952	1545.612
59.904	783.3004
119.808	404.3932
0.0234	903770
0.0468	426938.6
0.0936	212509.8
0.1872	103856.2
0.3744	44012.43
0.7488	21166.67
1.4976	11362.91
2.9952	6820.834
5.9904	3860.172
11.9808	3564.194

Table 84 Rheological Data of 32 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
5.11	5558.205
10.21	2827.544
170.23	251.0331
340.46	162.3138
510.69	136.8293
1021.38	70.45895

2.34	15754.04
4.68	8702.168
9.36	5118.665
18.72	3202.182
37.44	1627.476
74.88	870.1075
149.76	473.4328
299.52	243.6126
599.04	126.1539
1198.08	60.37845
0.234	118009.9
0.468	63034.76
0.936	34491.76
1.872	16526.27
3.744	7015.817
7.488	3975.653
14.976	2953.3
29.952	2058.332
59.904	1041.16
119.808	537.8204
0.0234	1387346
0.0468	680240.4
0.0936	342998.6
0.1872	148951.6
0.3744	74235.94
0.7488	37597.71
1.4976	22456.86
2.9952	8469.934
5.9904	4339.91
11.9808	4860.987
2.34	14180.49
4.68	6975.11
9.36	5099.475
18.72	2684.064
37.44	1481.156
74.88	814.9376
149.76	426.0586
299.52	219.0261
599.04	116.2593
1198.08	51.90807
0.234	65814.4
0.468	42118.18

0.936	14438.7
1.872	12880.26
3.744	10062.15
7.488	6482.285
14.976	3612.94
29.952	1914.411
59.904	993.1859
119.808	516.8319
0.0234	1302912
0.0468	664888.8
0.0936	299822.2
0.1872	143674.5
0.3744	77114.37
0.7488	40596.07
1.4976	17359.64
2.9952	8320.016
5.9904	5449.305
11.9808	4463.703

Table 85 Rheological Data of 35 wt% Extendosphere thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
5.1069	6732.335
10.2138	3366.167
170.23	336.8934
340.46	254.307
510.69	194.0695
1021.38	109.3005
2.34	13911.84
4.68	8740.547
9.36	5464.076
18.72	3216.574
37.44	1831.365
74.88	976.8492
149.76	566.3821
0.234	139118.4
0.468	72245.74
0.936	47156.85
1.872	25929.14
3.744	13516.27
7.488	7093.952
14.976	4554.426
29.952	2544.067

59.904	1326.004
119.808	692.2362
0.0234	1490970
0.0468	709024.7
0.0936	350674.4
0.1872	162864
0.3744	85509.79
0.7488	48271.88
1.4976	18618.95
2.9952	8859.722
5.9904	5809.108
11.9808	5475.651
2.34	15216.73
4.68	9508.128
9.36	5406.508
18.72	3633.946
37.44	1852.953
74.88	979.2479
149.76	531.0014
299.52	288.5881
0.234	108798.9
0.468	48258.82
0.936	25568.63
1.872	13455.95
3.744	6200.261
7.488	4107.581
14.976	3852.809
29.952	2325.187
59.904	1309.513
119.808	670.4981
0.0234	1675189
0.0468	774269.1
0.0936	378499.3
0.1872	175337.2
0.3744	84550.31
0.7488	42035.29
1.4976	22097.05
2.9952	10179
5.9904	5059.517
11.9808	4621.118

Table 86 Rheological Data of 3.5 wt% CNC in water

Shear Rate (s^{-1})	Viscosity (mPa.s)
51.069	100.4674
102.138	68.64159
153.207	55.44942
306.414	37.73602
170.23	52.81099
340.46	35.70632
510.69	27.87333
1021.38	18.39331
170.23	54.78094
340.46	39.65623
510.69	26.43749
1021.38	21.39592
4.68	393.1011
9.36	244.5244
18.72	179.8308
37.44	128.2944
74.88	86.93479
149.76	57.85954
299.52	38.52454
599.04	26.15851
3.744	491.3763
7.488	353.6293
14.976	218.7917
29.952	154.3713
59.904	104.1709
119.808	67.07729
1.4976	1168.474
2.9952	704.1713
5.9904	442.0366
11.9808	265.9938
2.34	786.2021
4.68	508.2382
9.36	311.6877
18.72	208.6151
37.44	140.2879
74.88	91.73217
149.76	59.65856
299.52	39.42405
599.04	26.60826
1.872	982.7527

3.744	587.324
7.488	365.6227
14.976	248.7754
29.952	157.3697
59.904	104.1709
119.808	69.32606
1.4976	1348.375
2.9952	794.1223
5.9904	457.0284
11.9808	288.4815

Table 87 Rheological Data of 5 wt% Extendosphere thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
37.44	68.32716
74.88	43.75835
149.76	32.07361
299.52	22.33337
599.04	16.56374
7.488	221.7013
14.976	140.8343
29.952	88.40732
59.904	57.6963
119.808	40.09201
0.7488	2217.013
1.4976	1108.506
3.00	614.2204
5.9904	322.102
11.9808	176.0428
4.68	373.9115
9.36	215.7401
18.72	127.0596
37.44	82.71931
74.88	52.15377
149.76	35.67165
299.52	24.73206
599.04	17.913
3.744	443.4025
7.488	245.6882
14.976	140.8343
29.952	88.40732
59.904	60.69466
119.808	40.09201
0.3744	4434.025

0.7488	2217.013
1.4976	1168.474
2.9952	614.2204
5.9904	322.102
11.9808	176.0428

Table 88 Rheological Data of 11 wt% Extendosphere thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	81.09068
102.138	54.10905
153.207	43.82339
306.414	30.30828
170.23	41.18496
340.46	29.312
510.69	23.61045
1021.38	16.0681
170.23	54.78094
340.46	33.52335
510.69	22.3489
1021.38	13.21874
4.68	527.4278
9.36	350.0668
18.72	227.8046
37.44	147.484
74.88	95.33021
149.76	60.25823
299.52	38.52454
599.04	25.259
3.744	491.3763
7.488	293.662
14.976	188.8081
29.952	121.3893
59.904	80.18403
119.808	53.58465
2.9952	764.1386
5.9904	412.053
11.9808	265.9938
2.34	824.5812
4.68	489.0487
9.36	302.0929
18.72	194.2229
37.44	123.4971

74.88	82.13741
149.76	53.06216
299.52	35.22634
599.04	24.20957
3.744	539.3502
7.488	317.6489
14.976	206.7983
29.952	130.3844
59.904	84.68157
119.808	57.33261
1.4976	1288.408
2.9952	734.155
5.9904	412.053
11.9808	258.4978
1.53207	2896.79
3.06414	1803.635
51.069	170.2236
102.138	101.582
153.207	76.76382
306.414	47.42438
5.1069	714.0232
10.2138	502.337
170.23	74.31916
340.46	46.46041
510.69	35.23648
1021.38	22.26866
170.23	79.31246
340.46	51.92199
510.69	38.70324
1021.38	25.4845
2.34	2014.332
4.68	1218.251
9.36	762.6417
18.72	477.2685
37.44	272.2159
74.88	166.0916
149.76	86.64384
299.52	52.61685
599.04	32.90482
14.976	332.7296
29.952	211.3402
59.904	132.6554
119.808	85.06747
0.3744	5873.24
0.7488	3656.227

1.4976	2307.852
2.9952	1393.795
5.9904	831.8239
11.9808	520.8547
2.34	1592.162
4.68	1122.303
9.36	733.8574
18.72	424.4973
37.44	253.0264
74.88	152.8988
149.76	89.04253
299.52	55.31537
599.04	34.85376
3.744	923.1408
7.488	569.5115
14.976	362.7132
29.952	223.3337
59.904	144.6489
119.808	91.0642
0.1872	10307.26
0.3744	6352.978
0.7488	3896.096
1.4976	2427.786
2.9952	1513.73
5.9904	921.7748
11.9808	528.3506

Table 89 Rheological Data of 14 wt% Extendosphere thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	5415.764
3.06414	3160.006
51.069	265.1696
102.138	148.0862
153.207	109.0584
306.414	66.80111
5.1069	1992.887
10.2138	1122.392
170.23	108.616
340.46	64.48076
510.69	48.41266
5.1069	1417.173
10.2138	913.0157
170.23	67.0467
340.46	58.05487

510.69	46.88042
1021.38	31.61738
2.34	3357.599
4.68	2542.328
9.36	1443.87
18.72	736.3271
37.44	423.3335
74.88	236.853
149.76	128.0213
299.52	73.6054
599.04	43.24918
0.234	9397.184
0.468	8344.603
0.936	5611.516
1.872	3477.392
3.744	2098.499
7.488	1217.158
14.976	668.5463
29.952	403.2355
59.904	233.1006
119.808	142.0364
0.0234	78620.21
0.0468	46985.92
0.0936	35966.15
0.1872	27098.1
0.3744	17626.83
0.7488	10852.3
1.4976	6265.692
2.9952	3552.617
5.9904	1956.21
11.9808	1090.544

Table 90 Rheological Data of 17 wt% Extendosphere thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
5.1069	6732.335
10.2138	3979.455
170.23	275.5646
340.46	150.0481
510.69	100.032
1021.38	54.1046
2.34	14717.8
4.68	7685.122

9.36	4542.979
18.72	2895.149
37.44	1397.202
74.88	679.4115
149.76	326.513
299.52	146.7655
599.04	82.9775
1198.08	43.13785
0.234	83084.98
0.468	48066.93
0.936	26240.26
1.872	14607.32
3.744	8119.214
7.488	4683.267
14.976	2929.313
29.952	1497.638
59.904	757.8143
119.808	380.4063
0.0234	988203.9
0.0468	457641.9
0.0936	224023.5
0.1872	108173.9
0.3744	57205.23
0.7488	31121.24
1.4976	16819.93
2.9952	10748.69
5.9904	6093.953
11.9808	3983.965
2.34	21933.06
4.68	10697.88
9.36	5396.913
18.72	2693.659
37.44	1260.477
74.88	609.8495
149.76	291.1323
299.52	151.8627
599.04	82.82759
1198.08	42.98793
0.234	93063.53
0.468	54591.37
0.936	31901.17
1.872	15278.95

3.744	8814.835
7.488	5043.071
14.976	2647.467
29.952	1449.665
59.904	730.829
119.808	356.4194
0.0234	1111017
0.0468	505615.7
0.0936	242253.6
0.1872	120167.3
0.3744	64161.44
0.7488	39036.92
1.4976	21497.38
2.9952	12577.69
5.9904	7997.914
11.9808	4103.9

Table 91 Rheological Data of 20 wt% Extendosphere thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
170.23	177.4385
340.46	113.2508
510.69	91.85486
1021.38	52.06031
2.34	17826.5
4.68	10103
9.36	5857.462
18.72	2962.313
37.44	1497.947
74.88	715.3919
149.76	331.91
299.52	164.4558
599.04	87.32513
1198.08	42.53818
0.234	103042.1
0.468	58429.28
0.936	28638.95
1.872	15662.74
3.744	8742.874
7.488	5151.012
14.976	2707.434
29.952	1479.648
59.904	745.8208

119.808	363.9153
0.0234	1126369
0.0468	553589.5
0.0936	291186.9
0.1872	156627.4
0.3744	74955.55
0.7488	38437.25
1.4976	20537.91
2.9952	12247.87
5.9904	6903.511
11.9808	3774.08
0.9	47300.71
1.8	26436.76
3.6	15393.14
7.2	8359.189
14.4	4222.07
28.8	2174.749
57.6	1064.013
115.2	517.1398
230.4	277.153
460.8	144.6824
0.09	255531.6
0.18	156309.4
0.36	88688.69
0.72	49611.33
1.44	27524.11
2.88	17202.59
5.76	9068.526
11.52	4704.166
23.04	2452.963
46.08	1268.957
0.009	2310656
0.018	1270862
0.036	645625
0.072	331307.6
0.144	180945.1
0.288	96843.89
0.576	55005.68
1.152	34298.95
2.304	21131.57
4.608	12636.48

Table 92 Rheological Data of 23 wt% Extendosphere thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
510.69	108.2092
1021.38	72.50324
2.34	18440.57
4.68	9277.853
9.36	5339.345
18.72	3595.567
37.44	1831.365
74.88	928.8754
149.76	436.2531
299.52	214.5285
599.04	112.2116
1198.08	52.05799
0.234	91144.58
0.468	48642.62
0.936	28638.95
1.872	16238.43
3.744	8814.835
7.488	6518.266
14.976	4092.678
29.952	2004.362
59.904	1039.661
119.808	504.0889
0.0234	1475618
0.0468	714781.6
0.0936	349715
0.1872	158546.4
0.3744	78793.45
0.7488	40476.14
1.4976	22276.96
2.9952	12577.69
5.9904	7308.29
11.9808	4658.597
0.9	53009.44
1.8	27795.98
3.6	15766.92
7.2	11264.53
14.4	6388.331
28.8	3338.583
57.6	1537.617
115.2	802.7889

230.4	381.2185
460.8	164.3274
0.09	278638.3
0.18	152231.8
0.36	85290.64
0.72	53349.19
1.44	31516.83
2.88	16183.17
5.76	11638.31
11.52	6732.38
23.04	3509.546
46.08	1852.998
0.009	3955314
0.018	1692221
0.036	829120
0.072	387375.6
0.144	182644.1
0.288	94295.35
0.576	51395.24
1.152	27290.46
2.304	16565.43
4.608	15052.28

Table 93 Rheological Data of 26 wt% Extendosphere thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
2.34	22470.37
4.68	11024.1
9.36	5943.815
18.72	3350.901
37.44	2195.966
74.88	1115.973
149.76	547.7922
299.52	267.8994
599.04	135.7487
1198.08	70.19809
0.234	99204.18
0.468	55934.64
0.936	31133.59
1.872	17773.59
3.744	9294.573
7.488	10176.27
14.976	5328.004

29.952	2562.058
59.904	1332.001
119.808	657.755
0.0234	1318264
0.0468	574698
0.0936	248010.5
0.1872	125444.4
0.3744	64161.44
0.7488	37357.84
1.4976	20897.71
2.9952	13657.1
5.9904	10261.68
11.9808	6240.234
0.9	63339.53
1.8	25961.03
3.6	13830.03
7.2	13014.53
14.4	7246.34
28.8	3593.437
57.6	1868.927
115.2	963.1346
230.4	482.0983
460.8	176.2737
0.09	410482.9
0.18	202523
0.36	109077
0.72	53009.39
1.44	24890.62
2.88	16522.98
5.76	11638.31
11.52	7348.278
23.04	4146.681
46.08	2118.471
0.009	3370849
0.018	1719405
0.036	876692.8
0.072	411161.9
0.144	215775.1
0.288	117657
0.576	77093.04
1.152	35148.46
2.304	23308.45

4.608	13963.84

Table 94 Rheological Data of 29 wt% Extendosphere thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
5.1069	20224.67
10.2138	12974.34
170.23	802.9922
340.46	493.4893
510.69	365.7901
1021.38	152.2307
2.34	34559.77
0.234	351354.6
0.0234	3636359
0.0468	1850802
0.9	61708.47
1.8	29291.13
3.6	19029.06
7.2	12538.8
0.09	1201550
0.18	608930.4
0.36	284076.9
0.72	128955.9
1.44	63713.4
2.88	22681.95
5.76	12402.87

Table 95 Rheological Data of 5 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	3.583387
102.138	2.76053
153.207	3.132135
306.414	2.211958
170.23	3.400223
340.46	1.990762

Table 96 Rheological Data of 10 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	5.52106
102.138	3.729366
153.207	5.069808
306.414	3.180795

170.23	2.818921
340.46	1.700112
510.69	1.520942

Table 97 Rheological Data of 15 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	5.52106
102.138	5.667039
153.207	5.069808
306.414	2.857849
170.23	2.23762
340.46	1.409461
510.69	1.133408
1021.38	1.051122

Table 98 Rheological Data of 20 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	7.458732
102.138	5.667039
153.207	4.423917
306.414	2.534904
170.23	1.656318
340.46	1.11881
510.69	1.327175
1021.38	2.116842

Table 99 Rheological Data of 25 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	5.52106
102.138	4.698202
153.207	5.069808
306.414	3.180795
170.23	2.23762
340.46	1.700112
510.69	1.908477
1021.38	2.891911

Table 100 Rheological Data of 30 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	7.458732

102.138	6.635875
153.207	5.069808
306.414	3.180795
170.23	2.23762
340.46	1.990762
510.69	2.489779
1021.38	2.407493

Table 101 Rheological Data of 35 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	7.458732
102.138	6.635875
153.207	5.715698
306.414	3.50374
170.23	5.72543
340.46	2.862715
510.69	2.877313
1021.38	2.019958

Table 102 Rheological Data of 40 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
3.06414	27.42858
51.069	9.396405
102.138	7.604711
153.207	6.361589
306.414	5.118467
5.1069	16.45715
10.2138	17.91694
170.23	6.306732
340.46	5.187922
510.69	4.427451
1021.38	4.054514

Table 103 Rheological Data of 45 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
3.06414	27.42858
51.069	9.396405
102.138	9.542384
153.207	8.299262
306.414	6.410249
5.1069	16.45715
10.2138	17.91694

170.23	6.306732
340.46	5.769224
510.69	5.396287

Table 104 Rheological Data of 50 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	119.4462
3.06414	92.01766
51.069	21.02244
102.138	13.41773
153.207	12.17461
306.414	10.60854
5.1069	74.58732
10.2138	56.67039
170.23	12.70105
340.46	8.385082
510.69	7.915262
1021.38	8.801812

Table 105 Rheological Data of 55 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	184.0353
3.06414	156.6067
51.069	30.7108
102.138	21.16842
153.207	18.63352
306.414	16.7445
5.1069	93.96405
10.2138	85.73548
170.23	19.67667
340.46	16.52331
510.69	14.50335
1021.38	13.45223

Table 106 Rheological Data of 60 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	506.9808
3.06414	318.0795
51.069	63.65124
102.138	49.26467
153.207	41.2397

306.414	32.56883
5.1069	248.9779
10.2138	153.554
170.23	38.85963
340.46	33.38106
510.69	31.3611
1021.38	26.14398

Table 107 Rheological Data of 65 wt% Solosphere suspension in water

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	636.1589
3.06414	544.1413
51.069	168.2856
102.138	126.7716
153.207	106.4747
306.414	80.36475
5.1069	500.8753
10.2138	347.3213
170.23	96.40851
340.46	80.17585
170.23	103.844
340.46	82.58638
510.69	75.50052
1021.38	50.01602

Table 108 Rheological Data of 5 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	3.583779
102.138	4.698398
153.207	4.424047
306.414	3.18086
170.23	3.400341
340.46	2.281472
510.69	2.102283

Table 109 Rheological Data of 10 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
102.138	8.573743
153.207	8.299392
306.414	7.702096

170.23	7.469453
340.46	5.769283
510.69	5.783861
1021.38	4.538952
51.069	5.521451
102.138	8.573743
153.207	8.299392
306.414	7.702096
170.23	7.469453
340.46	5.187981
510.69	6.365163
1021.38	4.829603

Table 110 Rheological Data of 15 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	9.396796
102.138	6.636071
153.207	6.36172
306.414	6.73326
10.2138	8.230531
170.23	8.632057
340.46	6.059934
510.69	3.652421
1021.38	3.95765
3.06414	27.4351
51.069	5.521451
102.138	4.698398
153.207	4.424047
306.414	4.149696
10.2138	8.230531
170.23	3.981642
340.46	3.444076
510.69	2.683585
1021.38	3.570116

Table 111 Rheological Data of 20 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
3.06414	59.72965
51.069	9.396796
102.138	8.573743
153.207	7.007611

306.414	7.056205
5.1069	74.59124
10.2138	46.98398
170.23	7.469453
340.46	4.89733
510.69	3.846188
1021.38	3.279465

Table 112 Rheological Data of 25 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	54.87021
3.06414	59.72965
51.069	17.14749
102.138	10.51142
153.207	9.591174
306.414	8.993878
5.1069	55.21451
10.2138	37.29562
170.23	9.213358
340.46	5.478632
510.69	7.915301
1021.38	4.345185
1.53207	119.4593
3.06414	27.4351
51.069	7.459124
102.138	5.667235
153.207	5.715829
306.414	5.764423
5.1069	35.83779
10.2138	27.60726
170.23	6.30685
340.46	5.478632
510.69	4.42749
1021.38	3.860767

Table 113 Rheological Data of 30 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	119.4593
3.06414	124.3187
51.069	7.459124
102.138	6.636071

153.207	5.069938
306.414	3.18086
5.1069	16.46106
10.2138	17.91889
170.23	5.144246
340.46	4.606679
510.69	3.652421
1021.38	3.95765
1.53207	119.4593
3.06414	92.02419
51.069	7.459124
102.138	5.667235
153.207	5.069938
306.414	5.118532
5.1069	16.46106
10.2138	17.91889
170.23	5.725548
340.46	4.606679
510.69	4.233723
1021.38	4.829603

