CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME IV

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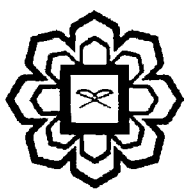

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CHAPTER 33

PRODUCTION OF ACTIVATED CARBON FROM OIL PALM EMPTY FRUIT BUNCH FOR ADSORPTION OF CADMIUM IN AQUEOUS SOLUTION

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ABSTRACT

Powdered Activated carbon (PAC) was prepared from oil palm empty fruit bunch (EFB) for adsorption of cadmium from aqueous solution. The EFB was carbonized and activated in bioreactor system of horizontal furnace placed CSC - Split tube (Lenton thermal design, UK). Carbonization under a steady flow of nitrogen gas for 30 minutes followed by activation with steam at different flow rates, temperatures and activation times were used to optimize production condition. The AC samples produced at activation temperature of 900 °C with steam flow rate of 2.0mL/min and activation period of 15 minutes was selected as best quality adsorbent with total yield of 21.7%. It had adsorbed more than 97 % of total cadmium from aqueous solution of 0.3 mg/L within 2 minutes contact time. Characterizations of AC based-EFB had shown good quality adsorbent with highly active sites and well developed pores with BET surface area of 635.16 m^2/g.

Keywords: palm oil empty fruit bunch, steam activation, powdered activated carbon, cadmium adsorption.

INTRODUCTION

The discharge of heavy metals into water-bodies is a serious pollution problem which may affect the quality of water supply while increasing concentrations of these metals in the water constitute a severe health hazard due to their non-degradability, bio- accumulative properties, and toxicity. Numerous metals such as chromium Cr (III) and Cr (VI), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), cadmium (Cd), etc are known to be significantly toxic (Najual , 2008).

Cadmium is introduced into the bodies of water from smelting, metal plating, cadmium-nickel batteries, phosphate fertilizer, mining, pigments, stabilizers, alloy industries and sewage sludge. Harmful effects of cadmium on human include a number of acute and chronic disorders, such as "itai-itai" disease, renal damage, emphysema, hypertension, and testicular atrophy (Leyva-Ramos *et al.*, 1997).

USEPA and Malaysian Environmental Quality on Sewage and Industrial Effluents Regulations, recommend a maximum allowable limit of 0.01 ppm for total Cd (Department of Environmental, DOE Malaysia, 1979). Adsorption process is gaining interest as effective processes for the treatment of industrial effluent containing toxic metals. The adsorption