CELLULOSE/GRAPHENE-OXIDE ORIENTED COMPOSITE FOR PHENOL REMOVAL FROM AQUEOUS SOLUTIONS: FORMULATION AND ANALYSIS

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Abstract: In this research, freeze drying was utilised to remove excess water from wet CNF and CNF-PF composite films, which sped up the processing time and made the films wrinklefree. The nanocomposite was manufactured by heating the freeze-dried sheets. Primary physical and mechanical factors were evaluated in addition to the morphology. Discontinuous patches, possibly voids generated by low-temperature drying, can be seen in both CNF and CNF-PF complex films. Both films show these gaps. The films are both supple and robust since the adding of PF has a negligible impact on the mechanical strength of the material. The mechanical asset of a film is often diminished after being freeze dried as opposed to oven dried. Freeze-drying CNF and CNF-based nanocomposites can be an efficient method of preparation when time is of the essence.

Keywords: phenol formaldeyde (PF); nanocomposites; mechanical strength; cellulose nanofibrils (CNF); freeze dry.

I. INTRODUCTION

As people develop more aware of the position of defensive the setting, they increase their reliance on biomass and biomaterials. With a yearly growth rate of 1.5 x 1012 metric tonnes [1], cellulose remains the greatest copious usual reserve on Earth. The theoretical modulus of cellulose's smallest fibres, termed microfibrils, is greater than 150 GPa [2]. By repeatedly subjecting pulp fibre to high-speed shear, a novel cellulosic material was developed in the early 1980s [3, 4]. Microfibrils and aggregates of microfibrils formed as a result. Cellulose nanofibrils (CNF) was the more popular name for this high-performance cellulose variant [5], but the word "microfibrils" is now more commonly used.

Depending on the defibrillation methods and the starting fibres, the resulting cellulose nanofibrils have widths (or diameters) of less than 100 nm. Taking readings in the microsecond or micromillimeter range. CNF produced are solvent- and water-soluble, unlike cellulose, and form a stable gel structure at low concentration [6]. Nanofibrils are able to interconnect in solution and after drying because of their high aspect ratio (greater than 100) and abundance of surface hydroxyls. CNF is a crucial reinforcing component in nano- or bio-composites [7-8] due to its unique tangling activity. In addition to its superior mechanical Applications for cellulose nanofibrils abound [9] because to their robustness, high aspect ratio, and sizable surface area.

Hydrophilic groups on CNF, especially hydroxyls, became much more accessible once interfibrillar hydrogen bonding was broken. Consequently, both the dry plain materials and the composites on which they are based are highly reactive to the presence of water and moisture, and can absorb substantially more water than their initial weight. When nanofibrils