Table 114 Rheological Data of 35 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	119.4593
3.06414	92.02419
51.069	13.27214
102.138	10.51142
153.207	8.299392
306.414	7.702096
5.1069	55.21451
10.2138	27.60726
170.23	6.888151
340.46	6.931886
510.69	5.977628
1021.38	5.410905
1.53207	119.4593
3.06414	124.3187
51.069	15.20981
102.138	8.573743
153.207	6.36172
306.414	6.087369
5.1069	55.21451

10.2138	27.60726
170.23	6.30685
340.46	5.478632
510.69	5.008792
1021.38	5.217138

Table 115 Rheological Data of 40 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	119.4462
3.06414	124.3122
51.069	15.20942
102.138	10.51122
153.207	8.945153
306.414	8.670867
5.1069	93.96405
10.2138	56.67039
170.23	8.631939
340.46	8.385082
510.69	5.783822
1021.38	6.282838
1.53207	184.0484
3.06414	124.3187
51.069	13.27214
102.138	8.573743
153.207	7.653501
306.414	7.056205
5.1069	74.59124
10.2138	46.98398
170.23	6.888151
340.46	6.350585
510.69	5.977628
1021.38	5.798439

Table 116 Rheological Data of 45 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	442.3917
3.06414	285.7849
51.069	22.96011
102.138	15.3554
153.207	12.17461
306.414	9.639703

5.1069	190.8477
10.2138	105.1122
170.23	11.53845
340.46	9.257035
510.69	8.496563
1021.38	6.476605
37.44	51.53632
74.88	35.36293
149.76	26.07688
299.52	17.23615
599.04	10.71693
29.952	58.42368
59.904	32.2102
119.808	24.3506
149.76	14.6831
299.52	11.8391
599.04	10.56701

Table 117 Rheological Data of 50 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	442.3917
3.06414	318.0795
51.069	32.64848
102.138	18.26191
153.207	16.04995
306.414	12.54621
5.1069	210.2244
10.2138	124.4889
170.23	15.02626
340.46	10.71029
510.69	8.496563
18.72	98.27527
37.44	51.53632
74.88	26.96751
149.76	15.88245
299.52	10.04008
599.04	7.41873
14.976	110.8506
29.952	55.42531
59.904	30.71102
119.808	17.60428
18.72	79.08574

37.44	44.34025
74.88	23.36947
149.76	14.08343
299.52	8.540895
599.04	6.369303

Table 118 Rheological Data of 55 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	377.8026
3.06414	285.7849
51.069	40.39917
102.138	25.04376
153.207	19.27941
306.414	13.51505
5.1069	248.9779
10.2138	143.8657
170.23	19.67667
340.46	14.1981
510.69	11.40307
1021.38	10.83637
18.72	83.88312
37.44	49.13763
74.88	26.96751
149.76	17.08179
299.52	11.53926
599.04	9.06783

Table 119 Rheological Data of 60 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	636.1589
3.06414	447.2576
51.069	52.0252
102.138	33.76329
153.207	23.15475
306.414	21.58868
5.1069	326.4848
10.2138	192.3075
170.23	25.48969
340.46	20.59242
510.69	18.18493
9.36	177.361

18.72	103.0726
37.44	56.33371
74.88	34.16358
149.76	21.87917
299.52	15.43713
599.04	12.36603
7.488	233.6947
14.976	122.8441
29.952	64.42041
59.904	38.20693
119.808	22.85142
37.44	46.73894
74.88	26.96751
149.76	17.08179
299.52	12.43877
599.04	10.11726
29.952	55.42531
59.904	32.2102
119.808	19.85306

Table 120 Rheological Data of 65 wt% Solospheres thickened by 0.25 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	765.3371
3.06414	705.614
51.069	115.9684
102.138	75.42325
153.207	60.61642
306.414	45.1637
5.1069	559.0055
10.2138	357.0096
170.23	56.87999
340.46	43.84449
510.69	38.14295
2.34	862.9603
4.68	527.4278
9.36	340.472
18.72	203.8177
37.44	118.6997
74.88	70.14395
149.76	46.46576
299.52	32.82764
599.04	29.60662

1.872	1078.7
3.744	683.2716
7.488	413.5966
14.976	212.795
29.952	118.391
59.904	75.68648
119.808	49.08711
1.4976	1228.441
2.9952	794.1223
5.9904	457.0284
11.9808	258.4978
2.34	862.9603
4.68	527.4278
9.36	292.4982
18.72	155.8439
37.44	89.91538
74.88	55.7518
149.76	36.87099
299.52	26.53108
599.04	21.51104
1.872	934.7788
3.744	611.3109
7.488	341.6358
14.976	194.8048
29.952	109.3959
59.904	65.19221
119.808	40.8416
0.7488	2217.013
1.4976	1348.375
2.9952	824.1059
5.9904	442.0366
11.9808	213.5224

Table 121 Rheological Data of 5 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
3.06414	59.72965
51.069	24.89818
102.138	16.32443
153.207	16.69597
306.414	10.93155
5.1069	55.21451
10.2138	46.98398

170.23	17.35158
340.46	13.61686
510.69	10.24051
1021.38	5.604672
1.53207	54.87021
3.06414	59.72965
51.069	22.9605
102.138	18.26211
153.207	17.34186
306.414	10.93155
5.1069	55.21451
10.2138	46.98398
170.23	16.77028
340.46	12.45425
510.69	9.659206
1021.38	6.08909

Table 122 Rheological Data of 10 wt% Solospheres thickened by 0.5 wt% CNCf

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	184.0484
3.06414	124.3187
51.069	38.46188
102.138	22.13745
153.207	19.92543
306.414	14.161
5.1069	74.59124
10.2138	46.98398
170.23	18.51419
340.46	13.03555
510.69	11.59688
1021.38	6.08909
74.88	22.17013
149.76	12.88408
299.52	8.540895
599.04	6.369303
59.904	27.71266
119.808	16.1051
149.76	13.48375
299.52	8.241059
599.04	6.369303
29.952	52.42695
59.904	29.21184

119.808	16.85469

Table 123 Rheological Data of 15 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	184.0484
3.06414	188.9078
51.069	40.39956
102.138	27.95047
153.207	20.57132
306.414	15.12984
5.1069	74.59124
10.2138	66.36071
170.23	10.37596
340.46	8.385141
510.69	6.752697
1021.38	5.895323
74.88	24.56882
149.76	13.48375
299.52	9.140568
599.04	6.669139
29.952	52.42695
59.904	30.71102
119.808	17.60428
74.88	20.97078
149.76	14.08343
299.52	8.840732
599.04	6.669139
29.952	52.42695
59.904	30.71102
119.808	16.1051

Table 124 Rheological Data of 20 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	313.2265
3.06414	221.2024
51.069	26.83585
102.138	18.26211
153.207	15.40419
306.414	11.57744
5.1069	132.7214
10.2138	95.4258

170.23	15.02638
340.46	11.5823
510.69	9.077904
1021.38	7.736112
74.88	26.96751
149.76	16.48212
299.52	11.23942
599.04	8.018403
29.952	52.43
59.904	32.21
119.808	19.85
37.44	49.13763
74.88	25.76816
149.76	15.28277
299.52	8.241059
599.04	7.41873
14.976	122.8441
29.952	64.42041
59.904	39.70611
119.808	22.10183

Table 125 Rheological Data of 25 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	313.2265
3.06414	221.2024
51.069	32.64887
102.138	20.19978
153.207	16.05008
306.414	14.161
5.1069	229.605
10.2138	153.556
170.23	19.09549
340.46	11.5823
510.69	13.72832
1021.38	8.898715
149.76	12.88408
299.52	9.740241
599.04	6.968975
59.904	27.71266
119.808	16.1051
37.44	49.13763

74.88	25.76816
149.76	14.6831
299.52	9.440405
599.04	5.919548
1198.08	5.433424
14.976	122.8441
29.952	64.42041
59.904	38.20693
119.808	22.10183

Table 126 Rheological Data of 30 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	377.8156
3.06414	188.9078
51.069	36.52421
102.138	22.13745
153.207	19.27954
306.414	13.51511
5.1069	248.9818
10.2138	114.8025
170.23	21.4207
340.46	12.45425
37.44	46.73894
74.88	24.56882
149.76	12.88408
299.52	10.93959
599.04	6.519221
29.952	55.42531
59.904	30.71102
119.808	17.60428
11.9808	161.051
74.88	24.56882
149.76	12.88408
299.52	9.440405
599.04	5.020039
14.976	116.8474
29.952	61.42204
59.904	33.70939
119.808	18.35387
11.9808	146.0592

Table 127 Rheological Data of 35 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	377.8156
3.06414	253.4969
51.069	57.83861
102.138	31.82581
153.207	24.44666
306.414	16.09868
5.1069	152.0981
10.2138	95.4258
170.23	25.48981
340.46	15.36076
510.69	15.47222
1021.38	10.44885

Table 128 Rheological Data of 40 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	377.8156
3.06414	253.4969
51.069	59.77628
102.138	34.73232
153.207	27.67612
306.414	17.39046
5.1069	190.8516
10.2138	114.8025
170.23	26.07111
340.46	16.52337
510.69	16.63483
1021.38	11.99899
37.44	58.7324
74.88	35.36293
149.76	24.87754
299.52	13.03844
29.952	61.42204
59.904	41.2053
119.808	22.85142

Table 129 Rheological Data of 45 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	377.8156
3.06414	285.7914

51.069	79.15301
102.138	40.54534
153.207	28.9679
306.414	19.97402
5.1069	248.9818
10.2138	240.7512
170.23	26.07111
340.46	18.26727
510.69	17.79743
1021.38	13.35536
170.23	42.51519
340.46	27.39047
510.69	22.3489
1021.38	15.26304
18.72	146.2491
37.44	97.11146
74.88	47.35638
149.76	24.87754
299.52	15.73697
599.04	12.06619
3.744	467.3894
7.488	257.6816
14.976	158.8245
29.952	118.391
59.904	59.19548
119.808	31.09692
11.9808	168.5469
9.36	196.5505
18.72	136.6543
37.44	70.72585
74.88	37.76162
149.76	21.2795
299.52	13.63811
599.04	10.41709
7.488	233.6947
14.976	158.8245
29.952	109.3959
59.904	53.19875
119.808	27.34897
11.9808	161.051

Table 130 Rheological Data of 50 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	636.172
3.06414	414.9696
51.069	96.59206
102.138	62.82858
153.207	46.40695
306.414	28.04766
5.1069	287.7352
10.2138	153.556
170.23	45.83537
340.46	28.1494
510.69	20.51017
1021.38	14.71173
170.23	54.78094
340.46	33.52335
510.69	30.52607
1021.38	21.39592

Table 131 Rheological Data of 55 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	1282.063
3.06414	834.7987
51.069	239.9798
102.138	151.9615
153.207	105.8289
306.414	50.33089
5.1069	636.5163
10.2138	357.0116
170.23	98.73383
340.46	57.50514
510.69	40.66197
1021.38	25.85335
170.23	54.78094
340.46	33.52335
510.69	38.70324
1021.38	25.4845
4.68	489.0487
9.36	359.6615
18.72	333.347
37.44	200.2552
74.88	110.9217

149.76	76.4494
299.52	42.42241
599.04	28.25736
3.744	467.3894
7.488	317.6489
14.976	434.6739
29.952	271.3075
59.904	150.6456
119.808	86.56666
0.0468	39310.11
0.0936	20614.53
0.1872	11266.74
0.3744	6592.847
0.7488	3416.358
1.4976	1828.114
2.9952	944.0405
5.9904	487.0121
11.9808	251.0019
4.68	412.2906
9.36	311.6877
18.72	304.5627
37.44	193.0591
74.88	107.3237
149.76	72.25169
299.52	43.02208
599.04	29.60662
3.744	443.4025
7.488	281.6685
14.976	410.687
29.952	250.319
59.904	147.6472
119.808	93.31298
0.0936	19655.05
0.1872	13185.69
0.3744	6832.716
0.7488	3416.358
1.4976	1828.114
2.9952	944.0405
5.9904	502.0039
11.9808	385.9283

Table 132 Rheological Data of 60 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	2444.666
3.06414	1286.922
51.069	336.8635
102.138	189.7461
153.207	129.081
306.414	75.52064
5.1069	1275.948
10.2138	831.7414
170.23	98.73383
340.46	68.84052
510.69	52.67554
170.23	79.31246
340.46	51.92199
510.69	46.88042
1021.38	31.61738
4.68	834.4603
9.36	474.7987
18.72	554.0266
37.44	310.595
74.88	164.8923
149.76	88.44286
299.52	53.21652
599.04	32.15523
1.872	886.805
3.744	611.3109
7.488	617.4853
14.976	602.5823
29.952	376.2503
59.904	189.6243
119.808	95.56175
0.0234	97809.74
0.0468	54661.73
0.0936	27330.87
0.1872	14145.17
0.3744	7312.455
0.7488	3776.162
1.4976	1888.081
2.9952	1004.008
5.9904	531.9875
11.9808	295.9774

2.34	1246.751
4.68	853.6498
9.36	666.694
18.72	352.5365
37.44	241.0329
74.88	103.7256
149.76	56.06052
299.52	30.12912
599.04	18.96243
1.872	1126.674
3.744	875.1669
7.488	569.5115
14.976	470.6543
29.952	247.3206
59.904	125.1595
119.808	72.32443
0.0234	101647.6
0.0468	50823.82
0.0936	27330.87
0.1872	13665.43
0.3744	6832.716
0.7488	3656.227
1.4976	1888.081
2.9952	1033.991
5.9904	531.9875
11.9808	415.912

Table 133 Rheological Data of 65 wt% Solospheres thickened by 0.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	2703.023
3.06414	1351.511
51.069	358.1779
102.138	193.6215
153.207	134.2481
306.414	78.42714
5.1069	1334.078
10.2138	899.5599
170.23	107.4534
340.46	65.93402
510.69	56.93842
10.2138	708.5864

170.23	103.844
340.46	64.18775
510.69	55.05759
1021.38	43.88314
2.34	786.2021
4.68	930.4079
9.36	493.9882
18.72	554.0266
37.44	341.778
74.88	175.6864
149.76	93.24024
299.52	54.41587
599.04	34.40401
0.234	7094.44
0.468	3547.22
0.936	1773.61
1.872	982.7527
3.744	779.2193
7.488	641.4722
14.976	638.5627
29.952	394.2405
59.904	192.6227
119.808	95.56175
0.0234	136188.8
0.0468	66175.45
0.0936	31168.77
0.1872	15584.39
0.3744	8271.931
0.7488	4255.9
1.4976	2547.721
2.9952	1573.697
5.9904	876.7994
11.9808	670.7729
2.34	1707.3
4.68	987.9765
9.36	724.2626
18.72	438.8894
37.44	248.229
74.88	124.1145
149.76	66.25496
299.52	39.12421
599.04	26.00859

0.234	7094.44
0.468	3547.22
0.936	1965.505
1.872	1510.465
3.744	971.1146
7.488	641.4722
14.976	572.5987
29.952	301.2912
59.904	150.6456
119.808	75.32279
0.0234	132350.9
0.0468	62337.54
0.0936	29249.82
0.1872	13665.43
0.3744	6832.716
0.7488	3656.227
1.4976	2008.015
2.9952	1153.926
5.9904	831.8239
11.9808	558.3343

Table 134 Rheological Data of 5 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1152.885
3.06414	608.7369
51.069	104.3428
102.138	54.10905
153.207	37.36448
306.414	21.58875
5.1069	655.893
10.2138	318.2581
170.23	32.46543
340.46	19.13922
510.69	14.30962
1021.38	12.96783
170.23	67.0467
340.46	33.52335
510.69	26.43749
1021.38	13.21874
2.34	1093.235
4.68	584.9964
9.36	340.472

18.72	194.2229
37.44	128.2944
74.88	85.73544
149.76	45.86609
299.52	26.23124
599.04	14.91464
1.872	1030.726
3.744	683.2716
7.488	377.6162
14.976	230.7852
29.952	157.3697
59.904	95.17585
119.808	51.33588
1.4976	1348.375
2.9952	1004.008
5.9904	546.9793
11.9808	295.9774
2.34	786.2021
4.68	469.8592
9.36	302.0929
18.72	189.4255
37.44	106.7062
74.88	59.34984
149.76	34.4723
299.52	20.53435
599.04	13.56538
1.872	1030.726
3.744	683.2716
7.488	377.6162
14.976	230.7852
29.952	157.3697
59.904	95.17585
119.808	51.33588
0.1872	10787
0.3744	7072.585
0.7488	3896.096
1.4976	2487.754
2.9952	1303.844
5.9904	711.8894
11.9808	385.9283

Table 135 Rheological Data of 10 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1217.474
3.06414	608.7369
51.069	100.4674
102.138	53.14021
153.207	44.46928
306.414	23.52642
5.1069	636.5163
10.2138	327.9465
170.23	32.46543
340.46	19.42987
510.69	27.29203
1021.38	15.68057
170.23	67.0467
340.46	33.52335
510.69	26.43749
1021.38	13.21874
2.34	1093.235
4.68	565.8068
9.36	340.472
18.72	218.2098
37.44	125.8958
74.88	68.9446
149.76	38.67001
299.52	24.13239
599.04	18.36276
1.872	982.7527
3.744	779.2193
7.488	461.5704
14.976	272.7623
29.952	160.3681
59.904	110.1677
119.808	57.33261
0.0936	19655.05
0.1872	9827.527
0.3744	4913.763
0.7488	2456.882
1.4976	1288.408
2.9952	794.1223
5.9904	487.0121
11.9808	303.4733

2.34	786.2021
4.68	412.2906
9.36	215.7401
18.72	194.2229
37.44	113.9023
74.88	60.54919
149.76	32.07361
299.52	20.53435
599.04	14.16505
0.234	7094.44
0.468	3739.115
0.936	2061.453
1.872	1126.674
3.744	779.2193
7.488	389.6096
14.976	266.7656
29.952	157.3697
59.904	90.6783
119.808	48.33752
5.9904	457.0284
11.9808	280.9856

Table 136 Rheological Data of 15 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	506.9938
3.06414	285.7914
51.069	73.33999
102.138	37.63883
153.207	27.03023
306.414	22.55759
5.1069	268.3585
10.2138	153.556
170.23	28.97762
340.46	20.01118
510.69	19.1538
1021.38	12.87094
170.23	42.51519
340.46	27.39047
510.69	26.43749
1021.38	13.21874
9.36	225.3348

18.72	194.2229
37.44	125.8958
74.88	65.34657
149.76	38.07034
299.52	24.13239
599.04	19.26227
3.744	707.2585
7.488	353.6293
14.976	296.7492
29.952	166.3648
59.904	86.18076
119.808	45.33915
2.9952	644.2041
5.9904	322.102
11.9808	213.5224
9.36	225.3348
18.72	146.2491
37.44	106.7062
74.88	55.7518
149.76	32.07361
299.52	19.93468
599.04	16.56374
0.234	8629.603
0.468	3739.115
0.936	2061.453
1.872	1366.543
3.744	683.2716
7.488	389.6096
14.976	194.8048
29.952	184.355
59.904	104.1709
119.808	56.58302
0.0234	151540.4
0.0468	68094.4
0.0936	27330.87
0.1872	9827.527
0.3744	5153.632
0.7488	2336.947
1.4976	1168.474
2.9952	674.1877
5.9904	472.0202
11.9808	236.0101

Table 137 Rheological Data of 20 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
3.06414	221.2024
51.069	65.5893
102.138	35.70116
153.207	26.38434
306.414	21.2658
5.1069	248.9818
10.2138	231.0629
170.23	28.97762
340.46	18.55792
510.69	16.82859
1021.38	12.38653
170.23	42.51519
340.46	21.25759
510.69	14.17173
1021.38	11.17445
18.72	160.6412
37.44	80.32062
74.88	42.559
149.76	25.47721
299.52	18.4355
599.04	19.11235
7.488	305.6554
14.976	176.8146
29.952	142.3779
59.904	71.18894
119.808	34.84488
11.9808	168.5469
9.36	244.5244
18.72	223.0072
37.44	123.4971
74.88	70.14395
149.76	48.26478
299.52	31.02863
599.04	19.71202
0.234	8245.812
0.468	3547.22
0.936	1773.61
1.872	886.805
3.744	467.3894

7.488	269.6751
14.976	182.8114
29.952	145.3762
59.904	65.19221
119.808	36.34406
0.0234	93971.84
0.0468	48904.87
0.0936	21574.01
0.1872	10307.26
0.3744	4913.763
0.7488	2576.816
1.4976	1168.474
2.9952	614.2204
5.9904	307.1102
11.9808	198.5306

Table 138 Rheological Data of 25 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	571.5829
3.06414	318.086
51.069	55.90094
102.138	31.82581
153.207	25.73845
306.414	22.23464
5.1069	326.4887
10.2138	231.0629
170.23	30.14022
340.46	20.30183
510.69	13.34078
1021.38	10.64262
170.23	30.24943
340.46	21.25759
510.69	18.26031
1021.38	11.17445
18.72	127.0596
37.44	111.5036
74.88	54.55246
149.76	31.47394
299.52	19.63484
599.04	17.01349
0.234	11316.14
0.468	5274.278

