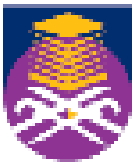

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Title : DEVELOPMENT OF FLAT SHEET ULTRAFILTRATION MEMBRANE FOR HEAVY METALS REMOVAL FROM AUTOMOBILE INDUSTRIAL WASTEWATER

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This thesis is concerned with the production of new flat sheet ultrafiltration (FSUF) membrane. This process includes formulation, fabrication, and characterization of the developed FSUF. Spiral wound module was used in the membrane system for automobile wastewater treatment. About 6,700 lit/vehicle is the average rate of wastewater generation of the automobile industry. In Malaysia, the current treatment process of the automobile industry is activated sludge process (ASP) which shows poor efficiency for heavy metal, COD and BOD_5 removal and also, ASP requires high electricity consumption that increases the treatment cost. The objectives of this study are to create a new formula for FSUF membrane to minimize the concentration of heavy metals, COD and BOD_5 to the allowable limits. The research work was divided into five phases which include wastewater sampling, membrane development, membrane characterization, module fabrication and wastewater treatment system fabrication. The first phase deals with the characterization of the automobile effluent such as Iron, Chromium, Zinc, Copper and Lead as well as pH, COD, and BOD5. The initial Proton effluent showed that pH and Zn comply with EQA 2009 standards A and B. In addition, COD, BOD_5, Fe, Cr and SS do not comply with EQA 2009 standards A and B. Pb and Cu comply with EQA 2009 standard B but not with standard A.The second phase deals with the development, design and fabrication of flat sheet ultrafiltration membrane, 18 membranes formulas were created in stages I & II using titration and % composition processes. From stages I and II, 4 membrane formulas (M_1- M_4) and 14 membranes (M_5- M_{18}) were obtained respectively. In stage II, polymer (PSF) and additive (PVP) concentration are varied in 14 membranes (M_5 - M_{18}) and the concentration of the solvent (DMAc) is constant. The third phase is membrane characterization of 18 membranes to get the best performance from stages I and II. Based on flux rate, salt rejection, Spectrophotometer Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR) and molecular weight cut off (MWCO), one of the developed FSUF membranes was selected to be incorporated into the membrane treatment system. It shows increasing the polymer concentration in the solution causes increasing the thickness of skin and decrease the porosity of the membrane surface. The characterization showed that membranes M_2 and M_8 are the best membrane performance in stages I and II respectively. The flux rate of for membranes M_2 and M_8 are 52235 $l/m^2.hr$ and 66957 $l/m^2.hr$ respectively and that is why membrane M_8 was selected to be run in the membrane system. In the fourth phase, there are four types of samples which are raw sample, raw sample after aeration process, raw sample after coagulation process and raw sample after aeration and coagulation processes in series. The last phase is to assess the efficiency of the developed FSUF membrane system. The best system performance in term of heavy metals removal is a system (C) which contains screening, the coagulation process and the developed FSUF membrane. The results of pH, BOD5, COD, (Fe), (Cr), (Zn), (Pb), (Cu), SS and Turbidity after using the membrane system (C) are 6.28, 14.3 mg/l, 24 mg/l, 0.037 mg/l, 0.036 mg/l, 0.08 mg/l, 0.071 mg/l, 0.065 mg/l, 49 mg/l and 16.6 NTU respectively. In conclusion, after using membrane system (C) in the treatment unit in Proton factory, the effluent can be discharged based on EQA 2009 standards A and B.