

UNIVERSITI TEKNOLOGI MARA

**COMPARATIVE ADSORPTION OF
Pb(II) IONS BY USING SULPHURIC
ACID AND UREA CHEMICALLY
TREATED PETAI BELALANG
(*Leucaena leucocephala*)
LEAF POWDER**

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ABSTRACT

The use of Petai Belalang as an alternative adsorbent to overcome several classes of pollutants present in the environment has been studied. The potential of Petai Belalang (*Leucaena leucocephala*) leaf powder that was pretreated using sulphuric acid (SLLP) and urea (ULLP) for the removal of Pb(II) ions from wastewater was investigated. The scope of studies was conducted in details with respect to the characterization and batch adsorption studies. The determination of pH_{Zpc} in which the adsorbent was in the neutral state was found to be 5.62 and 6.50 for SLLP and ULLP, respectively. High percentage composition of sulphur and nitrogen in SLLP and ULLP were probably due to the pretreatments. FTIR spectra show both adsorbents contain large amount of hydroxyl, carbonyl, amine, amide, sulphate functional groups which provide an active sites for Pb(II) to adsorb efficiently. EDS analysis showed that the adsorbents mostly contain elemental compositions of Na, Mg, Ca, K, S. Ion exchange was said to be the dominant mechanism for SLLP since the disappearance peak of Ca and the appearance of peak Pb(II) ions after adsorption. Lead adsorption study was conducted at pH 4 in order to avoid the lead precipitation that occurred with the effective adsorbent dosage of 0.02 g. The pseudo – second order kinetic model was best fitted in SLLP and also ULLP with the values of correlation coefficient between 0.97 – 0.10 and small values of normalized standard deviation. Boyd kinetic plots showed that the film diffusion took place in both of the adsorbents. Isotherm studies revealed that the adsorption process that took place was monolayer adsorption on the homogeneous surface of SLLP and ULLP. The negative values of Gibbs free energy (ΔG°) for SLLP and ULLP attained at -2.43 and -0.52 kJ mol⁻¹ with increasing the temperature may be attributed to the spontaneous adsorption process. Positive values of enthalpy change (ΔH°) of SLLP and ULLP were obtained at 8.96 and 13.08 kJ mol⁻¹ respectively. The ionic strength studies gave the lowest value of percentage removal (%) and adsorption capacity (mg g⁻¹) due to the high competition between the salt with the metal ions in solution. About 0.100 mol L⁻¹ of HCl and 0.010 mol L⁻¹ Na₂EDTA were successfully desorbed by SLLP and ULLP with the percentage desorption achieved at 62.43 and 26.82 %, respectively. In regeneration studies, it was proven that both adsorbents could be used more than two cycles of processes and can be repeatedly used. It can be conclude that both adsorbents have high potential for Pb(II) removal with the maximum adsorption capacity values attained at 204.50 and 89.29 mg g⁻¹ for SLLP and ULLP, respectively.

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