0.936	1965.505
1.872	1030.726
3.744	803.2062
7.488	437.5835
14.976	236.7819
29.952	199.3468
59.904	105.6701
119.808	52.08547
0.0234	109323.5
0.0468	45066.97
0.0936	23492.96
0.1872	12705.96
5.9904	352.0857
11.9808	198.5306
4.68	373.9115
9.36	244.5244
18.72	151.0465
37.44	121.0984
74.88	68.9446
149.76	42.26805
299.52	25.33173
599.04	19.71202
7.488	281.6685
14.976	236.7819
29.952	124.3877
59.904	50.20039
119.808	28.84815
0.0234	78620.21
0.0468	37391.15
2.9952	584.2368
5.9904	307.1102
11.9808	183.5387

Table 139 Rheological Data of 30 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	506.9938
3.06414	285.7914
51.069	63.65163
102.138	36.67
153.207	28.32201
306.414	27.72471
5.1069	190.8516

10.2138	124.4909
170.23	23.7459
340.46	37.15958
510.69	21.86654
1021.38	12.87094
170.23	42.51519
340.46	21.25759
510.69	18.26031
1021.38	13.21874
9.36	234.9296
18.72	218.2098
37.44	121.0984
74.88	61.74853
149.76	35.07198
299.52	22.03353
599.04	22.41055
3.744	635.2978
7.488	341.6358
14.976	314.7394
29.952	175.3599
59.904	86.18076
119.808	46.83833
0.0234	90133.93
0.0468	43148.01
0.0936	18695.58
5.9904	352.0857
11.9808	221.0183
9.36	215.7401
18.72	170.236
37.44	106.7062
74.88	59.34984
149.76	34.4723
299.52	22.93304
599.04	20.46161
7.488	293.662
14.976	230.7852
29.952	220.3353
59.904	86.18076
119.808	47.58792
0.0234	97809.74
0.0468	45066.97
0.0936	19655.05

0.1872	9347.788
5.9904	352.0857
11.9808	273.4897

Table 140 Rheological Data of 40 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1023.706
3.06414	576.4423
51.069	90.77904
102.138	49.26487
153.207	36.71859
306.414	24.49526
5.1069	326.4887
10.2138	298.8814
170.23	34.79064
340.46	33.38112
510.69	23.22291
1021.38	21.88112
170.23	54.78094
340.46	33.52335
510.69	26.43749
1021.38	21.39592
9.36	186.9558
18.72	280.5758
37.44	130.6931
74.88	62.94788
149.76	36.87099
299.52	24.13239
599.04	22.56047
0.234	9780.974
0.468	5658.068
0.936	2829.034
1.872	1366.543
3.744	659.2847
7.488	353.6293
14.976	212.795
29.952	199.3468
59.904	95.17585
119.808	49.8367
0.0234	74782.31
0.0468	31634.29
0.0936	15817.15

0.1872	7908.574
0.3744	3714.418
0.7488	1857.209
1.4976	988.5717
2.9952	584.2368
5.9904	382.0693
11.9808	243.506
2.34	709.444
4.68	412.2906
9.36	244.5244
18.72	242.1967
37.44	118.6997
74.88	60.54919
149.76	35.67165
299.52	22.03353
599.04	22.26063
0.234	9780.974
0.468	5466.173
0.936	2349.296
1.872	1318.569
3.744	779.2193
7.488	569.5115
14.976	284.7557
29.952	151.373
59.904	80.18403
119.808	43.83997
0.0234	82458.12
0.0468	39310.11
0.0936	19655.05
0.1872	9827.527
0.3744	4913.763
0.7488	2456.882
1.4976	1288.408
2.9952	674.1877
5.9904	397.0611
11.9808	295.9774

Table 141 Rheological Data of 45 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1346.652
3.06414	673.326
51.069	148.9092

102.138	49.26487
153.207	52.86586
306.414	29.33944
5.1069	481.5025
10.2138	308.5698
170.23	65.59963
340.46	36.57828
510.69	31.94244
1021.38	24.10945
10.2138	504.1571
170.23	79.31246
340.46	45.78911
510.69	34.61466
1021.38	23.44021
2.34	862.9603
4.68	508.2382
9.36	359.6615
18.72	290.1706
37.44	159.4774
74.88	83.33675
149.76	46.46576
299.52	30.72879
599.04	22.11071
0.234	14770.25
0.468	6809.44
0.936	3980.406
1.872	2134.124
3.744	755.2324
7.488	473.5638
14.976	356.7165
29.952	307.2879
59.904	158.1415
119.808	70.07565
0.0468	41229.06
0.0936	22533.48
0.1872	10307.26
0.3744	4913.76
0.7488	2456.88
1.4976	1348.38
2.9952	794.12
5.9904	397.06
11.9808	370.94

2.34	862.9603
4.68	604.1859
9.36	388.4458
18.72	280.5758
37.44	118.6997
74.88	60.54919
149.76	32.07361
299.52	19.33501
599.04	16.11399
0.234	9780.974
0.468	3739.115
0.936	2253.348
1.872	1462.491
3.744	827.1931
7.488	593.4984
14.976	296.7492
29.952	229.3304
59.904	104.1709
119.808	50.58629
0.0234	70944.4
0.0468	50823.82
0.0936	24452.44
0.1872	10787
0.3744	5393.502
0.7488	2816.685
1.4976	1468.31
2.9952	794.1223
5.9904	442.0366
11.9808	295.9774

Table 142 Rheological Data of 50 wt% Soylospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1992.543
3.06414	1028.566
51.069	187.6627
102.138	100.6132
153.207	75.47204
306.414	58.08158
5.1069	578.3861
10.2138	473.2719
170.23	83.61998
340.46	60.121

510.69	50.35033
170.23	116.1097
340.46	64.18775
510.69	50.969
1021.38	31.61738
2.34	1515.404
4.68	853.6498
9.36	589.9359
18.72	477.2685
37.44	341.778
74.88	162.4936
149.76	88.44286
299.52	55.61521
599.04	36.65278
0.234	9397.184
0.468	5082.382
0.936	3020.929
1.872	1462.491
3.744	971.1146
7.488	821.3741
14.976	470.6543
29.952	478.1946
59.904	212.112
119.808	102.3081
0.0234	151540.4
0.0468	75770.21
0.0936	35966.15
0.1872	15584.39
0.3744	6592.847
0.7488	3296.424
1.4976	2008.015
2.9952	1183.91
5.9904	651.9221
11.9808	490.8711
2.34	1400.267
4.68	834.4603
9.36	407.6354
18.72	400.5104
37.44	231.4382
74.88	128.9119
149.76	69.25333
299.52	41.82274

599.04	29.75654
0.234	9397.184
0.468	5082.382
0.936	2541.191
1.872	1462.491
3.744	923.1408
7.488	1600.949
14.976	800.4744
29.952	457.2061
59.904	224.1055
119.808	100.0593
0.0234	109323.5
0.0468	54661.73
0.0936	28290.34
0.1872	13665.43
0.3744	7072.585
0.7488	3656.227
1.4976	1828.114
2.9952	1033.991
5.9904	591.9548
11.9808	483.3752

Table 143 Rheological Data of 53 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1605.008
3.06414	834.7987
51.069	239.9798
102.138	130.6471
153.207	92.2652
306.414	71.64529
5.1069	888.4137
10.2138	512.0254
170.23	84.20129
340.46	62.15555
10.2138	504.1571
170.23	103.844
340.46	64.18775
510.69	50.969
1021.38	35.70597
2.34	1937.574
4.68	853.6498
9.36	561.1516

18.72	640.3795
37.44	372.961
74.88	146.9021
149.76	82.44613
299.52	55.91505
599.04	43.3991
1198.08	42.61314
0.234	12083.72
0.468	4890.487
0.936	2541.191
1.872	1942.229
3.744	1306.931
7.488	485.5573
14.976	446.6674
29.952	415.229
59.904	170.1349
119.808	92.56338
0.0234	143864.6
0.0468	56580.68
0.0936	26371.39
0.1872	12705.96
0.3744	6352.978
0.7488	3656.227
1.4976	2307.852
2.9952	1243.877
5.9904	651.9221
11.9808	505.8629
2.34	1285.13
4.68	738.5126
9.36	398.0406
18.72	453.2816
37.44	229.0395
74.88	126.5132
149.76	72.25169
299.52	54.7157
599.04	41.75
1198.08	42.23834
0.234	10548.56
0.468	6617.545
0.936	3596.615
1.872	1798.308
3.744	779.2193

7.488	569.5115
14.976	464.6576
29.952	271.3075
59.904	146.148
119.808	87.31625
0.0234	113161.4
0.0468	54661.73
0.0936	26371.39
0.1872	12705.96
0.3744	6832.716
0.7488	4135.966
1.4976	2127.95
2.9952	1273.861
5.9904	741.873
11.9808	445.8956

Table 144 Rheological Data of 56 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1605.008
3.06414	867.0932
51.069	319.4244
102.138	164.5564
153.207	125.2056
306.414	84.56311
5.1069	752.7766
10.2138	492.6487
170.23	126.055
340.46	76.39745
10.2138	504.1571
170.23	128.3755
340.46	88.71926
510.69	67.32335
1021.38	41.83885
2.34	1438.646
4.68	1007.166
9.36	541.9621
18.72	659.569
37.44	466.5099
74.88	212.8661
149.76	109.4314
299.52	66.70916
599.04	50.59517

1198.08	47.11068
0.234	13618.88
0.468	6041.859
0.936	3020.929
1.872	1750.334
3.744	1306.931
7.488	797.3872
14.976	572.5987
29.952	376.2503
59.904	192.6227
119.808	109.804
0.0234	132350.9
0.0468	60418.59
0.0936	25411.91
0.1872	12705.96
0.3744	7792.193
0.7488	4255.9
1.4976	2367.819
2.9952	1333.828
5.9904	681.9057
11.9808	580.822
2.34	1285.13
4.68	738.5126
9.36	398.0406
18.72	453.2816
37.44	229.0395
74.88	126.5132
149.76	72.25169
299.52	54.7157
599.04	41.75
1198.08	42.23834
0.234	10548.56
0.468	6617.545
0.936	3596.615
1.872	1798.308
3.744	779.2193
7.488	569.5115
14.976	464.6576
29.952	271.3075
59.904	146.148
119.808	87.31625
0.0234	113161.4

0.0468	54661.73
0.0936	26371.39
0.1872	12705.96
0.3744	6832.716
0.7488	4135.966
1.4976	2127.95
2.9952	1273.861
5.9904	741.873
11.9808	445.8956

Table 145 Rheological Data of 59 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1411.241
3.06414	737.915
51.069	424.0587
102.138	212.9982
153.207	141.3529
306.414	89.40729
5.1069	1062.804
10.2138	521.7138
170.23	134.7745
340.46	76.1068
10.2138	504.1571
170.23	152.907
340.46	94.85214
510.69	79.5891
1021.38	54.1046
2.34	1784.058
4.68	968.787
9.36	666.694
18.72	386.1182
37.44	538.4706
74.88	258.4412
149.76	126.8219
299.52	71.2067
599.04	49.84558
1198.08	44.63703
0.234	14770.25
0.468	6233.754
0.936	3404.72
1.872	1942.229
3.744	1139.023

7.488	713.433
14.976	548.6118
29.952	475.1963
59.904	236.099
119.808	118.7991
0.0234	147702.5
0.0468	62337.54
0.0936	33087.72
0.1872	16543.86
0.3744	9471.277
0.7488	4975.507
1.4976	2787.59
2.9952	1513.73
5.9904	741.873
11.9808	565.8302
2.34	1438.646
4.68	987.9765
9.36	609.1254
18.72	534.8371
37.44	284.2094
74.88	152.8988
149.76	84.24515
299.52	53.81619
599.04	39.20139
0.234	11699.93
0.468	5849.964
0.936	3308.772
1.872	1942.229
3.744	731.2455
7.488	617.4853
14.976	476.651
29.952	517.1734
59.904	230.1022
119.808	110.5536
0.0234	128513
0.0468	66175.45
0.0936	35006.68
0.1872	18462.82
0.3744	9471.277
0.7488	4615.704
1.4976	2607.688
2.9952	1423.779

5.9904	831.8239
11.9808	603.3097

Table 146 Rheological Data of 65 wt% Solospheres thickened by 1 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1927.954
3.06414	1028.566
5.1069	2380.422
10.2138	1199.899
5.1069	2234.89
10.2138	1321.874
170.23	128.3755
340.46	94.85214
510.69	79.5891
1021.38	58.19319
2.34	5007.899
4.68	2676.655
9.36	1712.523
18.72	1513.503
37.44	879.0848
74.88	716.5912
149.76	316.3185
299.52	186.3439
599.04	114.9101
1198.08	74.021
0.234	48160.03
0.468	28685.5
0.936	15302.23
1.872	7938.957
3.744	2746.146
7.488	1516.995
14.976	1472.108
29.952	888.9705
59.904	588.4067
119.808	273.2148
0.0234	285867.1
0.0468	146771.5
0.0936	73385.74
0.1872	37172.61
0.3744	22184.34
0.7488	12651.32
1.4976	7405.071

2.9952	4062.339
5.9904	2076.145
11.9808	1068.056
2.34	4048.422
4.68	2312.054
9.36	1271.164
18.72	784.301
37.44	574.451
74.88	357.9869
149.76	218.5719
299.52	135.0719
599.04	87.62497
1198.08	62.17746
0.234	28970.5
0.468	15636.62
0.936	8489.946
1.872	4628.763
3.744	2554.251
7.488	1984.739
14.976	1526.078
29.952	987.9165
59.904	657.3691
119.808	399.1461
0.0234	312732.5
0.0468	158285.2
0.0936	78183.12
0.1872	39091.56
0.3744	19545.78
0.7488	9772.89
1.4976	5606.052
2.9952	3372.715
5.9904	2166.096
11.9808	1450.348

Table 147 Rheological Data of 5 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	1282.05
3.06414	673.3194
8.5115	277.2731
102.138	46.35816
153.207	36.07257
306.414	27.72465

5.1069	1179.061
10.2138	589.5303
170.23	60.9491
340.46	33.09041
510.69	27.87329
1021.38	20.23408
10.2138	504.1571
170.23	42.51519
340.46	27.39047
510.69	18.26031
1021.38	13.21874
2.34	2436.502
4.68	1218.251
9.36	417.2301
18.72	294.9679
37.44	181.0657
74.88	118.1178
149.76	98.03762
299.52	51.4175
599.04	29.75654
1198.08	30.61968
0.234	8245.812
0.468	4122.906
0.936	2253.348
1.872	1318.569
3.744	1258.958
7.488	641.4722
14.976	374.7067
29.952	253.3173
59.904	204.6161
119.808	101.5585
0.0234	97809.74
0.0468	54661.73
0.0936	27330.87
0.1872	13665.43
0.3744	6832.716
0.7488	3656.227
1.4976	1948.048
2.9952	1063.975
5.9904	936.7667
11.9808	498.367
2.34	1860.816

4.68	1160.682
9.36	570.7464
18.72	299.7653
37.44	149.8827
74.88	90.53283
149.76	46.46576
299.52	29.82928
599.04	20.76145
1198.08	28.89562
0.234	12467.51
0.468	4122.906
0.936	2445.244
1.872	1606.412
3.744	1282.944
7.488	689.446
14.976	308.7427
29.952	220.3353
59.904	149.1464
119.808	85.81707
0.0234	189919.5
0.0468	89202.88
0.0936	43641.97
0.1872	21341.24
0.3744	10670.62
0.7488	5215.377
1.4976	2607.688
2.9952	1333.828
5.9904	996.7339
11.9808	595.8138

Table 148 Rheological Data of 10 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	1475.817
3.06414	770.2031
8.5115	986.4613
102.138	86.08045
153.207	63.19998
306.414	55.49795
5.1069	481.4986
10.2138	260.126
170.23	52.81087
340.46	30.7652

510.69	25.54808
1021.38	22.94682
10.2138	504.1571
170.23	67.0467
340.46	39.65623
510.69	34.61466
1021.38	19.35162
2.34	1707.3
4.68	1218.251
9.36	724.2626
18.72	347.7392
37.44	181.0657
74.88	116.9184
149.76	50.66347
299.52	59.21325
599.04	33.80433
1198.08	18.55127
0.234	5943.068
0.468	3931.011
0.936	1581.715
1.872	838.8312
3.744	659.2847
7.488	353.6293
14.976	206.7983
29.952	253.3173
59.904	183.6276
119.808	112.8023
0.02	116999.3
0.05	64256.5
0.09	32128.25
0.19	19422.29
0.37	8511.8
0.75	4495.769
1.50	2607.688
3.00	1513.73
5.99	966.7503
11.98	550.8383
2.34	2820.292
4.68	1045.545
9.36	743.4521
18.72	395.713
37.44	226.6408
74.88	181.6831
149.76	98.63729
299.52	50.81783
599.04	26.60826

1198.08	30.24489
0.234	7862.021
0.468	4506.697
0.936	1581.715
1.872	934.7788
3.744	731.2455
7.488	425.59
14.976	350.7198
29.952	253.3173
59.904	210.6129
119.808	109.804
0.0234	63268.59
0.0468	45066.97
0.0936	32128.25
0.1872	19422.29
0.3744	8511.8
0.7488	4495.769
1.4976	2847.557
2.9952	1513.73
5.9904	1056.701
11.9808	603.3097

Table 149 Rheological Data of 15 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1282.05
3.06414	673.3194
8.5115	939.9571
102.138	97.70649
153.207	69.65889
306.414	54.85206
5.1069	500.8753
10.2138	260.126
170.23	70.83123
340.46	43.84449
510.69	26.71069
1021.38	26.43463
5.1069	599.4556
10.2138	504.1571
170.23	67.0467
340.46	45.78911
510.69	30.52607

1021.38	25.4845
2.34	1016.476
9.36	292.4982
18.72	227.8046
37.44	217.046
74.88	103.7256
149.76	59.05889
299.52	44.8211
599.04	36.05311
1198.08	37.81576
0.234	9780.974
0.468	4698.592
0.936	2157.401
1.872	1030.726
3.744	635.2978
7.488	593.4984
14.976	404.6903
29.952	145.3762
59.904	126.6587
119.808	72.32443
0.0234	186081.6
0.0468	71932.31
0.0936	32128.25
0.1872	15104.65
0.3744	7312.455
0.7488	3776.162
1.4976	2008.015
2.9952	1004.008
5.9904	457.0284
11.9808	370.9365
2.34	1822.437
4.68	1218.251
9.36	455.6092
37.44	82.71931
74.88	116.9184
149.76	51.86281
299.52	46.02045
599.04	39.65114
1198.08	31.96895

0.234	12467.51
0.468	7001.335
0.936	3596.615
1.872	1894.255
3.744	1210.984
7.488	689.446
14.976	542.6151
29.952	220.3353
59.904	236.099
119.808	30.34733
0.0234	166892.1
0.0468	70013.35
0.0936	38844.58
0.1872	28537.32
0.3744	6352.978
0.7488	3176.489
1.4976	1648.212
2.9952	914.0568
5.9904	516.9957
11.9808	280.9856

Table 150 Rheological Data of 20 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1346.639
3.06414	673.3194
8.5115	846.9488
102.138	103.5195
153.207	72.88835
306.414	60.34214
5.1069	500.8753
10.2138	269.8144
170.23	69.66862
340.46	44.13514
510.69	27.09822
1021.38	27.2097
5.1069	1008.314
10.2138	708.5864
170.23	79.31246

340.46	45.78911
510.69	34.61466
1021.38	29.57309
2.34	978.0974
4.68	565.8068
9.36	311.6877
18.72	218.2098
37.44	226.6408
74.88	116.9184
149.76	60.25823
299.52	47.51963
599.04	38.75163
1198.08	39.68973
0.234	10164.76
0.468	4506.697
0.936	2157.401
1.872	1222.622
3.744	659.2847
7.488	629.4788
14.976	506.6347
29.952	85.40895
59.904	192.6227
119.808	100.0593
0.0234	109323.5
0.0468	58499.64
0.0936	35966.15
0.1872	18942.55
0.3744	11390.23
0.7488	5095.442
1.4976	2487.754
2.9952	1303.844
5.9904	636.9303
11.9808	378.4324
2.34	1438.646
4.68	757.7021
9.36	388.4458
18.72	227.8046
37.44	159.4774
74.88	192.4772

149.76	112.4298
299.52	48.71897
599.04	21.81088
1198.08	39.0151
0.234	11699.93
0.468	7193.231
0.936	7050.731
1.872	1558.439
3.744	635.2978
7.488	905.3283
14.976	602.5823
29.952	307.2879
59.904	165.6374
119.808	87.31625
0.0234	166892.1
0.0468	102635.6
0.0936	52277.25
0.1872	27577.84
0.3744	14508.53
0.7488	5215.377
1.4976	3207.361
2.9952	1603.681
5.9904	1371.529
11.9808	708.2525

Table 151 Rheological Data of 25 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1346.639
3.06414	705.614
8.5115	881.8269
102.138	87.04929
153.207	69.65889
306.414	47.42432
5.1069	694.6425
10.2138	405.4514
170.23	72.57513
340.46	48.4949
510.69	35.81775
5.1069	1417.173

