PREPARATION AND CHARACTERIZATION OF LOW-COST CELLULOSIC MICROFILTRATION MEMBRANE

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LAPORAN AKHIR PENYELIDIKAN 'PREPARATION AND CHARACTERIZATION OF LOW-COST CELLULOSIC MICROFILTRATION MEMBRANE'

Merujuk kepada perkara di atas, bersama-sama ini disertakan 4 (empat) naskah Laporan Akhir Penyelidikan bertajuk 'Preparation and characterization of low-cost cellulosic microfiltration membrane' oleh kumpulan Penyelidik dari Fakulti Kejuruteraan Kimia untuk makluman pihak tuan.

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Yang benar,

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ABSTRACT

An attempt to investigate the possibility of using pineapple leave fibers (PALFs) as one of the alternative source of cellulose polymer for membrane fabrication has been carried out in this research. The PALFs were extracted mechanically from raw pineapple leaves. The extracted PALFs were then chemically treated and characterized prior to the membrane preparation. It was found that PALFs contained 94.58% holocellulose, 9.02% hemicellulose, 4.32% lignin and 1.10% ash. The chemical constituents obtained were found to be in the range of data reported in literatures. The cellulosic microfiltration membranes were prepared from the cellulose/*N*-methylmorpholine-*N*-oxide (NMMO)/ PEG 400 solutions (dope) at different cellulose concentrations (i.e. 6–8 wt%) by using immersion precipitation method. The influence of cellulose concentrations on the mechanical properties, microfiltration rate (MFR) and rejection rate (RR) of membranes were investigated in determining the optimized cellulosic microfiltration membrane. The optimized membrane was found to be at the cellulose concentration of 8 wt% that possessed considerable mechanical properties at MFR of 91.79 $mLh^{-1}m^{-2}mmHg^{-1}$ and dextran's RR of 86.51% under an applied pressure of 10 psi. Further characterizations on the optimized membrane were carried out in order to confirm the chemical structure, morphological changes, thermal properties and stability upon substituting the former cellulose's source, i.e. hardwood plant. The optimized cellulose membranes for both types (i.e. PALFs and hardwood) possessed analogous chemical structures which have been confirmed by the existence of similar functional groups detections. Meanwhile, scanning electron microscopy analysis of the optimized cellulose membranes elucidated that the source of cellulose has brought profound effect on the structural and morphology of resulting membranes. In general, matte and porous surfaces in a sponge-like configurations and uniform granular microporous structure were observed throughout the thickness of both membranes. But, the average pore size of membrane derived from PALFs was exhibited to be smaller than the hardwood which in turn affecting the MFR and RR performances. The use of PALFs as alternative source of cellulose polymer did not bring much alterations in the thermal properties and stability of resultant membranes. Both of the optimized cellulose membranes were observed to have a thermal stability up to 275 ± 5°C before enduring further decomposition in nitrogen atmosphere. These membranes have found to undergo two-stage decomposition patterns due to dehydration and degradation of the polymer matrixes. Hence, based on the overall results, it can be concluded that PALFs as a non-wood plant can be utilized as one of alternative source for cellulose polymer in preparing the cellulosic microfiltration membranes.

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