The Effect of Fatty Acid Chain Length on Esterification of Nanocellulose based Aerogels for Oil Spill Clean-Up and its Adsorption Isotherm Study

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Oil spill concern raised global apprehension due to their hazardous effect on the environment and ecological life. Recently, The development of three-dimensional nanocellulose based aerogel as superabsorbent notably attracted too much attention due to their remarkable properties such as low density, high absorption capacity, and high surface area, etc. The present research study emphases on the fabrication of low-density nanocellulose based composite aerogel for selective adsorption of crude oil. The composite aerogel had fabricated using nanocellulose and polyvinyl alcohol through facile one-pot synthesis without addition of crosslinking agent [1]. This physically crosslinked aerogel was further processed to induce hydrophobicity for selective absorption of oil. The hydrophobic treatment was done by using dip-coating in fatty acid chloride mixture via inducing esterification linkage with the cellulose chain. The properties of esterified nanocellulose based aerogel have effected by the side-chain length effect of fatty acids. In this work, A series of nanocellulose based composite aerogel were functionalized using different types of fatty acid chloride, having varying chain lengths from C_8-C_{22} at different molar concentrations. The surface morphology of obtained samples was studied using a field emission scanning electron microscope (FE-SEM), and its three-dimensional porous self-assembled structure was evident by X-ray microtomography. The chemical composition of obtained functionalized samples was characterized using Fourier transformed infrared spectroscopy (FTIR). Contact angle analysis confirmed the effect of side-chain length on functionalized aerogels. The resultant aerogel exhibited hydrophobic and oleophilic nature[2]. The series of functionalized aerogels were testified for the separation of crude oil from oil-water mixture. The performance of oil adsorption was evaluated by oil rejection rate and oil and adsorption efficiency. The adsorb oil was quickly recovered using simple mechanical squeezing, and aerogels were reused for further oil absorption process. Kinetic study and adsorption isotherm study were also investigated at different oil-water sapertaiom conditions for different functionalized composite aerogels.

Acknowledgement
This research project has been supported by the Ministry of Human Resource Development, Govt of India, under Star project (Grant No. STR-1492-PPE). The author, Monika Chhajed, also acknowledges the Ministry of Human Resource and Development, Govt. of India, for financial assistantship.

Reference

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