10.2138	708.5864
170.23	67.0467
340.46	58.05487
510.69	38.70324
1021.38	29.57309
2.34	1822.437
4.68	3022.067
9.36	465.204
18.72	347.7392
37.44	197.8565
74.88	98.92825
149.76	58.45921
299.52	47.21979
599.04	40.85049
1198.08	40.96404
0.234	11699.93
0.468	6425.65
0.936	4076.354
1.872	2613.863
3.744	851.18
7.488	677.4526
14.976	500.638
29.952	88.40732
59.904	93.67667
119.808	53.58465
0.0234	113161.4
0.0468	52742.78
0.0936	23492.96
0.1872	8868.05
0.3744	4434.025
0.7488	2336.947
1.4976	1228.441
2.9952	674.1877
5.9904	397.0611
11.9808	340.9529
2.34	2206.227
4.68	1026.356
9.36	484.3935
18.72	2516.156
37.44	185.863

74.88	116.9184
149.76	111.8301
299.52	59.21325
599.04	33.95425
1198.08	39.31494
0.234	20527.11
0.468	10455.45
0.936	5515.568
1.872	2086.151
3.744	2338.369
7.488	1049.25
14.976	944.3958
29.952	430.2208
59.904	111.6669
119.808	25.84978
0.0234	163054.1
0.0468	70013.35
0.0936	33087.72
0.1872	14145.17
0.3744	7072.585
0.7488	3416.358
1.4976	1528.277
2.9952	704.1713
5.9904	442.0366
11.9808	318.4651

Table 152 Rheological Data of 30 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1411.228
3.06414	705.614
8.5115	951.5832
102.138	99.64416
153.207	75.47191
306.414	53.23734
5.1069	733.396
10.2138	415.1398
170.23	75.48164
340.46	53.72662

510.69	37.56165
5.1069	1417.173
10.2138	708.5864
170.23	67.0467
340.46	58.05487
510.69	50.969
1021.38	33.66167
2.34	2705.155
4.68	1486.904
9.36	877.7788
18.72	611.5952
37.44	351.3727
74.88	187.6798
149.76	97.43795
299.52	52.01717
599.04	49.09599
1198.08	44.78695
0.234	10164.76
0.468	6233.754
0.936	4364.197
1.872	2805.758
3.744	1450.853
7.488	653.4657
14.976	446.6674
29.952	82.41059
59.904	119.1628
119.808	61.08056
0.0234	105485.6
0.0468	58499.64
0.0936	25411.91
0.1872	14624.91
0.3744	7552.324
0.7488	3896.096
1.4976	2127.95
2.9952	1093.959
5.9904	546.9793
11.9808	251.0019
2.34	1016.476
4.68	546.6173

9.36	330.8772
18.72	237.3994
37.44	135.4905
74.88	82.13741
149.76	48.26478
299.52	47.81946
599.04	39.05147
1198.08	40.43932
0.234	8245.812
0.468	4506.697
0.936	3500.668
1.872	2038.177
3.744	851.18
7.488	725.4264
14.976	590.5889
29.952	301.2912
59.904	128.1579
119.808	60.33097
0.0234	136188.8
0.0468	75770.21
0.0936	41723.01
0.1872	21341.24
0.3744	8032.062
0.7488	4615.704
1.4976	2127.95
2.9952	1004.008
5.9904	442.0366
11.9808	340.9529

Table 153 Rheological Data of 35 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1411.228
3.06414	737.9085
8.5115	1149.226
102.138	113.2079
153.207	89.68151
306.414	76.48941
5.1069	752.7727

10.2138	453.8933
170.23	99.31501
340.46	70.29372
510.69	54.80694
5.1069	1417.173
10.2138	708.5864
170.23	103.844
340.46	64.18775
510.69	59.14617
1021.38	43.88314
2.34	2052.711
4.68	1429.336
9.36	436.4197
18.72	448.4842
37.44	159.4774
74.88	152.8988
149.76	156.2059
299.52	111.0849
599.04	28.5572
1198.08	45.23671
0.234	14386.46
0.468	6617.545
0.936	3308.772
1.872	2709.81
3.744	1762.683
7.488	1181.178
14.976	692.5333
29.952	103.3991
59.904	276.5769
119.808	133.0413
0.0234	132350.9
0.0468	64256.5
0.0936	32128.25
0.1872	16064.12
0.3744	8991.538
0.7488	4495.769
1.4976	1948.048
2.9952	1273.861
5.9904	651.9221
11.9808	475.8792

2.34	2474.881
4.68	1007.166
9.36	868.1841
18.72	371.7261
37.44	111.5036
74.88	134.9086
149.76	118.4265
299.52	82.00081
599.04	63.33822
1198.08	40.28941
0.234	14002.67
0.468	7577.021
0.936	4556.092
1.872	2421.967
3.744	1282.944
7.488	773.4002
14.976	554.6085
29.952	292.2961
59.904	155.1431
119.808	85.06747
0.0234	193757.4
0.0468	102635.6
0.0936	55155.68
0.1872	27577.84
0.3744	8032.062
0.7488	4855.573
1.4976	2547.721
2.9952	1603.681
5.9904	936.7667
11.9808	318.4651

Table 154 Rheological Data of 40 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1927.941
3.06414	1190.032
8.5115	1509.633
102.138	151.9613
153.207	113.5795

5.1069	849.6563
10.2138	482.9584
170.23	107.4532
5.1069	1826.031
10.2138	1321.874
170.23	152.907
340.46	82.58638
510.69	59.14617
1021.38	45.92743
2.34	1784.058
4.68	1218.251
9.36	561.1516
18.72	338.1444
37.44	382.5557
74.88	208.0687
149.76	115.4281
299.52	67.9085
599.04	48.49632
1198.08	39.98957
0.234	11316.14
0.468	6041.859
0.936	3116.877
1.872	3045.627
3.744	2050.526
7.488	1133.204
14.976	668.5463
29.952	79.41223
59.904	296.0662
119.808	151.7811
0.0234	101647.6
0.0468	52742.78
0.0936	30209.29
0.1872	17023.6
0.3744	9231.408
0.7488	4615.704
1.4976	2427.786
2.9952	1453.762
5.9904	756.8648

11.9808	400.9201
2.34	1822.437
4.68	1237.44
9.36	906.5631
18.72	275.7784
37.44	200.2552
74.88	184.0818
149.76	163.402
299.52	119.1805
599.04	73.0829
1198.08	40.73916
0.234	27051.55
0.468	14101.46
0.936	4172.301
1.872	2757.784
3.744	2338.369
7.488	1061.243
14.976	698.53
29.952	361.2584
59.904	206.1153
119.808	107.5552
0.0234	140026.7
0.0468	110311.4
0.0936	57074.64
0.1872	29017.06
0.3744	15707.87
0.7488	4495.769
1.4976	4406.707
2.9952	2233.337
5.9904	1206.619
11.9808	505.8629

Table 155 Rheological Data of 45 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	2573.831
3.06414	1448.388
8.5115	2056.057

102.138	275.9724
5.1069	985.2934
10.2138	541.0885
5.1069	1826.031
10.2138	3161.738
170.23	263.2988
340.46	137.7823
510.69	108.2092
1021.38	62.28178
2.34	2244.606
4.68	1640.421
9.36	1098.458
18.72	602.0004
37.44	356.1701
74.88	223.6602
149.76	136.4167
299.52	96.6928
599.04	59.8901
1198.08	54.30676
0.234	20527.11
0.468	12374.4
0.936	6954.783
1.872	2709.81
3.744	2002.552
7.488	1181.178
14.976	692.5333
29.952	721.0621
59.904	276.5769
119.808	133.0413
0.0234	182243.7
0.0468	102635.6
0.0936	57074.64
0.1872	30456.27
0.3744	16187.61
0.7488	8933.348
1.4976	4586.609
2.9952	2473.206
5.9904	1251.595

11.9808	633.2934
2.34	2858.671
4.68	1678.8
9.36	964.1317
18.72	491.6606
37.44	272.2159
74.88	168.4903
149.76	87.84318
299.52	89.19689
599.04	50.59517
1198.08	54.15684
0.234	25900.18
0.468	8344.603
0.936	5035.83
1.872	2613.863
3.744	1378.892
7.488	1193.171
14.976	584.5921
29.952	220.3353
59.904	189.6243
119.808	131.5421
0.0234	262839.7
0.0468	141014.6
0.0936	71466.78
0.1872	47726.85
0.3744	25062.77
0.7488	17688.57
1.4976	8904.253
2.9952	3732.519
5.9904	1656.374
11.9808	850.6747

Table 156 Rheological Data of 50 wt% Solospheres thickened by 1.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	3413.49
3.06414	1706.745
5.1069	1508.465

10.2138	1132.079
5.1069	1008.314
10.2138	2957.309
170.23	251.0331
340.46	150.0481
510.69	116.3864
1021.38	64.32607
2.34	2282.985
4.68	1371.767
9.36	1050.485
18.72	616.3926
37.44	737.562
74.88	378.3758
149.76	212.5751
299.52	169.553
599.04	102.4669
1198.08	53.48221
0.234	28586.71
0.468	13333.88
0.936	7146.678
1.872	3141.575
3.744	1618.761
7.488	869.3479
14.976	464.6576
29.952	289.2977
59.904	252.59
119.808	152.5307
0.0234	178405.8
0.0468	83446.03
0.0936	39804.06
0.1872	25179.15
0.3744	15228.14
0.7488	9413.086
1.4976	4766.51
2.9952	1873.533
5.9904	816.8321
11.9808	865.6666

Table 157 Rheological Data of 5 wt% Solospheres thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	3736.435

3.06414	1868.218
8.5115	3381.425
5.1069	2457.925
10.2138	2052.473
5.1069	1417.173
10.2138	1117.445
170.23	177.4385
340.46	113.2508
510.69	87.76628
1021.38	45.92743
2.34	5583.585
4.68	4269.386
9.36	2048.34
18.72	933.0198
37.44	567.2549
74.88	392.7679
149.76	218.5719
299.52	124.5776
599.04	66.78634
1198.08	31.81903
0.234	34727.36
0.468	16404.21
0.936	8393.998
1.872	3957.13
3.744	3105.95
7.488	1972.746
14.976	1292.206
29.952	826.0049
59.904	535.9354
119.808	297.2017
0.0234	615927.1
0.0468	298368.8
0.0936	146306
0.1872	76990.88
0.3744	38975.18
0.7488	19967.33
1.4976	7584.973
2.9952	3402.699
5.9904	1791.3
11.9808	1517.811
2.34	5967.375
4.68	3194.772
9.36	2048.34
18.72	1374.379
37.44	737.562
74.88	404.7614
149.76	226.3676
299.52	118.281

599.04	62.73855
1198.08	27.24652
0.234	30889.46
0.468	16020.41
0.936	8489.946
1.872	4436.868
3.744	3801.57
7.488	1948.759
14.976	1220.245
29.952	1011.903
59.904	589.9059
119.808	305.4472
0.0234	834687.7
0.0468	369370
0.0936	153022.3
0.1872	73152.98
0.3744	38495.44
0.7488	17808.51
1.4976	5965.856
2.9952	3222.797
5.9904	1896.243
11.9808	2057.516

Table 15857 Rheological Data of 10 wt% Solospheres thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	3994.791
3.06414	2546.403
5.1069	3911.179
10.2138	2236.552
5.1069	2643.749
10.2138	1730.733
170.23	263.2988
340.46	174.5796
510.69	145.0065
2.34	6811.715
4.68	4921.83
9.36	3017.411
18.72	1446.34
37.44	677.5947
74.88	416.7548
149.76	241.9591
299.52	199.2368
599.04	111.6119
1198.08	47.78532
0.234	45473.5
0.468	21969.17
0.936	11368.38

1.872	5108.502
3.744	4545.165
7.488	3603.856
14.976	2143.741
29.952	1101.854
59.904	574.9141
119.808	361.6666
0.0234	500789.9
0.0468	250394.9
0.0936	122319
0.1872	60679.78
0.3744	30579.76
0.7488	15649.68
1.4976	8724.351
2.9952	5711.439
5.9904	4384.885
11.9808	2417.32
2.34	5391.689
4.68	3118.014
9.36	2470.51
18.72	1259.242
37.44	665.6013
74.88	401.1633
149.76	278.5391
299.52	170.4526
599.04	100.368
1198.08	58.27959
0.23	56603.43
0.47	27534.13
0.94	13287.33
1.87	6595.69
3.74	4209.348
7.49	2476.471
14.98	2239.689
29.95	1218.791
59.90	474.4689
119.81	249.9775
0.0234	420193.8
0.0468	204340.1
0.0936	96413.17
0.1872	46287.63
0.3744	22424.21
0.7488	11571.91
1.4976	7644.94
2.9952	4362.175
5.9904	2990.646

11.9808	2327.369

Table 158 Rheological Data of 15 wt% Solospheres thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	5221.984
3.06414	2998.527
51.069	431.809
5.1069	2787.329
10.2138	2033.096
5.1069	6323.476
10.2138	3775.026
170.23	410.4879
340.46	223.6426
510.69	161.3608
1021.38	90.90188
2.34	10150.69
4.68	14151.99
9.36	3554.718
18.72	1906.888
37.44	967.8364
74.88	495.9116
149.76	304.3251
299.52	221.1249
599.04	134.8492
1198.08	62.77714
0.234	90377
0.468	49026.41
0.936	22402.35
1.872	11920.78
3.744	6799.934
7.488	3903.692
14.976	1981.83
29.952	382.247
59.904	498.4558
119.808	279.9611
0.0234	489276.2
0.0468	242719.1
0.0936	122319
0.1872	61159.52
0.3744	26501.98
0.7488	13490.86
1.4976	7584.973
2.9952	4122.306
5.9904	3065.605
11.9808	2304.881

2.34	4662.487
4.68	2830.171
9.36	1798.876
18.72	3801.855
37.44	672.7974
74.88	347.1928
149.76	201.781
299.52	202.535
599.04	129.0024
1198.08	59.40398
0.234	91528.37
0.468	43461.44
0.936	21250.98
1.872	12304.58
3.744	7255.686
7.488	3903.692
14.976	2581.503
29.952	1317.737
59.904	690.3511
119.808	82.8187
0.0234	462410.8
0.0468	221610.6
0.0936	106007.9
0.1872	47726.85
0.3744	26981.72
0.7488	14450.34
1.4976	9084.155
2.9952	5921.325
5.9904	3725.245
11.9808	2439.808

Table 159 Rheological Data of 20 wt% Solospheres thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
0.3393	36821.54
0.6786	19326.6
1.885	12342.64
22.62	1046.87
33.93	697.9131
67.86	538.2274
1.131	12328.62
2.262	10377.11
37.7	875.395
75.4	566.829
113.1	452.9838
226.2	229.2394

5.1069	5505.759
10.2138	3161.738
170.23	300.0961
340.46	223.6426
510.69	173.6266
1021.38	94.99046
2.34	8845.805
4.68	5651.032
9.36	3132.549
18.72	1849.32
37.44	732.7646
74.88	339.9967
149.76	199.3823
299.52	133.8725
599.04	112.5114
1198.08	65.47566
0.234	89993.21
0.468	50945.36
0.936	26815.95
1.872	12352.55
3.744	5720.523
7.488	3028.17
14.976	2107.761
29.952	322.2797
59.904	507.4509
119.808	291.205
0.0234	412518
0.0468	202421.1
0.0936	102170
0.1872	53963.45
0.3744	28181.07
0.7488	11451.97
1.4976	7704.907
2.9952	4302.208
5.9904	2555.883
11.9808	1847.631
2.34	4931.141
4.68	2715.034
9.36	1818.066
18.72	1139.307
37.44	656.0065
74.88	379.5751
149.76	217.9722
299.52	153.062
599.04	119.2577
1198.08	59.85373

0.234	91144.58
0.468	45956.08
0.936	24513.2
1.872	11680.92
3.744	6344.183
7.488	4443.398
14.976	2233.692
29.952	1233.782
59.904	577.9125
119.808	329.4341
0.0234	562196.4
0.0468	256151.8
0.0936	125197.5
0.1872	60200.04
0.3744	29620.28
0.7488	15529.75
1.4976	7225.169
2.9952	4721.979
5.9904	2900.695
11.9808	2207.434

Table 160 Rheological Data of 25 wt% Solospheres thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	7208.1759
3.06414	5159.0691
8.5115	3877.3882
102.138	331.22863
153.207	224.87556
306.414	148.94603
5.1069	4109.5596
10.2138	3129.7451
170.23	236.46237
340.46	123.09895
510.69	99.914449
5.1069	2234.8901
10.2138	2344.0208
170.23	361.4249
340.46	217.50972
510.69	173.62658
2.34	8423.635
4.68	14305.51
9.36	2940.6533
18.72	1566.2743
37.44	922.26124
74.88	524.69594

149.76	304.92474
299.52	223.5236
599.04	138.74708
1198.08	70.87272
0.234	105728.62
0.468	54015.684
0.936	28734.9
1.872	11441.046
3.744	6560.0652
7.488	3783.7577
14.976	2077.7774
29.952	394.24045
59.904	553.92555
119.808	333.93169
0.0234	504627.78
0.0468	246557.03
0.0936	116562.18
0.1872	56362.137
0.3744	28181.068
0.7488	13610.796
1.4976	8244.6127
2.9952	4901.881
5.9904	2780.7606
11.9808	1967.5654
2.34	6159.2705
4.68	3540.184
9.36	2019.5559
18.72	1422.3528
37.44	778.33977
74.88	419.15353
149.76	238.96073
299.52	158.4591
599.04	133.2001
1198.08	71.247515
0.234	104193.46
0.468	54399.474
0.936	28255.161
1.872	12448.497
3.744	6775.9474
7.488	3903.6923
14.976	2833.3652
29.952	1731.5108
59.904	759.31348
119.808	438.12484
0.0234	677333.55
0.0468	329072.01

0.0936	161657.57
0.1872	72193.50
0.3744	34897.40
0.7488	16369.29
1.4976	9923.70
2.9952	6071.24
5.9904	3575.33
11.9808	2080.00

Table 161 Rheological Data of 30 wt% Solospheres thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	9777.275
3.06414	5294.285
8.5115	5143.008
102.138	432.6404
153.207	289.7791
306.414	163.1437
5.1069	4474.642
10.2138	3535.392
170.23	274.1876
340.46	148.6547
510.69	108.0274
5.1069	4279.183
10.2138	2752.879
170.23	398.2222
340.46	235.9084
0.9	25145.36
1.8	13660.06
3.6	7883.425
7.2	6507.244
14.4	2947.797
28.8	1410.185
57.6	747.5682
115.2	460.8593
230.4	352.5473
460.8	198.5734
0.09	180774
0.18	91066.61
0.36	49610.97
0.72	30242.38
1.44	8070.222
2.88	5776.615
5.76	3801.535
11.52	3302.465
23.04	1476.02

46.08	639.7852
0.009	584440
0.018	319404.4
0.036	146110
0.072	71355.97
0.144	33129.44
0.288	16989.48
0.576	9131.875
1.152	4672.127
2.304	4353.659
4.608	3663.479
0.9	10193.91
1.8	5232.878
3.6	4213.525
7.2	3347.053
14.4	1724.497
28.8	921.7146
57.6	524.5708
115.2	386.5268
230.4	378.5636
460.8	176.5391
0.09	205240
0.18	112814.2
0.36	58445.92
0.72	32281.21
1.44	14696.43
2.88	5988.993
5.76	6201.411
11.52	2283.049
23.04	1019.407
46.08	528.2865
0.009	747546.7
0.018	373773.3
0.036	169896.4
0.072	81550.14
0.144	39925.56
0.288	20387.53
0.576	10830.9
1.152	6583.533
2.304	4088.186
4.608	2734.323

Table 11591 Rheological Data of 35 wt% Solospheres thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**

1.53207	9101.196
3.06414	5835.148
8.5115	4096.438
102.138	351.511
153.207	246.5101
306.414	180.0457
5.1069	3703.912
10.2138	3393.416
170.23	285.14
340.46	166.3004
5.1069	4688.042
10.2138	3161.738
170.23	410.4879
340.46	260.4399
0.9	34388.07
1.8	17669.76
3.6	9140.706
7.2	6626.176
14.4	2624.982
28.8	1414.433
57.6	787.9201
115.2	521.3872
230.4	387.0588
460.8	198.8388
0.09	197084.7
0.18	106697.7
0.36	53009.03
0.72	27523.93
1.44	18774.1
2.88	10916.17
5.76	7178.352
11.52	3323.703
23.04	1624.685
46.08	836.2352
0.009	1005799
0.018	468918.9
0.036	224265.3
0.072	110433.6
0.144	64561.46
0.288	36953.06
0.576	20812.69
1.152	9450.642
2.304	4619.132
4.608	4194.425
0.9	17941.48
1.8	7883.361

3.6	5538.767
7.2	4026.664
14.4	2047.313
28.8	1078.875
57.6	624.3887
115.2	409.8885
230.4	364.2281
460.8	190.6092
0.09	137278.9
0.18	67280.22
0.36	34319.72
0.72	17669.57
1.44	15376.04
2.88	12063.02
5.76	7794.25
11.52	3939.601
23.04	1937.944
46.08	998.1738
0.009	1440750
0.018	584452.8
0.036	265041.9
0.072	135919
0.144	70508.06
0.288	37377.81
0.576	20387.93
1.152	13485.83
2.304	7433.147
4.608	7088.082

