

Title: Lithium Chloride-Mediated enhancement of dye removal capacity in Borneo bamboo derived nanocellulose-based nanocomposite membranes (NCMs)

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Abstract: Demand for sustainable materials for membrane fabrication is rapidly increasing, particularly in Sarawak coastal areas. nanocellulose emerges as a promising alternative for membrane development due to its availability, intrinsic biodegradability, and high strength. However, the hydrophobicity of nanocellulose limits its applicability in water treatment operations. Hence necessitating the need for innovative solutions. Herein, we examine the potential of bamboo-derived nanocellulose to enhance nanocomposite membrane-based water treatment systems by incorporating lithium chloride as a pore-forming additive. Nanocomposite membranes (NCMs) were synthesised using a LiCl-doped solution of nanocellulose and polyvinylidene fluoride (PVDF) through phase inversion and controlled solidification methods. The results show that nanocellulose incorporation induces structural alterations in NCMs, with reduced size in cellulose microfibrils. The crystallinity of nanocellulose was enhanced through interactions between PVDF and nanocellulose. The integration of nanocellulose along with lithium chloride was observed to have a significant impact on water permeation flux, attaining 104 L/m²h due to improved hydrophobicity and reduced fouling. In addition, the developed NCMs recorded 93 % methylene blue (MB) removal within 10 min. Revealing high potential of NCMs as an alternative and sustainable material for the development of nanocomposite membranes to mitigate contemporary challenges of water scarcity.

Keywords: Nanocellulose, Nanocomposite membranes (NCMs), Polyvinylidene fluoride (PVDF), Lithium chloride (LiCl) additive, Phase inversion, Water permeation flux

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