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Entitled
MODIFICATION OF CELLULOSE FIBERS BY ACYL GRAFTING FOR OIL SPILL REMEDIATION

by
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Abstract

Oil spills represent a significant source of aquatic pollution with substantial repercussions on the environment as well as the economic and societal well-being of coastal communities. This research project is focused on the utilization of chemically modified cellulose-based fibers to remediate oil-contaminated water. The hydroxyl groups present in cellulose were acetylated under optimized conditions, thereby rendering the fibers hydrophobic and enhancing their affinity for crude oil. The modified cellulosic material was characterized by several physical and chemical techniques (IR, TGA, contact angle measurement, SEM, and back titration) to determine the extent of acylation and assess their morphological properties. The derivatized cellulose materials were used in the recovery of crude in simulated water. Factors such as degree of acetylation, time of exposure to the crude oil, and temperature on oil recovery efficiency were assessed. The highest oil loading capacity was 20 g oil/g of modified cotton at 20 ˚C. The adsorption followed the second order-kinetics and Langmuir adsorption model with high linear regression coefficient values. The adsorption process is exothermic with a negative entropy while Gibbs free energy is positive suggesting the event is non-spontaneous. The recyclability of the modified materials, a critical concern in this research endeavor, will also be thoroughly assessed. The development of such materials holds great promise in providing an efficient, cost-effective, and environmentally friendly solution for addressing petroleum oil-induced aquatic pollution in the Gulf Cooperation Council (GCC) region.

Keywords: Oil spills, Economy, chemically modified cellulose-based cotton fibers, Esterification, Characterization, Hydrophobicity, oil loading adsorptions, Recyclability