Table 162 Rheological Data of 40 wt% Solospheres thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	11805.51
3.06414	6037.972
5.1069	7516.997
10.2138	4123.581
0.9	33844.38
1.8	17261.99
3.6	10092.16
7.2	8376.175
14.4	3848.282
28.8	1720.258
57.6	891.9856
115.2	612.7099
230.4	392.3682
460.8	230.6956

0.09	286793.3
0.18	120289.9
0.36	74756.58
0.72	31091.89
1.44	21067.78
2.88	14399.18
5.76	9854.321
11.52	5904.102
23.04	2962.67
46.08	1425.586
0.009	1794148
0.018	815520.6
0.036	380575.8
0.072	186889.9
0.144	90896.39
0.288	50120.52
0.576	28033.56
1.152	16671.51
2.304	11096.68
4.608	8176.521
0.9	26232.73
1.8	12028.99
3.6	7679.542
7.2	6677.147
14.4	3202.651
28.8	1635.306
57.6	904.7283
115.2	533.068
230.4	389.1826
460.8	207.5995
0.09	235142.9
0.18	133202.5
0.36	65242.03
0.72	29562.76
1.44	17669.73
2.88	12275.4
5.76	12126.77
11.52	4151.979
23.04	2070.68
46.08	1114.982
0.009	1699002
0.018	795132.2
0.036	380575.8
0.072	169899.6
0.144	81551.74
0.288	39926.35

0.576	22724.1
1.152	13167.27
2.304	9610.026
4.608	7088.082

Table 163 Rheological Data of 45 wt% Solospheres thickened by 2.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
0.9	30718.17
1.8	13524.13
3.6	8291.192
7.2	11009.67
14.4	6074.008
28.8	3015.766
57.6	1686.281
0.09	273201.1
0.18	109416.1
0.36	57426.5
0.72	32790.92
1.44	15121.19
2.88	10916.17
5.76	10130.41
11.52	5553.677
23.04	2521.984
46.08	1375.146
0.009	1753371
0.018	890277.8
0.036	445138.9
0.072	278637.4
0.144	135920.6
0.288	54792.85
0.576	26334.53
1.152	14441.54
2.304	15769
4.608	9211.866
0.9	22019.14
1.8	13728.02
3.6	6999.931
7.2	8019.379
14.4	4094.641
28.8	2085.549
57.6	1131.973
115.2	660.4951
230.4	500.1503
0.09	193007
0.18	87668.56

0.36	64222.61
0.72	32621.01
1.44	17669.73
2.88	10194.09
5.76	9811.845
11.52	6541.237
23.04	3334.332
46.08	1725.57
0.009	1590264
0.018	815520.6
0.036	451935
0.072	248054.9
0.144	146964.3
0.288	81127.78
0.576	40351.51
1.152	22299.54
2.304	15875.19
4.608	8415.447

Table 16064 Rheological Data of 5 wt% Solospheres thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
0.9	50562.81
1.8	27320.24
3.6	15257.21
7.2	7951.418
14.4	5173.524
28.8	3020.014
57.6	1556.73
115.2	725.2705
230.4	357.3258
460.8	145.7442
0.09	203880.8
0.18	108736.5
0.36	65242.03
0.72	36358.88
1.44	21152.74
2.88	13549.67
5.76	10703.84
11.52	6498.761
23.04	3451.14
46.08	1741.498
0.01	5015504
0.02	1964063
0.04	832517.2
0.07	389074.2

0.14	184342.9
0.29	100666.6
0.58	76880.61
1.15	39077.44
2.30	16618.52
4.61	9610.076
0.9	47164.76
1.8	27048.39
3.6	15053.32
7.2	8308.214
14.4	4400.466
28.8	2493.315
57.6	1267.895
115.2	576.6056
230.4	322.8143
460.8	167.513
0.09	172618.7
0.18	93785.06
0.36	54708.06
0.72	41965.67
1.44	26334.77
2.88	17797.24
5.76	10958.69
11.52	5447.488
23.04	2744.982
46.08	1176.041
0.009	1671818
0.018	808724.4
0.036	390770
0.072	198783.1
0.144	104488.6
0.288	54368.09
0.576	29307.83
1.152	18476.73
2.304	16034.47
4.608	13459.44

Table 165 Rheological Data of 10 wt% Solospheres thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
0.9	56815.23
1.8	28203.73
3.6	15393.13
7.2	7713.554
14.4	3916.243
28.8	2132.272

57.6	1272.143
115.2	974.8152
230.4	434.313
0.09	299026.3
0.18	141357.8
0.36	111115.8
0.72	59635.56
1.44	24295.94
2.88	18306.94
5.76	12424.1
11.52	6498.761
23.04	3360.879
46.08	1728.225
0.009	2405798
0.018	1087365
0.036	509701.9
0.072	253151.9
0.144	134221.6
0.288	69234.58
0.576	46298.11
1.152	27396.62
2.304	25856.98
4.608	14308.95
0.9	46077.38
1.8	25689.17
3.6	14509.63
7.2	7424.719
14.4	3873.767
28.8	2026.083
57.6	1078.879
115.2	773.0556
230.4	496.9646
460.8	241.0491
0.09	311259.3
0.18	181454.9
0.36	122329.4
0.72	63543.32
1.44	34235.25
2.88	24805.73
5.76	10321.55
11.52	5192.634
23.04	2686.578
46.08	1582.215
0.009	2201914
0.018	835908.9

0.036	407760.3
0.072	205579.2
0.144	158857.5
0.288	89622.92
0.576	41838.16
1.152	27290.43
2.304	16034.47
4.608	13459.44

Table 166 Rheological Data of 15 wt% Solospheres thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
0.9	56815.23
1.8	29223.15
3.6	15495.07
7.2	12470.83
14.4	5742.698
28.8	2841.616
57.6	1505.759
115.2	862.2546
0.09	199803.1
0.18	112134.6
0.36	80193.47
0.72	59635.56
1.44	34914.86
2.88	19623.69
5.76	13316.09
11.52	6764.234
23.04	3408.664
46.08	1664.511
0.009	2297060
0.018	965035
0.036	479119.4
0.072	316016
0.144	168202.2
0.288	102365.6
0.576	60102.71
1.152	38546.49
2.304	28140.05
4.608	14308.95
0.9	47028.83
1.8	23650.34
3.6	15053.32
7.2	8444.136
14.4	4425.951
28.8	2331.908

57.6	1420.808
115.2	975.8771
230.4	520.3263
0.09	205240
0.18	105338.4
0.36	75776
0.72	49951.1
1.44	29902.73
2.88	19708.64
5.76	10342.79
11.52	5022.731
23.04	2559.151
46.08	1343.289
0.009	1957254
0.018	849501.1
0.036	400964.2
0.072	251452.9
0.144	126576
0.288	87074.38
0.576	69872.12
1.152	37166.03
2.304	25856.98
4.608	15105.37

Table 167 Rheological Data of 20 wt% Solospheres thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
0.9	50698.73
1.8	29223.15
3.6	17873.71
7.2	11655.3
14.4	5734.203
28.8	2858.606
57.6	1459.036
115.2	792.1697
0.09	260968.1
0.18	113493.8
0.36	59805.14
0.72	33980.24
1.44	23446.42
2.88	14186.8
5.76	13570.94
11.52	6859.805
23.04	3435.212
46.08	1770.701
0.009	1930070

0.018	985423.3
0.036	479119.4
0.072	232763.6
0.144	110435.2
0.288	53093.82
0.576	26334.53
1.152	25272.84
2.304	18529.92
4.608	12264.81
0.9	47164.76
1.8	27048.39
3.6	15053.32
7.2	8308.214
14.4	4400.466
28.8	2493.315
57.6	1267.895
115.2	576.6056
230.4	322.8143
460.8	167.513
0.09	172618.7
0.18	93785.06
0.36	54708.06
0.72	41965.67
1.44	26334.77
2.88	17797.24
5.76	10958.69
11.52	5447.488
23.04	2744.982
46.08	1176.041
0.009	1671818
0.018	808724.4
0.036	390770
0.072	198783.1
0.144	104488.6
0.288	54368.09
0.576	29307.83
1.152	18476.73
2.304	16034.47
4.608	13459.44

Table 168 Rheological Data of 25 wt% Solospheres thickened by 3.5 wt% CNC

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
0.9	42271.56
1.8	23990.14
3.6	16888.27

7.2	11570.35
14.4	6192.94
28.8	3291.858
57.6	1754.242
115.2	983.3103
0.09	241939
0.18	142037.4
0.36	77475.03
0.72	39926.83
1.44	29732.83
2.88	15461.07
5.76	14208.08
11.52	7263.324
23.04	3764.398
46.08	2009.626
0.009	2229099
0.018	1128142
0.036	557274.7
0.072	336404.3
0.144	173299.2
0.288	103215.1
0.576	54793.25
1.152	32387.52
2.304	16246.85
4.608	13459.44
0.9	41320.1
1.8	20931.89
3.6	11451.38
7.2	9888.31
14.4	5165.028
28.8	2616.495
57.6	1399.57
115.2	750.7559
0.09	188929.3
0.18	97862.72
0.36	54708.06
0.72	34999.65
1.44	23956.13
2.88	13677.09
5.76	14271.79
11.52	6859.805
23.04	3663.519
46.08	1781.319
0.009	1821332
0.018	924258.3
0.036	404362.2

0.072	197084
0.144	118080.8
0.288	90047.67
0.576	43112.43
1.152	25697.6
2.304	14388.54
4.608	14255.86

Table 169 Rheological Data of 25 wt% Extendosphere thickened by 1 wt% CNC with pH 5.1

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1282.063
3.06414	673.326
51.069	208.9771
102.138	115.1457
153.207	79.34739
306.414	41.28842
5.1069	830.2835
10.2138	531.4021
170.23	67.92484
340.46	44.1352
510.69	33.68635
1021.38	20.13722
5.1069	1417.173
10.2138	708.5864
170.23	91.57822
340.46	51.92199
510.69	38.70324
1021.38	21.39592
2.34	1323.509
4.68	719.3231
9.36	388.4458
18.72	223.0072
37.44	166.6735
74.88	90.53283
149.76	53.06216
299.52	31.6283
599.04	28.5572
1.872	1030.726
3.744	707.2585
7.488	557.518
14.976	482.6478
29.952	247.3206
59.904	165.6374
119.808	69.32606
1.4976	1348.375

2.9952	1093.959
5.9904	651.9221
11.9808	400.9201
2.34	2551.639
4.68	1870.695
9.36	1088.864
18.72	769.9088
37.44	389.7518
74.88	190.0785
149.76	91.44122
299.52	49.61848
599.04	28.10744
1198.08	30.99448
0.234	38949.06
0.468	21009.69
0.936	11080.53
1.872	3765.235
3.744	2266.408
7.488	1253.138
14.976	740.5071
29.952	451.2094
59.904	206.1153
119.808	107.5552
0.0234	508465.7
0.0468	202421.1
0.0936	98332.13
0.1872	46287.63
0.3744	18106.57
0.7488	7374.199
1.4976	3747.067
2.9952	2743.059
5.9904	1656.374
11.9808	850.6747

Table 170 Rheological Data of 25 wt% Extendosphere thickened by 1 wt% CNC with pH 6.28

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1217.474
3.06414	673.326
51.069	218.6654
102.138	117.0834
153.207	83.22273
306.414	45.16377
5.1069	985.2973
10.2138	541.0905

170.23	63.85572
340.46	47.33236
510.69	34.65518
1021.38	19.6528
5.1069	1417.173
10.2138	708.5864
170.23	91.57822
340.46	51.92199
510.69	38.70324
1021.38	21.39592
2.34	1285.13
4.68	700.1335
9.36	378.8511
18.72	227.8046
37.44	169.0722
74.88	102.5263
149.76	56.06052
299.52	31.02863
599.04	32.15523
3.744	683.2716
7.488	605.4919
14.976	506.6347
29.952	259.3141
59.904	155.1431
119.808	84.31788
1.4976	1348.375
2.9952	1093.959
5.9904	636.9303
11.9808	430.9038
2.34	1285.13
4.68	738.5126
9.36	388.4458
18.72	242.1967
37.44	173.8696
74.88	101.3269
149.76	53.66183
299.52	34.02699
599.04	27.35785
1198.08	30.99448
1.872	1078.7
3.744	707.2585
7.488	605.4919
14.976	338.7263
29.952	232.3288
59.904	159.6407
119.808	93.31298

1.4976	1348.375
2.9952	824.1059
5.9904	502.0039
11.9808	400.9201

Table 171 Rheological Data of 25 wt% Extendosphere thickened by 1 wt% CNC with pH 7.02

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1217.474
3.06414	673.326
51.069	207.0394
102.138	119.0211
153.207	87.74397
306.414	49.03911
5.1069	985.2973
10.2138	512.0254
170.23	67.34354
340.46	49.07626
510.69	36.59285
1021.38	20.13722
5.1069	1008.314
10.2138	708.5864
170.23	79.31246
340.46	51.92199
510.69	38.70324
1021.38	23.44021
2.34	1208.372
4.68	584.9964
9.36	350.0668
18.72	232.602
37.44	173.8696
74.88	102.5263
149.76	57.85954
299.52	31.6283
599.04	33.65442
7.488	629.4788
14.976	620.5725
29.952	340.2699
59.904	123.6603
119.808	58.0822
1.50	1288.408
3.00	944.0405
5.99	741.873
11.98	438.3997
2.34	1285.13

4.68	738.5126
9.36	388.4458
18.72	242.1967
37.44	173.8696
74.88	101.3269
149.76	53.66183
299.52	34.02699
599.04	27.35785
1198.08	30.99448
1.872	1078.7
3.744	707.2585
7.488	605.4919
14.976	338.7263
29.952	232.3288
59.904	159.6407
119.808	93.31298
1.4976	1348.375
2.9952	824.1059
5.9904	502.0039
11.9808	400.9201

Table 173 Rheological Data of 25 wt% Extendosphere thickened by 1 wt% CNC with pH 8.3

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1282.063
3.06414	705.6205
51.069	208.9771
102.138	121.9276
153.207	89.68164
306.414	48.39322
5.1069	965.9206
10.2138	512.0254
170.23	88.8517
340.46	47.33236
510.69	37.94923
1021.38	21.00917
5.1069	1008.314
10.2138	708.5864
170.23	79.31246
340.46	51.92199
510.69	38.70324
1021.38	23.44021
2.34	1285.13
4.68	431.4801
9.36	378.8511
18.72	251.7915

37.44	205.0526
74.88	110.9217
149.76	57.85954
299.52	31.02863
599.04	27.65769
7.488	953.3021
14.976	746.5038
29.952	196.3484
59.904	135.6538
119.808	70.07565
1.4976	1468.31
2.9952	974.0241
5.9904	936.7667
11.9808	663.277
2.34	1899.195
4.68	1007.166
9.36	359.6615
18.72	189.4255
37.44	185.863
74.88	106.1243
149.76	55.46085
299.52	36.72552
599.04	26.45834
1198.08	29.94505
1.872	1174.648
3.744	779.2193
7.488	533.5311
14.976	374.7067
29.952	250.319
59.904	152.1448
119.808	85.06747
1.4976	1348.375
2.9952	824.1059
5.9904	502.0039
11.9808	400.9201

Table 174 Rheological Data of 25 wt% Extendosphere thickened by 1 wt% CNC with pH 9.01

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	100.467
102.138	106.426
153.207	86.45206
306.414	49.36199
5.1069	946.54
10.2138	502.3351

170.23	64.43691
340.46	40.93798
510.69	34.65514
1021.38	20.1372
5.1069	1008.314
10.2138	708.5864
170.23	91.57822
340.46	51.92199
510.69	38.70324
1021.38	21.39592
2.34	2436.502
4.68	1352.578
9.36	877.7788
18.72	525.2423
37.44	310.595
74.88	160.0949
149.76	76.4494
299.52	43.32192
599.04	27.05801
0.234	25516.39
0.468	11990.61
0.936	6187.202
1.872	3381.444
3.744	1570.787
7.488	929.3152
14.976	632.566
29.952	349.265
59.904	180.6292
119.808	88.81543
0.0234	416355.9
0.0468	171717.9
0.0936	86818.41
0.1872	45328.16
0.3744	18346.43
0.7488	9652.955
1.4976	4946.412
2.9952	2413.239
5.9904	1446.489
11.9808	753.2279
2.34	2513.26
4.68	1467.715
9.36	868.1841
18.72	625.9873
37.44	329.7845
74.88	156.4968
149.76	79.44776

299.52	40.92323
599.04	26.00859
0.234	23213.65
0.468	12566.3
0.936	6570.993
1.872	3237.522
3.744	1690.722
7.488	1013.269
14.976	662.5496
29.952	343.2683
59.904	164.1382
119.808	90.31461
0.0234	335759.9
0.0468	173636.8
0.0936	92575.27
0.1872	51085.02
0.3744	20745.13
0.7488	9173.217
1.4976	4166.838
2.9952	2143.386
5.9904	1206.619
11.9808	693.2606

Table 175 Rheological Data of 25 wt% Extendosphere thickened by 1 wt% CNC with pH 10.18

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	181.8493
102.138	97.70649
153.207	66.42944
306.414	41.28835
5.1069	869.0331
10.2138	550.7769
170.23	55.71738
340.46	34.54366
510.69	28.26082
1021.38	18.87771
5.1069	1008.314
10.2138	708.5864
170.23	67.0467
340.46	39.65623
510.69	30.52607
1021.38	23.44021
2.34	2781.913
4.68	1678.8
9.36	839.3998

18.72	366.9287
37.44	185.863
74.88	100.1276
149.76	52.46249
299.52	30.42895
599.04	20.76145
0.234	22829.85
0.468	13333.88
0.936	6858.835
1.872	4101.051
3.744	2170.46
7.488	1109.217
14.976	500.638
29.952	289.2977
59.904	134.1546
0.0234	212946.9
0.0468	102635.6
0.0936	54196.21
0.1872	29017.06
0.3744	14268.66
0.7488	8453.61
1.4976	4706.543
2.9952	2263.321
5.9904	1311.562
11.9808	745.732
2.34	2705.155
4.68	1582.852
9.36	868.1841
18.72	419.6999
37.44	209.8499
74.88	108.523
149.76	62.65692
299.52	37.62503
599.04	24.50941
0.234	9013.393
0.468	8536.498
0.936	4843.935
1.872	2709.81
3.744	1426.866
7.488	785.3937
14.976	398.6936
29.952	202.3452
59.904	117.6636
119.808	69.32606
0.0936	18695.58
0.1872	13185.69

0.3744	8991.538
0.7488	5695.115
1.4976	3267.328
2.9952	1783.582
5.9904	921.7748
11.9808	543.3424

Table 11616 Rheological Data of 25 wt% Extendosphere thickened by 1 wt% CNC with pH 11.1

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53	1282.05
3.06	705.614
51.07	193.4753
102.14	115.1455
153.21	70.95067
306.41	41.6113
5.11	965.9167
10.21	502.3351
170.23	65.59951
340.46	37.74082
510.69	29.03589
1021.38	18.58706
170.23	67.0467
340.46	39.65623
510.69	30.52607
1021.38	19.35162
2.34	2666.776
4.68	1774.747
9.36	1021.7
18.72	496.458
37.44	260.2225
74.88	121.7158
149.76	67.45431
299.52	40.02372
599.04	25.55883
0.234	17456.79
0.468	10071.66
0.936	5995.307
1.872	3621.313
3.744	1930.591
7.488	989.2825
14.976	536.6183
29.952	289.2977
59.904	156.6423
0.0468	70013.35

0.0936	55155.68
0.1872	32854.96
0.3744	18106.57
0.7488	9652.955
1.4976	5066.347
2.9952	2773.043
5.9904	1446.489
11.9808	805.6993
2.34	2590.018
4.68	1582.852
9.36	1079.269
18.72	496.458
37.44	245.8303
74.88	119.3171
149.76	66.25496
299.52	37.92486
599.04	25.40891
0.234	16305.41
0.468	11990.61
0.936	6283.15
1.872	3429.418
3.744	2026.539
7.488	1025.263
14.976	518.6281
29.952	262.3124
59.904	147.6472
119.808	79.82034
0.0468	114149.3
0.0936	65709.93
0.1872	36692.87
0.3744	18346.43
0.7488	9413.086
1.4976	4706.543
2.9952	2533.173
5.9904	1626.39
11.9808	760.7238

Table 16277 Rheological Data of 25 wt% Solosphere thickened by 1 wt% CNC with pH 3.24

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	571.5829
3.06414	318.086
51.069	55.90094
102.138	31.82581
153.207	27.03023
306.414	21.58875

5.1069	287.7352
10.2138	211.6862
170.23	23.7459
340.46	18.84857
510.69	14.30962
1021.38	10.64262
170.23	30.24943
340.46	15.12471
510.69	18.26031
1021.38	13.21874
4.68	354.722
9.36	206.1453
18.72	74.28835
37.44	94.71277
74.88	48.55573
149.76	24.87754
299.52	12.73861
599.04	8.917912
14.976	194.8048
29.952	70.41713
59.904	51.69957
119.808	31.09692
37.44	89.91538
74.88	38.96096
149.76	24.27786
299.52	15.1373
599.04	12.36603
59.904	36.70775
119.808	16.85469

