Studies on adsorption/desorption behavior of rosin components onto/from cellulosic materials

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Summary

In this research, examinations to investigate interactions between rosin components and various cellulosic materials was conducted. The focus was on uncovering the complex dynamics of adsorption and desorption behaviors within this system.

The study focused on visualizing rosin colloid distribution in pulp post-papermaking. Propargyl group-bonded GRM colloids and Alum in pulp allowed colloid detection via fluorescence microscopy. During de-watering and heating process, observations revealed potential movement or transformation of both Alum and rosin colloids transformation. Weaker fluorescence in TEMPO-oxidized NBKP implied rosin's homogeneous dispersion, in line with prior studies on rosin's distribution.

The study utilized QCM-D analysis to delve into the dynamic adsorption/desorption behavior of rosin colloids onto/from cellulose nanofibers (CNFs) and TEMPO-oxidized cellulose nanofibers (TOCNFs) in aqueous media. These investigations challenged the traditional belief in the paper industry that solely electrostatic forces govern these interactions, revealing the pivotal role of non-electrostatic interactions. Additionally, modifications in rosin's structure and the use of surfactants in creating stable rosin colloids significantly impacted their adsorption and desorption onto/from CNFs and TOCNFs. Through QCM-D analysis, the study provided nuanced insights into the intricate dynamics of rosin colloid behavior.

The discovery of water solubility of abietic acid (ABA) combined with cellulosic materials demonstrated that solid dispersion method with cellulosic materials enhanced ABA's water solubility, which is an inherent poorly water-soluble material. the observed ABA dissolution behaviors across various cellulose matrices, exhibiting distinct mechanisms (either diffusion- or dissolution-controlled), hint at the wide range of potential applications. Furthermore, Alum's efficacy in preventing DCS formation in paper-making mills was evident in the ABA dissolved from the SD materials of ABA/CNF and ABA/CNF/Al.

The correlation between ABA's dissolution behavior and its efficacy in hindering fungal growth was investigated in the last chapter. SD materials of ABA with MC or HPMC significantly exhibited inhibitory effect on a white-rot growth. The similar dissolution behavior of ABA in both cases suggested a potential relationship between ABA's dissolution behavior and its effectiveness in hindering fungal growth. These findings suggest the SD materials comprising ABA and cellulosic materials can be new antifungal agents.