

**PARAMETERS AFFECTING THE ADSORPTION OF COPPER(II) AND  
LEAD(II) FROM AQUEOUS SOLUTION BY OIL PALM SHELL  
IN BATCH ADSORPTION SYSTEM**

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**PARAMETER-PARAMETER YANG MEMPENGARUHI JERAPAN KUPRUM(II)  
DAN PLUMBUM(II) DARI LARUTAN AKUES OLEH CENGERANG  
KELAPA SAWIT DALAM SISTEM JERAPAN KELOMPOK**

**ABSTRAK**

Penyelidikan ini bertujuan untuk: (i) menentukan kesesuaian cengkerang kelapa sawit sebagai media paya binaan menerusi analisis taburan saiz partikel, (ii) menyiasat pencirian fiziko-kimia cengkerang kelapa sawit, dan (iii) mengkaji jerapan logam beratnya dengan menggunakan Cu(II) dan Pb(II) sebagai model logam berat yang merangkumi kajian-kajian: (a) kesan pelbagai parameter terpilih terhadap prestasi jerapan, (b) kapasiti teoritikal jerapan mono-lapisan, dan (c) kinetik dan mekanisme jerapan. Semua kaedah yang digunakan adalah terbangun dan piawai. Berdasarkan kajian taburan saiz partikel dan pencirian fiziko-kimia, cengkerang kelapa sawit didapati sesuai digunakan sebagai media paya binaan. Kesan pelbagai parameter terhadap prestasi sistem jerapan Cu-OPS dan Pb-OPS adalah seperti dapatan lazim. Kapasiti teoritikal jerapan monolapisan untuk Cu(II) dan Pb(II) adalah 1.76 dan 3.39 mg/g. Pematuhan terhadap pelbagai model kinetik, seperti model difusi intrapartikel, pernyataan Boyd dan pseudo-tertib-kedua, menunjukkan penglibatan pelbagai mekanisme jerapan. Proses jerapan dipercayai bermula dengan difusi massa, diikuti oleh gabungan difusi filem dan intrapartikel, dan berakhir dengan jerapan pada tapak aktif.

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## ABSTRACT

The aims of this work were to: (i) determine the suitability of oil palm shell as constructed wetland filter bed media by analyzing its particle size distribution, (ii) investigate the physico-chemistry properties of oil palm shell, and (iii) study its heavy metal adsorption by using Cu(II) and Pb(II) as model heavy metal which include studies on the: (a) effect of various selected parameters on the adsorption performance, (b) theoretical monolayer adsorption capacity, and (c) adsorption kinetic and mechanism. All the methods used were standard and established. The oil palm shell was found to be suitable for constructed wetland application based on its particle size distribution and characterization studies. The effect of various parameters on the Cu-OPS and Pb-OPS adsorption performance followed typical findings. The theoretical monolayer adsorption capacities of OPS towards Cu(II) and Pb(II) were 1.76 and 3.39 mg/g, respectively. The compliance with various kinetic models, namely, intraparticle diffusion model, expression of Boyd and pseudo-second-order model, indicated that various adsorption mechanisms were involved. *The adsorption process is believed to have started from bulk diffusion followed by combination of film and intraparticle diffusions, and ended with adsorption on binding sites which was probably chemisorption.*