Table 178 Rheological Data of 25 wt% Solosphere thickened by 1 wt% CNC with pH 4.44

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	571.5829
3.06414	285.7914
51.069	36.52421
102.138	26.98163
153.207	28.32201
306.414	13.83806
5.1069	248.9818
10.2138	221.3745
170.23	24.90851
340.46	20.01118
510.69	16.63483
1021.38	10.64262
170.23	30.24943

340.46	21.25759
510.69	18.26031
1021.38	11.17445
18.72	151.0465
37.44	80.32062
74.88	43.75835
149.76	23.67819
299.52	12.73861
599.04	12.36603
3.744	443.4025
7.488	209.7078
14.976	182.8114
29.952	109.3959
59.904	57.6963
119.808	30.34733
37.44	87.51669
74.88	38.96096
149.76	26.07688
299.52	15.1373
599.04	11.61644
59.904	33.70939
119.808	19.10347

Table 179 Rheological Data of 25 wt% Solosphere thickened by 1 wt% CNC with pH 5.12

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	506.9938
3.06414	318.086
51.069	38.46188
102.138	30.85698
153.207	27.03023
306.414	24.49526
5.1069	268.3585
10.2138	250.4396
170.23	28.39632
340.46	20.01118
510.69	15.47222
1021.38	10.1582
170.23	30.24943
340.46	15.12471
510.69	22.3489
1021.38	11.17445
9.36	215.7401
18.72	131.8569
37.44	70.72585
74.88	48.55573

149.76	27.8759
299.52	13.33828
599.04	11.61644
7.488	233.6947
14.976	170.8179
29.952	106.3975
59.904	59.19548
119.808	32.5961
37.44	87.51669
74.88	36.56227
149.76	19.48048
299.52	14.53762
599.04	13.71529
59.904	32.2102
119.808	16.85469

Table 180 Rheological Data of 25 wt% Solosphere thickened by 1 wt% CNC with pH 6.48

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	571.5829
3.06414	318.086
51.069	50.08792
102.138	28.91931
153.207	26.38434
306.414	17.39046
5.1069	287.7352
10.2138	250.4396
170.23	27.23371
340.46	19.42987
510.69	15.47222
1021.38	10.54574
170.23	30.24943
340.46	15.12471
510.69	18.26031
1021.38	11.17445
9.36	215.7401
18.72	117.4648
37.44	77.92193
74.88	42.559
149.76	28.47557
299.52	14.53762
599.04	14.01513
7.488	233.6947
14.976	140.8343
29.952	79.41223
59.904	59.19548

119.808	35.59447
18.72	88.6805
37.44	49.13763
74.88	42.559
149.76	24.27786
299.52	13.93795
599.04	12.36603
59.904	38.20693
119.808	19.10347

Table 181 Rheological Data of 25 wt% Solosphere thickened by 1 wt% CNC with pH 7.05

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	571.5829
3.06414	318.086
51.069	42.33723
102.138	28.91931
153.207	29.61379
306.414	22.55759
5.1069	307.1119
10.2138	289.1931
170.23	28.39632
340.46	20.30183
510.69	15.85976
1021.38	10.35197
170.23	30.24943
340.46	21.25759
510.69	18.26031
1021.38	11.17445
18.72	122.2622
37.44	87.51669
74.88	48.55573
149.76	25.47721
299.52	14.23779
599.04	8.018403
14.976	194.8048
29.952	82.41059
59.904	51.69957
119.808	31.09692
37.44	58.7324
74.88	43.75835
149.76	26.07688
299.52	13.03844
599.04	11.01677
59.904	36.70775
119.808	19.10347

Table 182 Rheological Data of 25 wt% Solosphere thickened by 1 wt% CNC with pH 8.37

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	636.172
3.06414	350.3805
51.069	42.33723
102.138	26.0128
153.207	32.19735
306.414	22.55759
5.1069	268.3585
10.2138	260.128
170.23	27.81501
340.46	22.04573
510.69	15.08469
1021.38	10.35197
170.23	30.24943
340.46	15.12471
510.69	18.26031
1021.38	13.21874
18.72	117.4648
37.44	80.32062
74.88	50.95442
149.76	34.4723
299.52	19.03517
599.04	12.36603
7.488	269.6751
14.976	236.7819
29.952	73.4155
59.904	65.19221
119.808	43.09038
37.44	89.91538
74.88	42.559
149.76	24.27786
299.52	14.53762
599.04	11.91628
59.904	32.2102
119.808	16.85469

Table 183 Rheological Data of 25 wt% Solosphere thickened by 1 wt% CNC with pH 9.32

Shear Rate (s^{-1})	Viscosity (mPa.s)
1.53207	506.9938
3.06414	318.086
51.069	44.2749

102.138	26.98163
153.207	30.25968
306.414	21.58875
5.1069	287.7352
10.2138	250.4396
170.23	27.81501
340.46	20.01118
510.69	15.47222
1021.38	10.64262
170.23	30.24943
340.46	15.12471
510.69	18.26031
1021.38	11.17445
4.68	354.722
9.36	206.1453
18.72	146.2491
37.44	80.32062
74.88	48.55573
149.76	24.87754
299.52	12.73861
599.04	12.36603
7.488	245.6882
14.976	194.8048
29.952	82.41059
59.904	51.69957
119.808	31.09692
37.44	89.91538
74.88	38.96096
149.76	24.27786
299.52	15.1373
599.04	12.36603
59.904	36.70775
119.808	19.10347
2.9952	494.2859
5.9904	262.1347
11.9808	138.5633

Table 184 Rheological Data of 25 wt% Solosphere thickened by 1 wt% CNC with pH 10.01

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	571.5829
3.06414	285.7914
51.069	52.02559
102.138	29.88814
153.207	27.67612
306.414	22.55759

5.1069	268.3585
10.2138	260.128
170.23	28.97762
340.46	20.30183
510.69	15.66599
1021.38	9.480017
340.46	21.25759
510.69	22.3489
1021.38	11.17445
4.68	335.5325
9.36	225.3348
18.72	136.6543
37.44	80.32062
74.88	40.16031
149.76	24.87754
299.52	14.53762
599.04	11.91628
3.744	419.4156
7.488	245.6882
14.976	206.7983
29.952	121.3893
59.904	57.6963
119.808	33.34569
5.9904	262.1347
11.9808	146.0592
9.36	167.7662
18.72	117.4648
37.44	65.92847
74.88	38.96096
149.76	24.27786
299.52	14.83746
599.04	11.76636
29.952	58.42368
59.904	44.20366
119.808	29.59774
2.9952	494.2859
5.9904	262.1347
11.9808	138.5633

Table 185 Rheological Data of 1.5 wt% CNC with 0% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	7.458732
102.138	6.635875

153.207	6.361589
306.414	5.441413
170.23	5.72543
340.46	5.187922
510.69	4.621218
1021.38	4.054514

Table 186 Rheological Data of 1.5 wt% CNC with 0.15% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	506.9808
3.06414	350.374
51.069	52.0252
102.138	30.85678
153.207	23.80064
306.414	15.45272
5.1069	171.471
10.2138	153.554
170.23	22.58318
340.46	14.7794
510.69	11.59684
1021.38	8.22051
170.23	30.24943
340.46	21.25759
510.69	14.17173
1021.38	9.130157
4.68	565.8068
9.36	340.472
18.72	189.4255
37.44	97.11146
74.88	50.95442
149.76	27.8759
299.52	16.93631
599.04	10.56701
1.872	1078.7
3.744	659.2847
7.488	341.6358
14.976	188.8081
29.952	97.40241
59.904	59.19548
119.808	33.34569
0.3744	5633.371
0.7488	3296.424
1.4976	1828.114
2.9952	1033.991
5.9904	546.9793

11.9808	303.4733
2.34	1208.372
4.68	680.944
9.36	359.6615
18.72	194.2229
37.44	104.3075
74.88	56.95115
149.76	30.27459
299.52	18.4355
599.04	11.61644
1.872	1030.726
3.744	587.324
7.488	329.6424
14.976	182.8114
29.952	100.4008
59.904	59.19548
119.808	34.84488
0.0468	45066.97
0.0936	26371.39
0.1872	15104.65
0.3744	7792.193
0.7488	4016.031
1.4976	2187.917
2.9952	1153.926
5.9904	621.9384
11.9808	318.4651

Table 187 Rheological Data of 1.5 wt% CNC with 0.25% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1411.228
3.06414	737.9085
51.069	143.0958
102.138	75.42325
153.207	52.86573
306.414	28.04759
5.1069	675.2658
10.2138	453.8933
170.23	45.83525
340.46	26.69609
510.69	18.37869
1021.38	11.32079
5.1069	1008.314
10.2138	708.5864
170.23	54.78094
340.46	27.39047
510.69	22.3489

1021.38	11.17445
2.34	1784.058
4.68	911.2184
9.36	522.7725
18.72	333.347
37.44	224.2421
74.88	140.9053
149.76	59.65856
299.52	31.02863
599.04	17.61317
0.234	18224.37
0.468	11031.14
0.936	4460.144
1.872	2565.889
3.744	1258.958
7.488	725.4264
14.976	410.687
29.952	289.2977
59.904	143.1497
119.808	75.32279
0.0234	220622.7
0.0468	102635.6
0.0936	53236.73
0.1872	27098.1
0.3744	13788.92
0.7488	6054.919
1.4976	3327.296
2.9952	1873.533
5.9904	696.8975
11.9808	505.8629
2.34	1592.162
4.68	968.787
9.36	474.7987
18.72	357.3339
37.44	243.4316
74.88	118.1178
149.76	61.45758
299.52	32.52781
599.04	18.6626
0.234	15921.62
0.468	10071.66
0.936	4460.144
1.872	2421.967
3.744	1210.984
7.488	689.446
14.976	356.7165

29.952	310.2863
59.904	155.1431
119.808	81.31952
0.0234	224460.6
0.0468	100716.6
0.0936	44601.44
0.1872	21341.24
0.3744	11150.36
0.7488	4975.507
1.4976	3087.427
2.9952	1753.599
5.9904	876.7994
11.9808	385.9283

Table 188 Rheological Data of 1.5 wt% CNC with 0.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1152.872
3.06414	608.7303
51.069	160.5349
102.138	109.3325
153.207	142.6446
306.414	77.45824
5.1069	888.4098
10.2138	424.8282
170.23	49.32306
340.46	28.43999
510.69	21.09144
1021.38	21.78422
5.1069	1008.314
10.2138	708.5864
170.23	116.1097
340.46	70.32063
510.69	59.14617
1021.38	31.61738
2.34	1323.509
4.68	738.5126
9.36	350.0668
18.72	338.1444
37.44	178.667
74.88	187.6798
149.76	111.2304
299.52	67.30883
599.04	39.35131
0.234	15154.04
0.468	8152.707

0.936	4939.882
1.872	2901.706
3.744	1019.088
7.488	341.6358
14.976	332.7296
29.952	178.3582
59.904	143.1497
119.808	136.7893
0.0234	527655.2
0.0468	198583.2
0.0936	87777.88
0.1872	26618.37
0.3744	12349.71
0.7488	6534.657
1.4976	3507.198
2.9952	1033.991
5.9904	412.053
11.9808	415.912
2.34	1246.751
4.68	757.7021
9.36	493.9882
18.72	328.5496
37.44	181.0657
74.88	101.3269
149.76	59.65856
299.52	38.2247
599.04	28.5572
0.234	11316.14
0.468	5466.173
0.936	4172.301
1.872	2230.072
3.744	1498.827
7.488	533.5311
14.976	338.7263
29.952	205.3435
59.904	170.1349
119.808	116.5503
0.0234	477762.4
0.0468	221610.6
0.0936	102170
0.1872	44848.42
0.3744	10910.49
0.7488	5335.311
1.4976	2607.688
2.9952	1273.861
5.9904	711.8894

11.9808	438.3997

Table 189 Rheological Data of 1.5 wt% CNC with 1% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	829.9262
3.06414	479.5522
51.069	83.02796
102.138	58.95303
153.207	51.57395
306.414	35.79828
5.1069	365.2382
10.2138	211.6842
170.23	49.90436
340.46	37.45017
510.69	25.74185
1021.38	27.40347
5.1069	1008.314
10.2138	504.1571
170.23	67.0467
340.46	39.65623
510.69	30.52607
1021.38	19.35162
2.34	939.7184
4.68	623.3754
9.36	493.9882
18.72	347.7392
37.44	205.0526
74.88	85.73544
149.76	50.66347
299.52	36.42568
599.04	28.5572
0.234	9780.974
0.468	4890.487
0.936	2445.244
1.872	1222.622
3.744	611.3109
7.488	617.4853
14.976	344.723
29.952	229.3304
59.904	125.1595
119.808	64.07893
0.0234	128513
0.0468	70013.35
0.0936	28290.34

0.1872	15104.65
0.3744	5873.24
0.7488	3056.554
1.4976	1648.212
2.9952	824.1059
5.9904	412.053
11.9808	273.4897
2.34	939.7184
4.68	469.8592
9.36	234.9296
18.72	208.6151
37.44	140.2879
74.88	74.94133
149.76	39.26968
299.52	25.33173
599.04	24.35949
0.234	9780.974
0.468	5274.278
0.936	2637.139
1.872	1558.439
3.744	731.2455
7.488	569.5115
14.976	326.7328
29.952	205.3435
59.904	104.1709
119.808	52.08547
0.0234	151540.4
0.0468	75770.21
0.0936	29249.82
0.1872	13665.43
0.3744	6113.109
0.7488	2696.751
1.4976	1648.212
2.9952	764.1386
5.9904	307.1102
11.9808	265.9938

Table 190 Rheological Data of 1.5 wt% CNC with 1.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	829.9262
3.06414	414.9631
51.069	55.90055
102.138	36.6698
153.207	28.96777

306.414	37.73596
5.1069	403.9917
10.2138	231.0609
170.23	37.69703
340.46	24.08023
510.69	21.2852
1021.38	27.69412
5.1069	1008.314
10.2138	504.1571
170.23	79.31246
340.46	51.92199
510.69	38.70324
1021.38	21.39592
2.34	978.0974
4.68	316.3429
9.36	282.9034
18.72	242.1967
37.44	149.8827
74.88	85.73544
149.76	47.6651
299.52	34.62666
599.04	29.15687
0.234	11699.93
0.468	5274.278
0.936	2637.139
1.872	1366.543
3.744	491.3763
7.488	461.5704
14.976	338.7263
29.952	223.3337
59.904	116.1644
119.808	61.08056
0.0234	170730
0.0468	68094.4
0.0936	26371.39
0.1872	11266.74
0.3744	5633.371
0.7488	3176.489
1.4976	1468.31
2.9952	584.2368
5.9904	262.1347
11.9808	198.5306
4.68	412.2906
9.36	254.1191
18.72	160.6412
37.44	87.51669

74.88	48.55573
149.76	31.47394
299.52	21.13402
599.04	26.75818
0.234	10932.35
0.468	5849.964
0.936	2637.139
1.872	1510.465
3.744	875.1669
7.488	449.5769
14.976	248.7754
29.952	148.3746
59.904	80.18403
119.808	47.58792
0.02	147702.5
0.05	66175.45
0.09	27330.87
0.19	12705.96
0.37	5633.371
0.75	2696.751
1.50	1348.375
3.00	734.155
5.99	442.0366
11.98	251.0019

Table 191 Rheological Data of 1.5 wt% CNC with 2% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	894.5153
3.06414	447.2576
51.069	96.59167
102.138	76.39209
153.207	59.32464
306.414	50.00788
5.1069	481.4986
10.2138	386.0747
170.23	55.71738
340.46	30.47455
510.69	25.74185
1021.38	23.14059
5.1069	1008.314
10.2138	504.1571
170.23	54.78094
340.46	33.52335
510.69	26.43749

1021.38	21.39592
2.34	1093.235
4.68	815.2707
9.36	465.204
18.72	419.6999
37.44	241.0329
74.88	131.3106
149.76	77.04907
299.52	53.21652
599.04	36.95262
0.234	12083.72
0.468	6233.754
0.936	3500.668
1.872	2038.177
3.744	707.2585
7.488	629.4788
14.976	392.6968
29.952	247.3206
59.904	105.6701
119.808	62.57974
0.0234	132350.9
0.0468	60418.59
0.0936	24452.44
0.1872	11746.48
0.3744	5873.24
0.7488	3056.554
1.4976	1468.31
2.9952	704.1713
5.9904	277.1266
11.9808	176.0428
9.36	215.7401
18.72	266.1837
37.44	133.0918
74.88	71.3433
149.76	42.86772
299.52	35.22634
599.04	33.35458
0.234	10932.35
0.468	5849.964
0.936	2829.034
1.872	1462.491
3.744	731.2455
7.488	677.4526
14.976	482.6478
29.952	238.3255
59.904	119.1628

119.808	65.57811
0.0234	151540.4
0.0468	66175.45
0.0936	32128.25
0.1872	13665.43
0.3744	6592.847
0.7488	3536.293
1.4976	1648.212
2.9952	704.1713
5.9904	382.0693
11.9808	258.4978

Table 192 Rheological Data of 12 wt% Extendosphere thickened by 1.5 wt% CNC with 0% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1152.885
3.06414	737.915
51.069	67.52697
102.138	41.51418
153.207	30.25968
306.414	19.97402
5.1069	113.3447
10.2138	95.4258
170.23	25.48981
340.46	18.26727
510.69	15.27846
1021.38	10.7395
170.23	30.24943
340.46	21.25759
510.69	18.26031
1021.38	11.17445
18.72	112.6674
37.44	68.32716
74.88	42.559
149.76	26.67656
299.52	18.13566
599.04	12.21611
59.904	33.70939
119.808	23.60101
37.44	44.34025
74.88	29.3662
149.76	20.67983
299.52	15.73697
599.04	11.91628
29.952	49.42859

59.904	35.20857
119.808	24.3506

Table 193 Rheological Data of 12 wt% Extendosphere thickened by 1.5 wt% CNC with 0.15% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	3025.968
3.06414	1609.868
51.069	214.7901
102.138	110.3016
153.207	77.40971
306.414	42.5802
5.1069	927.1672
10.2138	492.6487
170.23	71.41265
340.46	38.03153
510.69	27.48579
1021.38	15.4868
5.1069	1008.314
10.2138	504.1571
170.23	79.31246
340.46	39.65623
510.69	34.61466
1021.38	19.35162
2.34	2858.671
4.68	1237.44
9.36	570.7464
18.72	386.1182
37.44	281.8107
74.88	174.487
149.76	83.0458
299.52	38.82437
599.04	22.8603
0.234	14770.25
0.468	7768.917
0.936	5131.778
1.872	2757.784
3.744	995.1015
7.488	653.4657
14.976	416.6838
29.952	295.2944
59.904	207.6145
119.808	93.31298
0.0234	358787.4

0.0468	102635.6
0.0936	43641.97
0.1872	25658.89
0.3744	13549.05
0.7488	7254.264
1.4976	3807.034
2.9952	1483.746
5.9904	816.8321
11.9808	633.2934
2.34	2244.606
4.68	949.5974
9.36	724.2626
18.72	419.6999
37.44	279.412
74.88	150.5001
149.76	74.05071
299.52	38.82437
599.04	22.11071
0.234	15537.83
0.468	8728.393
0.936	4652.04
1.872	2565.889
3.744	1570.787
7.488	785.3937
14.976	494.6412
29.952	343.2683
59.904	203.117
119.808	92.56338
0.0234	305056.7
0.0468	144852.5
0.0936	61872.02
0.1872	30456.27
0.3744	15947.74
0.7488	8333.675
1.4976	4106.87
2.9952	1993.468
5.9904	1071.693
11.9808	625.7974

Table 194 Rheological Data of 12 wt% Extendosphere thickened by 1.5 wt% CNC with 0.25% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	307.7984
102.138	231.4061

153.207	123.268
306.414	91.34496
5.1069	1353.455
10.2138	831.7414
170.23	135.3558
340.46	78.14135
510.69	56.74465
5.1069	1008.314
10.2138	708.5864
170.23	152.907
340.46	82.58638
510.69	67.32335
1021.38	37.75026
2.34	3933.285
4.68	1659.61
9.36	762.6417
18.72	621.19
37.44	358.5688
74.88	223.6602
149.76	143.0131
299.52	102.0899
599.04	56.89174
1198.08	44.03736
0.234	26283.97
0.468	12566.3
0.936	7530.469
1.872	2757.784
3.744	2050.526
7.488	1205.165
14.976	638.5627
29.952	418.2274
59.904	266.0826
119.808	93.31298
0.0234	642792.4
0.0468	306044.6
0.0936	179887.6
0.1872	40530.77
0.3744	15468
0.7488	6774.526
1.4976	2907.525
2.9952	2413.239
5.9904	1356.538
11.9808	558.3343
2.34	2321.365
4.68	1199.061
9.36	541.9621

18.72	592.4057
37.44	310.595
74.88	168.4903
149.76	116.0278
299.52	80.50163
599.04	52.84395
1198.08	46.96077
0.234	42403.18
0.468	14677.15
0.936	7242.626
1.872	3765.235
3.744	2050.526
7.488	1193.171
14.976	614.5758
29.952	358.2601
59.904	215.1104
119.808	139.038
0.0234	638954.5
0.0468	330991
0.0936	165495.5
0.1872	80349.05
0.3744	19305.91
0.7488	9053.283
1.4976	4586.609
2.9952	2833.01
5.9904	1326.554
11.9808	888.1543

