

UNIVERSITI TEKNOLOGI MARA

**STUDY ON THE ADSORPTION OF
PB(II) ONTO CITRIC ACID AND
MONOSODIUM GLUTAMATE
MODIFIED RUBBER LEAF
POWDER**

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of the requirements for the degree of
Master of Science

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a panel of examiners has met on 22nd September 2014 to conduct the final examination of Ahmad Faisal bin Fadzil on his Master thesis entitled “Study On The Adsorption Of Pb(II) Ions Onto Citric Acid And Monosodium Glutamate Modified Rubber Leaf Powder” in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

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AUTHOR'S DECLARATION

I declare that the work in this thesis/dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

To date, studies related to natural adsorbents were found to show promising potential as an alternative to current wastewater treatment methods. Most of the studies were found to center on the modified natural adsorbents as an alternative to activated carbon. However, little study has been done to explore the influence of modification of natural adsorbents using organic acids. This research attempts to fill in this knowledge gap by studying the influence and performance of citric acid and monosodium glutamate modified rubber leaf powder. Three main components of this study are the characterisation of modified adsorbents regarding their physicochemical properties; the adsorptive performance of the adsorbents in treating Pb(II) from aqueous solutions; and non-linear mathematical modelling on the adsorption data. Pb(II) adsorption studies were investigated under batch and fixed bed column modes. The results emerge to suggest that the amount of Pb(II) adsorbed increased with increasing pH, contact time, initial Pb(II) concentration, adsorbent dosage and temperature for citric acid modified rubber leaf powder (CARL) and monosodium glutamate modified rubber leaf powder (MGRL). The adsorption data suggests that the kinetics of Pb(II) adsorption by CARL and MGRL fits well with pseudo-second order model. This model theorises that chemisorption could be the rate determining step for Pb(II) adsorption. The equilibrium time was achieved within 90 min for CARL and MGRL. Adsorption of Pb(II) followed the Langmuir isotherm model for MGRL with the monolayer adsorption capacities of 125.82 mg/g. The q_{max} achieved by CARL was 97.19 mg/g. The optimum adsorption process occurred at pH 4. Possible mechanisms involved in the Pb(II) adsorption by CARL and MGRL were mainly physical adsorption and chemical adsorption, respectively. The findings from the FTIR spectra and Dubinin-Radushkevich isotherm model investigation supports the mechanism suggested. For both adsorbents, the rate limiting step is chemisorption. Fixed bed column data were in good agreement with the Thomas which predicts the maximum adsorption capacity and breakthrough curve and Yoon-Nelson model which predicts the service life of a column. The maximum adsorption capacity for the columns were 37.70 to 48.70 mg/g for CARL and 51.28 to 75.76 mg/g for MGRL. From both batch and fixed bed column studies, MGRL proved superior to CARL by having higher maximum adsorption capacities and longer service life.

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SAPERE AUDE