Table 195 Rheological Data of 12 wt% Extendosphere thickened by 1.5 wt% CNC with 0.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1152.885
3.06414	544.1478
51.069	208.9771
102.138	130.6471
153.207	155.5625
306.414	91.34496
5.1069	752.7766
10.2138	492.6487
170.23	135.3558
340.46	82.21047
5.1069	1008.314
10.2138	504.1571
170.23	116.1097

340.46	76.4535
510.69	50.969
1021.38	29.57309
2.34	978.0974
4.68	719.3231
9.36	234.9296
18.72	199.0203
37.44	312.9937
74.88	166.0916
149.76	104.0343
299.52	93.09476
599.04	59.74018
1198.08	43.43769
0.234	15921.62
0.468	8344.603
0.936	4747.987
1.872	2901.706
3.744	1786.67
7.488	917.3217
14.976	722.5169
29.952	484.1914
59.904	270.5801
119.808	148.0331
0.0234	516141.5
0.0468	225448.5
0.0936	98332.13
0.1872	23260.2
0.3744	11150.36
0.7488	4735.638
1.4976	2367.819
2.9952	1723.615
5.9904	1041.709
11.9808	513.3588
2.34	1438.646
4.68	719.3231
9.36	321.2825
18.72	318.9549
37.44	214.6473
74.88	181.6831
149.76	104.0343
299.52	77.8031
599.04	54.49305
1198.08	44.11232
0.234	24365.02
0.468	11414.93
0.936	5995.307

1.872	3429.418
3.744	1906.604
7.488	1001.276
14.976	530.6216
29.952	421.2257
59.904	296.0662
119.808	166.7729
0.0234	577548
0.0468	114149.3
0.0936	55155.68
0.1872	26618.37
0.3744	13069.31
0.7488	6294.788
1.4976	2967.492
2.9952	1363.811
5.9904	636.9303
11.9808	783.2116

Table 196 Rheological Data of 12 wt% Extendosphere thickened by 1.5 wt% CNC with 1% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	700.748
3.06414	318.0795
51.069	65.58891
102.138	37.63864
153.207	27.0301
306.414	39.35068
5.1069	248.9779
10.2138	134.1773
170.23	45.83525
340.46	28.14934
510.69	21.8665
1021.38	22.75305
170.23	79.31246
340.46	45.78911
510.69	38.70324
1021.38	23.44021
2.34	1361.888
4.68	623.3754
9.36	369.2563
18.72	208.6151
37.44	173.8696
74.88	102.5263
149.76	57.85954
299.52	37.62503

599.04	30.80597
0.234	8629.603
0.468	4314.801
0.936	2445.244
1.872	1414.517
3.744	899.1538
7.488	617.4853
14.976	338.7263
29.952	211.3402
59.904	144.6489
119.808	76.82197
0.0234	166892.1
0.0468	89202.88
0.0936	42682.49
0.1872	21341.24
0.3744	9231.408
0.7488	4016.031
1.4976	1768.146
2.9952	794.1223
5.9904	367.0775
11.9808	243.506
2.34	555.9278
4.68	258.7744
9.36	138.9819
18.72	122.2622
37.44	142.6866
74.88	72.54264
149.76	39.86936
299.52	26.23124
599.04	23.90973
0.234	10164.76
0.468	4890.487
0.936	2541.191
1.872	1462.491
3.744	1043.075
7.488	509.5442
14.976	290.7525
29.952	211.3402
59.904	135.6538
119.808	74.5732
0.0234	186081.6
0.0468	94959.74
0.0936	39804.06
0.1872	17983.08
0.3744	8271.931
0.7488	3896.096

1.4976	1888.081
2.9952	914.0568
5.9904	442.0366
11.9808	221.0183

Table 197 Rheological Data of 12 wt% Extendosphere thickened by 1.5 wt% CNC with 1.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1088.296
3.06414	576.4423
51.069	189.6003
102.138	132.5848
153.207	109.0584
306.414	83.91722
5.1069	520.2559
10.2138	279.5047
170.23	105.1282
340.46	65.64336
510.69	56.16335
170.23	91.57822
340.46	88.71926
510.69	71.41193
1021.38	37.75026
2.34	1477.025
4.68	642.565
9.36	609.1254
18.72	366.9287
37.44	296.2028
74.88	160.0949
149.76	100.4363
299.52	76.00409
599.04	55.24264
1198.08	35.34211
0.234	17073
0.468	8536.498
0.936	4364.197
1.872	2517.915
3.744	1906.604
7.488	917.3217
14.976	446.6674
29.952	391.2421
59.904	245.0941
119.808	131.5421
0.0234	259001.8
0.0468	127581.9

0.0936	63790.97
0.1872	30936.01
0.3744	13069.31
0.7488	5695.115
1.4976	2547.721
2.9952	1153.926
5.9904	591.9548
11.9808	273.4897
2.34	786.2021
4.68	508.2382
9.36	282.9034
18.72	242.1967
37.44	257.8238
74.88	140.9053
149.76	80.04744
299.52	61.3121
599.04	50.59517
1198.08	35.94178
0.234	21294.69
0.468	10647.35
0.936	5515.568
1.872	2997.653
3.744	1738.696
7.488	869.3479
14.976	548.6118
29.952	370.2535
59.904	245.0941
119.808	143.5356
0.0234	289705
0.0468	144852.5
0.0936	71466.78
0.1872	35253.65
0.3744	13788.92
0.7488	5335.311
1.4976	2367.819
2.9952	1033.991
5.9904	741.873
11.9808	415.912

Table 198 Rheological Data of 12 wt% Extendosphere thickened by 1.5 wt% CNC with 2% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1863.352
3.06414	1028.559

51.069	234.1664
102.138	130.6469
153.207	98.72398
306.414	81.97948
5.1069	675.2658
10.2138	357.0096
170.23	132.4492
170.23	116.1097
340.46	88.71926
510.69	63.23476
1021.38	35.70597
2.34	709.444
4.68	354.722
9.36	196.5505
18.72	256.5889
37.44	236.2356
74.88	197.2746
149.76	118.4265
299.52	77.8031
599.04	63.03838
0.234	14002.67
0.468	6425.65
0.936	2733.087
1.872	1174.648
3.744	563.3371
7.488	893.3348
14.976	380.7034
29.952	382.247
59.904	246.5932
119.808	148.7827
0.0234	285867.1
0.0468	141014.6
0.0936	70507.31
0.1872	35253.65
0.3744	13069.31
0.7488	3296.424
1.4976	1348.375
2.9952	584.2368
5.9904	307.1102
11.9808	445.8956
2.34	594.3068
4.68	316.3429
9.36	234.9296
18.72	261.3863
37.44	245.8303
74.88	215.2648

149.76	126.8219
299.52	79.60212
599.04	70.38438
1198.08	43.28777
0.234	14770.25
0.468	5658.068
0.936	2733.087
1.872	1174.648
3.744	779.2193
7.488	437.5835
14.976	446.6674
29.952	211.3402
59.904	198.6194
119.808	129.2933
0.0234	274353.4
0.0468	137176.7
0.0936	67628.88
0.1872	31895.49
0.3744	12109.84
0.7488	3056.554
1.4976	1108.506
2.9952	644.2041
5.9904	1026.718
11.9808	595.8138

Table 198 Rheological Data of 25 wt% Solosphere thickened by 1.5 wt% CNC with 0% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1346.639
3.06414	705.614
8.5115	881.8269
102.138	87.04929
153.207	69.65889
306.414	47.42432
5.1069	694.6425
10.2138	405.4514
170.23	72.57513
340.46	48.4949
510.69	35.81775
5.1069	1417.173
10.2138	708.5864
170.23	67.0467
340.46	58.05487
510.69	38.70324
1021.38	29.57309
2.34	1822.437

4.68	3022.067
9.36	465.204
18.72	347.7392
37.44	197.8565
74.88	98.92825
149.76	58.45921
299.52	47.21979
599.04	40.85049
1198.08	40.96404
0.234	11699.93
0.468	6425.65
0.936	4076.354
1.872	2613.863
3.744	851.18
7.488	677.4526
14.976	500.638
29.952	88.40732
59.904	93.67667
119.808	53.58465
0.0234	113161.4
0.0468	52742.78
0.0936	23492.96
0.1872	8868.05
0.3744	4434.025
0.7488	2336.947
1.4976	1228.441
2.9952	674.1877
5.9904	397.0611
11.9808	340.9529
2.34	2206.227
4.68	1026.356
9.36	484.3935
18.72	2516.156
37.44	185.863
74.88	116.9184
149.76	111.8301
299.52	59.21325
599.04	33.95425
1198.08	39.31494
0.234	20527.11
0.468	10455.45
0.936	5515.568
1.872	2086.151
3.744	2338.369
7.488	1049.25
14.976	944.3958

29.952	430.2208
59.904	111.6669
119.808	25.84978
0.0234	163054.1
0.0468	70013.35
0.0936	33087.72
0.1872	14145.17
0.3744	7072.585
0.7488	3416.358
1.4976	1528.277
2.9952	704.1713
5.9904	442.0366
11.9808	318.4651

Table 199 Rheological Data of 25 wt% Solosphere thickened by 1.5 wt% CNC with 0.15% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1669.597
3.06414	867.0932
51.069	125.6572
102.138	64.76625
153.207	45.11517
306.414	55.82096
5.1069	636.5163
10.2138	482.9603
170.23	60.94922
340.46	40.35674
510.69	27.09826
5.1069	1008.314
10.2138	504.1571
170.23	103.844
340.46	70.32063
510.69	59.14617
1021.38	37.75026
2.34	1899.195
4.68	1160.682
9.36	820.2103
18.72	434.092
37.44	181.0657
74.88	95.33021
149.76	58.45921
299.52	44.22143
599.04	43.84885
1198.08	45.23671

0.234	14386.46
0.468	8152.707
0.936	4843.935
1.872	3141.575
3.744	1642.748
7.488	1013.269
14.976	278.759
29.952	157.3697
59.904	90.6783
119.808	51.33588
0.0234	97809.74
0.0468	46985.92
0.0936	23492.96
0.1872	11746.48
0.3744	5873.24
0.7488	3056.554
1.4976	1588.245
2.9952	824.1059
5.9904	427.0448
11.9808	221.0183
2.34	901.3393
4.68	527.4278
9.36	330.8772
18.72	213.4124
37.44	113.9023
74.88	62.94788
149.76	46.46576
299.52	32.82764
599.04	40.85049
1198.08	39.68973
0.234	19375.74
0.468	11031.14
0.936	5995.307
1.872	3189.549
3.744	1738.696
7.488	881.3413
14.976	698.53
29.952	208.3419
59.904	104.1709
119.808	47.58792
0.0234	136188.8
0.0468	64256.5
0.0936	31168.77
0.1872	15584.39
0.3744	8032.062
0.7488	4135.966

1.4976	2247.885
2.9952	1183.91
5.9904	636.9303
11.9808	348.4488

Table 200 Rheological Data of 25 wt% Solosphere thickened by 1.5 wt% CNC with 0.25% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	146.9715
102.138	82.2053
153.207	61.26244
306.414	51.29973
5.1069	675.2697
10.2138	482.9603
170.23	65.59963
340.46	40.35674
510.69	27.09826
10.2138	504.1571
170.23	79.31246
340.46	45.78911
510.69	38.70324
1021.38	23.44021
2.34	1169.993
4.68	796.0812
9.36	474.7987
18.72	371.7261
37.44	200.2552
74.88	108.523
149.76	62.65692
299.52	46.62012
599.04	46.39746
1198.08	45.91134
0.234	13618.88
0.468	8152.707
0.936	6091.254
1.872	2949.679
3.744	1378.892
7.488	1073.237
14.976	578.5954
29.952	250.319
59.904	143.1497
119.808	76.07238
0.0234	136188.8
0.0468	62337.54

0.0936	26371.39
0.1872	13185.69
0.3744	7312.455
0.7488	3896.096
1.4976	2008.015
2.9952	914.0568
5.9904	606.9466
11.9808	415.912
2.34	1093.235
4.68	623.3754
9.36	455.6092
18.72	294.9679
37.44	142.6866
74.88	82.13741
149.76	54.26151
299.52	44.8211
599.04	44.29861
1198.08	44.78695
0.234	15154.04
0.468	8152.707
0.936	4460.144
1.872	2517.915
3.744	1426.866
7.488	881.3413
14.976	578.5954
29.952	250.319
59.904	108.6685
119.808	70.07565
0.0234	143864.6
0.0468	52742.78
0.0936	26371.39
0.1872	13185.69
0.3744	6832.716
0.7488	3536.293
1.4976	1768.146
2.9952	914.0568
5.9904	487.0121
11.9808	348.4488

Table 201 Rheological Data of 25 wt% Solosphere thickened by 1.5 wt% CNC with 0.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	636.172
3.06414	350.3805

51.069	135.3455
102.138	82.2053
153.207	60.61655
306.414	61.31104
5.1069	462.1258
10.2138	463.5836
170.23	76.06306
340.46	51.40147
510.69	39.8869
170.23	79.31246
340.46	51.92199
510.69	46.88042
1021.38	29.57309
9.36	186.9558
18.72	208.6151
37.44	106.7062
74.88	59.34984
149.76	35.07198
299.52	23.83255
599.04	26.15851
0.468	3739.115
0.936	2541.191
1.872	1654.386
3.744	971.1146
7.488	509.5442
14.976	326.7328
29.952	202.3452
59.904	104.1709
119.808	53.58465
0.0234	70944.4
0.0468	33553.25
0.0936	15817.15
0.1872	8388.312
0.3744	4434.025
0.7488	2696.751
1.4976	1408.343
2.9952	704.1713
5.9904	352.0857
11.9808	258.4978
4.68	354.722
9.36	234.9296
18.72	194.2229
37.44	99.51015
74.88	52.15377
149.76	30.27459
299.52	20.83419

599.04	21.06129
0.936	1869.558
1.872	1126.674
3.744	875.1669
7.488	413.5966
14.976	254.7721
29.952	106.3975
59.904	54.69793
119.808	36.34406
0.7488	2097.078
1.4976	1108.506
2.9952	614.2204
5.9904	352.0857
11.9808	213.5224

Table 202 Rheological Data of 25 wt% Solosphere thickened by 1.5 wt% CNC with 1% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	141.1585
102.138	81.23646
153.207	58.03299
306.414	46.45555
5.1069	481.5025
10.2138	482.9603
170.23	69.66874
340.46	45.58845
510.69	35.43025
5.1069	1008.314
10.2138	913.0157
170.23	91.57822
340.46	58.05487
510.69	42.79183
1021.38	29.57309
2.34	1016.476
4.68	719.3231
9.36	455.6092
18.72	376.5235
37.44	229.0395
74.88	119.3171
149.76	69.853
299.52	58.91341
599.04	47.59681
1198.08	36.0917
0.234	24365.02
0.468	12950.09
0.936	6954.783

1.872	3045.627
3.744	1570.787
7.488	941.3086
14.976	416.6838
29.952	313.2846
59.904	125.1595
119.808	73.07402
0.0234	109323.5
0.0468	54661.73
0.0936	27330.87
0.1872	11746.48
0.3744	5633.371
0.7488	2816.685
1.4976	1648.212
2.9952	1004.008
5.9904	472.0202
11.9808	258.4978
2.34	901.3393
4.68	489.0487
9.36	330.8772
18.72	294.9679
37.44	137.8892
74.88	77.34002
149.76	66.25496
299.52	57.11439
599.04	49.09599
1198.08	38.64031
0.234	16689.21
0.468	8344.603
0.936	4460.144
1.872	2853.732
3.744	1474.84
7.488	749.4133
14.976	740.5071
29.952	346.2666
59.904	200.1186
119.808	86.56666
0.0234	136188.8
0.0468	66175.45
0.0936	27330.87
0.1872	13185.69
0.3744	6592.847
0.7488	3416.358
1.4976	1948.048
2.9952	974.0241
5.9904	591.9548

11.9808	498.367

Table 203 Rheological Data of 25 wt% Solosphere thickened by 1.5 wt% CNC with 1.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	636.172
3.06414	447.2642
51.069	146.9715
102.138	72.51694
153.207	59.97066
306.414	43.22609
5.1069	520.2559
10.2138	415.1418
170.23	76.06306
340.46	46.16976
510.69	35.23648
5.1069	1008.314
10.2138	913.0157
170.23	91.57822
340.46	58.05487
510.69	46.88042
1021.38	31.61738
2.34	978.0974
4.68	776.8917
9.36	436.4197
18.72	179.8308
37.44	193.0591
74.88	114.5197
149.76	75.25005
299.52	63.71079
599.04	50.29534
1198.08	39.3899
0.234	9013.393
0.468	5274.278
0.936	2637.139
1.872	1126.674
3.744	851.18
7.488	713.433
14.976	536.6183
29.952	283.301
59.904	155.1431
119.808	95.56175
0.0234	93971.84
0.0468	48904.87
0.0936	24452.44

0.1872	13185.69
0.3744	5873.24
0.7488	3176.489
1.4976	1648.212
2.9952	1123.942
5.9904	636.9303
11.9808	258.4978
2.34	1361.888
4.68	642.565
9.36	311.6877
18.72	170.236
37.44	166.6735
74.88	89.33348
149.76	68.05398
299.52	57.41423
599.04	62.43871
1198.08	39.98957
0.234	12851.3
0.468	6233.754
0.936	3500.668
1.872	2134.124
3.744	1642.748
7.488	869.3479
14.976	800.4744
29.952	436.2175
59.904	185.1268
119.808	82.8187
0.0234	90133.93
0.0468	48904.87
0.0936	25411.91
0.1872	11746.48
0.3744	7072.585
0.7488	3896.096
1.4976	2247.885
2.9952	884.0732
5.9904	591.9548
11.9808	265.9938

Table 204 Rheological Data of 25 wt% Solosphere thickened by 1.5 wt% CNC with 2% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	894.5283
3.06414	576.4423
51.069	139.2209
102.138	70.57927

153.207	52.86586
306.414	49.03911
5.1069	597.7628
10.2138	327.9465
170.23	59.78661
340.46	39.19413
510.69	36.39909
5.1069	1008.314
10.2138	708.5864
170.23	79.31246
340.46	51.92199
510.69	42.79183
1021.38	25.4845
2.34	671.065
4.68	450.6697
9.36	292.4982
18.72	309.3601
37.44	181.0657
74.88	78.53937
149.76	52.46249
299.52	36.42568
599.04	33.95425
0.234	18224.37
0.468	9304.079
0.936	4652.04
1.872	2182.098
3.744	1330.918
7.488	773.4002
14.976	410.687
29.952	208.3419
59.904	87.67994
119.808	53.58465
0.0234	78620.21
0.0468	39310.11
0.0936	20614.53
0.1872	10787
0.3744	5633.371
0.7488	3416.358
1.4976	1588.245
2.9952	794.1223
5.9904	367.0775
11.9808	325.961
2.34	901.3393
4.68	412.2906
9.36	244.5244
18.72	189.4255

37.44	77.92193
74.88	50.95442
149.76	29.07525
299.52	22.63321
599.04	23.16014
0.234	15537.83
0.468	7768.917
0.936	3788.511
1.872	2038.177
3.744	1139.023
7.488	677.4526
14.976	518.6281
29.952	205.3435
59.904	108.6685
119.808	61.08056
0.0234	101647.6
0.0468	48904.87
0.0936	22533.48
0.1872	10307.26
0.3744	5873.24
0.7488	3056.554
1.4976	1528.277
2.9952	914.0568
5.9904	561.9712
11.9808	280.9856

Table 205 Rheological Data of 25 wt% Extendosphere thickened by 1.5 wt% CNC with 0% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	3994.791
3.06414	1965.101
51.069	259.3562
102.138	131.6158
153.207	90.3274
306.414	51.62261
5.1069	1760.362
10.2138	909.2463
170.23	86.52638
340.46	45.29774
510.69	34.07384
1021.38	20.52473
5.1069	1417.173
10.2138	913.0157
170.23	91.57822
340.46	51.92199

510.69	38.70324
1021.38	25.4845
2.34	2052.711
4.68	1870.695
9.36	1012.106
18.72	659.569
37.44	348.974
74.88	191.2779
149.76	101.036
299.52	51.71734
599.04	31.40564
0.234	22446.06
0.468	14869.04
0.936	7722.364
1.872	2661.837
3.744	1858.63
7.488	1169.184
14.976	800.4744
29.952	493.1865
59.904	273.5785
119.808	124.7958
0.0234	477762.4
0.0468	208178
0.0936	74345.21
0.1872	34294.18
0.3744	16667.35
0.7488	10612.43
1.4976	5606.052
2.9952	2563.157
5.9904	1206.619
11.9808	895.6502
2.34	2551.639
4.68	1870.695
9.36	1088.864
18.72	769.9088
37.44	389.7518
74.88	190.0785
149.76	91.44122
299.52	49.61848
599.04	28.10744
0.234	38949.06
0.468	21009.69
0.936	11080.53
1.872	3765.235
3.744	2266.408
7.488	1253.138

14.976	740.5071
29.952	451.2094
59.904	206.1153
119.808	107.5552
0.0234	508465.7
0.0468	202421.1
0.0936	98332.13
0.1872	46287.63
0.3744	18106.57
0.7488	7374.199
1.4976	3747.067
2.9952	2743.059
5.9904	1656.374
11.9808	850.6747

Table 206 Rheological Data of 25 wt% Extendosphere thickened by 1.5 wt% CNC with 0.15% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	2057.119
3.06414	1028.559
51.069	315.5487
102.138	193.6213
153.207	143.9363
306.414	93.60551
5.1069	1508.465
10.2138	763.9209
170.23	144.6566
10.2138	708.5864
170.23	116.1097
340.46	100.985
510.69	83.67769
1021.38	47.97172
2.34	3319.22
4.68	1083.924
9.36	810.6155
18.72	837.0722
37.44	488.0981
74.88	270.4347
149.76	169.3987
299.52	115.5825
599.04	62.73855
1198.08	26.42197
0.234	33959.78
0.468	17747.47
0.936	12711.64

1.872	5540.266
3.744	1546.8
7.488	1397.06
14.976	722.5169
29.952	580.139
59.904	353.0352
119.808	201.2541
0.0234	1183937
0.0468	593887.5
0.0936	216347.7
0.1872	62119
0.3744	21944.47
0.7488	9053.283
1.4976	4706.543
2.9952	1333.828
5.9904	726.8812
11.9808	535.8465
2.34	2666.776
4.68	1256.63
9.36	1050.485
18.72	765.1114
37.44	552.8628
74.88	284.8268
149.76	174.1961
299.52	103.8889
599.04	60.48977
1198.08	44.18728
0.234	35111.15
0.468	18515.05
0.936	10025.11
1.872	5780.135
3.744	2890.068
7.488	1337.093
14.976	644.5594
29.952	493.1865
59.904	423.4967
119.808	228.9889
0.0234	1279885
0.0468	647618.2
0.0936	153022.3
0.1872	70754.28
0.3744	32738.58
0.7488	15169.95
1.4976	2907.525
2.9952	1333.828
5.9904	1041.709

11.9808	325.961

Table 207 Rheological Data of 25 wt% Extendosphere thickened by 1.5 wt% CNC with 0.25% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
51.069	143.0958
102.138	113.2079
153.207	109.0582
306.414	87.14661
170.23	100.4776
340.46	70.29372
510.69	55.58201
10.21	708.5864
170.23	128.3755
340.46	94.85214
510.69	75.50052
1021.38	43.88314
2.34	1285.13
4.68	1007.166
9.36	628.315
18.72	539.6345
37.44	296.2028
74.88	212.8661
149.76	193.9853
299.52	129.0751
599.04	75.33168
1198.08	35.26715
0.234	23597.44
0.468	11606.82
0.936	6666.94
1.872	3477.392
3.744	2698.172
7.488	1013.269
14.976	632.566
29.952	619.1178
59.904	389.0155
119.808	199.0053
0.0234	481600.3
0.0468	217772.7
0.0936	110805.3
0.1872	49166.06
0.3744	22903.95
0.7488	10612.43
1.4976	4586.609

2.9952	1783.582
5.9904	1176.636
11.9808	835.6829

Table 208 Rheological Data of 25 wt% Extendosphere thickened by 1.5 wt% CNC with 0.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	3994.791
3.06414	1965.101
51.069	259.3562
102.138	131.6158
153.207	90.3274
306.414	51.62261
5.1069	1760.362
10.2138	909.2463
170.23	86.52638
340.46	45.29774
510.69	34.07384
1021.38	20.52473
5.1069	1417.173
10.2138	913.0157
170.23	91.57822
340.46	51.92199
510.69	38.70324
1021.38	25.4845
2.34	2052.711
4.68	1870.695
9.36	1012.106
18.72	659.569
37.44	348.974
74.88	191.2779
149.76	101.036
299.52	51.71734
599.04	31.40564
0.234	22446.06
0.468	14869.04
0.936	7722.364
1.872	2661.837
3.744	1858.63
7.488	1169.184
14.976	800.4744
29.952	493.1865
59.904	273.5785
119.808	124.7958

0.0234	477762.4
0.0468	208178
0.0936	74345.21
0.1872	34294.18
0.3744	16667.35
0.7488	10612.43
1.4976	5606.052
2.9952	2563.157
5.9904	1206.619
11.9808	895.6502
2.34	2551.639
4.68	1870.695
9.36	1088.864
18.72	769.9088
37.44	389.7518
74.88	190.0785
149.76	91.44122
299.52	49.61848
599.04	28.10744
0.234	38949.06
0.468	21009.69
0.936	11080.53
1.872	3765.235
3.744	2266.408
7.488	1253.138
14.976	740.5071
29.952	451.2094
59.904	206.1153
119.808	107.5552
0.0234	508465.7
0.0468	202421.1
0.0936	98332.13
0.1872	46287.63
0.3744	18106.57
0.7488	7374.199
1.4976	3747.067
2.9952	2743.059
5.9904	1656.374
11.9808	850.6747

Table 209 Rheological Data of 25 wt% Extendosphere thickened by 1.5 wt% CNC with 1% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1346.639
3.06414	834.7921

51.069	83.02796
102.138	50.23351
5.1069	307.108
10.2138	192.3075
9.36	177.361
18.72	112.6674
37.44	65.92847
74.88	42.559
149.76	29.07525
299.52	27.73043
0.234	7862.021
0.468	4122.906
0.936	2157.401
1.872	1462.491
3.744	419.4156
7.488	197.7143
14.976	212.795
29.952	139.3795
59.904	102.6718
119.808	55.08383
0.0234	128513
0.0468	48904.87
0.0936	22533.48
0.1872	11266.74
0.3744	4673.894
0.7488	1977.143
1.4976	988.5717
2.9952	494.2859
5.9904	292.1184
11.9808	176.0428
9.36	186.9558
18.72	141.4517
37.44	92.31408
74.88	54.55246
149.76	38.07034
299.52	29.52944
0.234	8629.603
0.468	3355.325
0.936	1485.767
1.872	790.8574
3.744	539.3502
7.488	185.7209
14.976	176.8146
29.952	190.3517
59.904	99.67339
119.808	56.58302

0.0234	140026.7
0.0468	64256.5
0.0936	23492.96
0.1872	10307.26
0.3744	4913.763
0.7488	1857.209
1.4976	928.6044
2.9952	614.2204
5.9904	247.1429
11.9808	228.5142

Table 210 Rheological Data of 25 wt% Extendosphere thickened by 1.5 wt% CNC with 1.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	571.5698
3.06414	350.374
51.069	77.21494
102.138	51.20234
153.207	85.16027
306.414	88.11544
5.1069	384.6149
10.2138	201.9958
170.23	89.43288
340.46	81.0478
170.23	67.0467
340.46	70.32063
510.69	67.32335
1021.38	45.92743
9.36	225.3348
18.72	213.4124
37.44	176.2683
74.88	98.92825
149.76	63.85627
299.52	95.19362
599.04	75.78143
1198.08	37.366
0.234	25132.6
0.468	12566.3
0.936	4172.301
1.872	934.7788
3.744	611.3109
7.488	341.6358
14.976	392.6968
29.952	352.2634
59.904	212.112

119.808	112.8023
0.0234	278191.3
0.0468	133338.8
0.0936	50358.3
0.1872	23739.94
0.3744	11630.1
0.7488	4375.835
1.4976	1888.081
2.9952	824.1059
5.9904	576.963
11.9808	348.4488
2.34	824.5812
4.68	623.3754
9.36	350.0668
18.72	237.3994
37.44	245.8303
74.88	131.3106
149.76	86.04416
299.52	93.99427
599.04	70.38438
1198.08	39.61477
0.234	21294.69
0.468	9687.87
0.936	4747.987
1.872	1846.282
3.744	635.2978
7.488	485.5573
14.976	284.7557
29.952	382.247
59.904	231.6014
119.808	145.7843
0.0234	324246.2
0.0468	154447.3
0.0936	69547.83
0.1872	26618.37
0.3744	10670.62
0.7488	5934.984
1.4976	2187.917
2.9952	674.1877
5.9904	561.9712
11.9808	340.9529

Table 211 Rheological Data of 25 wt% Extendosphere thickened by 1.5 wt% CNC with 2% Salt

Shear Rate (s^{-1})	Viscosity (mPa.s)
102.138	53.14002
153.207	54.15751
306.414	85.20893
170.23	55.13608
340.46	74.07218
170.23	79.31246
340.46	107.1179
510.69	67.32335
1021.38	52.06031
2.34	1745.679
4.68	872.8393
9.36	350.0668
18.72	309.3601
37.44	142.6866
74.88	116.9184
149.76	137.616
299.52	85.89869
599.04	79.22955
1198.08	40.51428
0.234	24365.02
0.468	11990.61
0.936	5611.516
1.872	1606.412
3.744	827.1931
7.488	413.5966
14.976	218.7917
29.952	202.3452
59.904	290.0695
119.808	160.0266
0.0234	489276.2
0.0468	221610.6
0.0936	44601.44
0.1872	22300.72
0.3744	10910.49
0.7488	4375.835
1.4976	1948.048
2.9952	1213.893
5.9904	891.7912
11.9808	385.9283
2.34	1400.267
4.68	796.0812
9.36	378.8511
18.72	338.1444

37.44	375.3596
74.88	196.0752
149.76	111.2304
299.52	121.8791
599.04	80.42889
1198.08	41.63867
0.234	30889.46
0.468	14485.25
0.936	5419.621
1.872	2517.915
3.744	851.18
7.488	461.5704
14.976	368.7099
29.952	220.3353
59.904	306.5605
119.808	163.7745
0.0234	485438.2
0.0468	215853.8
0.0936	99291.6
0.1872	49166.06
0.3744	14028.79
0.7488	6414.722
1.4976	3147.394
2.9952	1603.681
5.9904	876.7994
11.9808	408.416

Table 212 Rheological Data of 40 wt% Solosphere thickened by 1.5 wt% CNC with 0% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1927.941
3.06414	1190.032
8.5115	1509.633
102.138	151.9613
153.207	113.5795
5.1069	849.6563
10.2138	482.9584
170.23	107.4532
5.1069	1826.031
10.2138	1321.874
170.23	152.907
340.46	82.58638
510.69	59.14617
1021.38	45.92743
2.34	1784.058
4.68	1218.251
9.36	561.1516
18.72	338.1444

37.44	382.5557
74.88	208.0687
149.76	115.4281
299.52	67.9085
599.04	48.49632
1198.08	39.98957
0.234	11316.14
0.468	6041.859
0.936	3116.877
1.872	3045.627
3.744	2050.526
7.488	1133.204
14.976	668.5463
29.952	79.41223
59.904	296.0662
119.808	151.7811
0.0234	101647.6
0.0468	52742.78
0.0936	30209.29
0.1872	17023.6
0.3744	9231.408
0.7488	4615.704
1.4976	2427.786
2.9952	1453.762
5.9904	756.8648
11.9808	400.9201
2.34	1822.437
4.68	1237.44
9.36	906.5631
18.72	275.7784
37.44	200.2552
74.88	184.0818
149.76	163.402
299.52	119.1805
599.04	73.0829
1198.08	40.73916
0.234	27051.55
0.468	14101.46
0.936	4172.301
1.872	2757.784
3.744	2338.369
7.488	1061.243
14.976	698.53
29.952	361.2584
59.904	206.1153
119.808	107.5552

0.0234	140026.7
0.0468	110311.4
0.0936	57074.64
0.1872	29017.06
0.3744	15707.87
0.7488	4495.769
1.4976	4406.707
2.9952	2233.337
5.9904	1206.619
11.9808	505.8629

Table 213 Rheological Data of 40 wt% Solosphere thickened by 1.5 wt% CNC with 0.15% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1992.543
3.06414	1351.511
51.069	234.1668
102.138	123.8653
153.207	98.07822
306.414	75.19769
5.1069	1082.181
10.2138	977.0668
170.23	120.242
340.46	76.6881
5.1069	1008.314
10.2138	913.0157
170.23	128.3755
340.46	82.58638
510.69	63.23476
1021.38	37.75026
9.36	417.2301
18.72	170.236
37.44	125.8958
74.88	73.74199
149.76	46.46576
299.52	35.82601
599.04	43.09926
1198.08	40.51428
0.234	18224.37
0.468	9687.87
0.936	5131.778
1.872	2038.177

3.744	1163.01
7.488	845.361
14.976	956.3893
29.952	400.2372
59.904	144.6489
119.808	73.07402
2.9952	704.1713
5.9904	487.0121
11.9808	438.3997
2.34	709.444
4.68	373.9115
9.36	570.7464
18.72	155.8439
37.44	159.4774
74.88	76.14068
149.76	71.65202
299.52	59.81292
599.04	43.84885
1198.08	42.6881
0.234	17073
0.468	7768.917
0.936	3692.563
1.872	1894.255
3.744	1714.709
7.488	1097.224
14.976	572.5987
29.952	217.337
59.904	141.6505
119.808	77.57156
0.7488	2696.751
1.4976	1228.441
2.9952	494.2859
5.9904	561.9712
11.9808	490.8711

Table 214 Rheological Data of 40 wt% Solosphere thickened by 1.5 wt% CNC with 0.25% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1540.419
3.06414	770.2096
51.069	249.6682
102.138	146.1485
153.207	114.8714
306.414	87.14667
5.1069	1024.051

10.2138	792.9879
170.23	131.2867
340.46	77.8507
5.1069	1008.314
10.2138	708.5864
170.23	103.844
340.46	70.32063
510.69	59.14617
1021.38	37.75026
2.34	1668.921
4.68	1218.251
9.36	714.6678
18.72	525.2423
37.44	274.6146
74.88	150.5001
149.76	80.64711
299.52	70.90687
599.04	47.59681
1198.08	44.71199
0.234	20910.9
0.468	10647.35
0.936	5611.516
1.872	2805.758
3.744	251.5072
7.488	845.361
14.976	386.7001
29.952	277.3043
59.904	126.6587
119.808	99.3097
0.0234	78620.21
0.0468	41229.06
0.0936	19655.05
0.1872	5030.144
0.3744	6113.109
0.7488	2696.751
1.4976	1468.31
2.9952	1033.991
5.9904	891.7912
11.9808	415.912
4.68	373.9115
9.36	474.7987
18.72	434.092
37.44	171.4709
74.88	100.1276
149.76	56.06052
299.52	59.21325

599.04	50.29534
1198.08	43.66257
0.234	11699.93
0.468	7385.126
0.936	5035.83
1.872	1462.491
3.744	1091.049
7.488	905.3283
14.976	878.4318
29.952	331.2748
59.904	159.6407
119.808	99.3097
0.0234	82458.12
0.0468	39310.11
0.1872	8868.05
0.3744	5153.632
0.7488	2576.816
2.9952	764.1386
5.9904	502.0039
11.9808	355.9447

Table 215 Rheological Data of 40 wt% Solosphere thickened by 1.5 wt% CNC with 0.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	2121.721
3.06414	1190.039
51.069	247.7305
102.138	146.1485
153.207	114.2255
306.414	86.50078
5.1069	985.2973
10.2138	860.8065
170.23	133.0306
340.46	76.6881
5.1069	1008.314
10.2138	708.5864
170.23	128.3755
340.46	76.4535
510.69	55.05759
1021.38	35.70597
2.34	2206.227
4.68	1467.715
9.36	820.2103
18.72	822.68

37.44	408.9413
74.88	185.2811
149.76	113.6291
299.52	90.99591
599.04	59.59026
1198.08	40.6642
0.234	19375.74
0.468	9112.184
0.936	4652.04
1.872	2613.863
3.744	1522.814
7.488	1061.243
14.976	860.4416
29.952	562.1488
59.904	152.1448
119.808	94.06257
0.7488	2576.816
1.4976	1468.31
2.9952	824.1059
5.9904	442.0366
11.9808	393.4242
2.34	901.3393
4.68	508.2382
9.36	407.6354
18.72	434.092
37.44	185.863
74.88	118.1178
149.76	110.0311
299.52	89.49672
599.04	49.9955
1198.08	42.61314
0.234	11316.14
0.468	6041.859
0.936	3116.877
1.872	1990.203
3.744	1067.062
7.488	497.5507
14.976	374.7067
29.952	358.2601
59.904	188.1251
119.808	118.7991
0.0234	101647.6
0.0468	45066.97
0.0936	22533.48
0.1872	8388.312
0.3744	3954.287

0.7488	1977.143
1.4976	1288.408
2.9952	944.0405
5.9904	487.0121
11.9808	445.8956

Table 216 Rheological Data of 40 wt% Solosphere thickened by 1.5 wt% CNC with 1% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	2380.077
3.06414	1286.922
51.069	234.1668
102.138	150.0238
153.207	115.5173
306.414	84.88605
5.1069	1004.674
10.2138	967.3784
170.23	134.7745
340.46	73.78159
5.1069	1008.314
10.2138	708.5864
170.23	116.1097
340.46	82.58638
510.69	59.14617
1021.38	33.66167
2.34	1400.267
4.68	1295.009
9.36	714.6678
18.72	875.4512
37.44	420.9348
74.88	197.2746
149.76	88.44286
299.52	97.89214
599.04	63.63806
1198.08	42.3133
0.234	12851.3
0.468	9112.184
0.936	2541.191
1.872	3093.601
3.744	1306.931
7.488	785.3937
14.976	458.6609
29.952	523.1701
59.904	203.117
119.808	108.3048
1.4976	2307.852

2.9952	1393.795
5.9904	367.0775
11.9808	393.4242
2.34	1400.267
4.68	642.565
9.36	522.7725
18.72	482.0659
37.44	229.0395
74.88	150.5001
149.76	117.2272
299.52	103.8889
599.04	55.24264
1198.08	47.48548
0.234	14002.67
0.468	4506.697
0.936	1293.872
1.872	2278.046
3.744	1330.918
7.488	437.5835
14.976	476.651
29.952	409.2323
59.904	236.099
119.808	102.3081
0.0234	101647.6
0.0468	31634.29
0.0936	24452.44
0.1872	12705.96
0.3744	3954.287
0.7488	2456.882
1.4976	1588.245
2.9952	1063.975
5.9904	487.0121
11.9808	430.9038

Table 217 Rheological Data of 40 wt% Solosphere thickened by 1.5 wt% CNC with 1.5% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	1927.954
3.06414	1383.806
51.069	226.4161
102.138	124.8341
153.207	98.72411
306.414	74.5518
5.1069	1004.674
10.2138	996.4435

170.23	126.6363
340.46	76.1068
5.1069	1008.314
10.2138	708.5864
170.23	128.3755
340.46	88.71926
510.69	67.32335
1021.38	37.75026
2.34	1246.751
4.68	892.0288
9.36	580.3411
18.72	530.0397
37.44	272.2159
74.88	132.5099
149.76	113.6291
299.52	71.2067
599.04	58.241
1198.08	42.01347
0.234	9013.393
0.468	5849.964
0.936	3116.877
1.872	2086.151
3.744	1306.931
7.488	953.3021
14.976	746.5038
29.952	403.2355
59.904	204.6161
119.808	93.31298
0.0234	74782.31
0.0468	39310.11
0.0936	15817.15
2.34	901.3393
4.68	527.4278
9.36	561.1516
18.72	328.5496
37.44	298.6015
74.88	125.3138
149.76	87.84318
299.52	67.30883
599.04	53.74345
1198.08	38.49039
0.234	6326.859
0.468	4890.487
0.936	3308.772
1.872	2134.124
3.744	1450.853

7.488	881.3413
14.976	698.53
29.952	376.2503
59.904	264.5834
119.808	94.06257

Table 218 Rheological Data of 40 wt% Solosphere thickened by 1.5 wt% CNC with 2% Salt

Shear Rate (s^{-1})	**Viscosity (mPa.s)**
1.53207	2186.31
3.06414	1448.395
51.069	238.0422
102.138	128.7094
153.207	95.49466
306.414	77.13536
5.1069	1120.934
10.2138	918.9366
170.23	123.7298
340.46	78.14135
5.1069	1008.314
10.2138	913.0157
170.23	140.6413
340.46	82.58638
510.69	67.32335
1021.38	35.70597
2.34	1131.614
4.68	853.6498
9.36	541.9621
18.72	573.2161
37.44	255.4251
74.88	146.9021
149.76	106.433
299.52	67.60867
599.04	59.8901
1198.08	42.01347
0.234	12467.51
0.468	5849.964
0.936	2541.191
1.872	2134.124
3.744	1498.827
7.488	653.4657
14.976	1866.4384
29.952	403.2355
59.904	159.6407
119.808	97.06093

2.34	747.8231
4.68	431.4801
9.36	436.4197
18.72	318.9549
37.44	289.0068
74.88	125.3138
149.76	81.84645
299.52	77.8031
599.04	50.59517
1198.08	35.79186
0.234	11316.14
0.468	7385.126
0.936	3308.772
1.872	1942.229
3.744	1306.931
7.488	941.3086
14.976	632.566
29.952	391.2421
59.904	246.5932
119.808	98.56011