Lecture Notes in Mechanical Engineering

Muhammad Abbas Ahmad Zaini
Mazura Jusoh
Norasikin Othman *Editors*

Proceedings of the 3rd International Conference on Separation Technology

Sustainable Design in Construction, Materials and Processes

Springer

Heavy Metal Adsorbent of Carbon from Sago Liquid Biowaste for Sustainable Technology

Zainab Ngaini, Rafeah Wahi, Hasnain Hussain, Nurul Qhalila Bahrin, and Nur Hanani Hasana

Abstract Sarawak is one of the world's largest exporter of sago flour, from which the processing leads to a generation of biowaste in a significant amount. Thus, utilization of the biowaste is crucial to create a zero-waste sago processing industry. In this work, the heavy metal adsorbent was prepared from sago activated sludge via microwave technology. Sago effluent was treated via an activated sludge process to produce biomass, followed by microwave pyrolysis and chemical activation using NaOH. The efficiency of the adsorbent for adsorption of Cr, Pb and Zn in aqueous solution was studied at pH 2, contact time (24 h), adsorbent dosage (0.2–1 g/50 mL), and initial concentration (5–25 mg/L). Physicochemical analyses showed that the adsorbent has an average pore size of 36.29 μm and BET surface area of 471.1 m^2/g. The maximum removal of heavy metals was: Pb (89.8%), Cr (47.0%) and Zn (18.4%) at adsorbent dosage (1 g/50 mL), initial concentration (5 mg/L), mixing speed (150 rpm) and contact time (24 h). The Langmuir and Freundlich isotherm studies showed that Qe for Pb removal by sludge activated carbon was 3.202×10^{-3} mg/g. The results indicated the potential application of sago activated carbon for the removal of heavy metals, especially Pb from wastewater. Further isotherm study for the occurrence of chemisorptions process could be beneficial, which at the same creating a zero-waste sago processing industry for sustainable technology.

Keywords Adsorption · Biowaste · Heavy metal · Microwave pyrolysis · Sago effluent · Sago waste

1 Introduction

Sago (*Metroxylon sagu*) is an indigenous plant of Sarawak, Malaysia and easily grown in freshwater swamps and tropical lowland forests. Malaysia is one of the largest producers of sago flour in the world with annual export est. 41,000–48,000

Z. Ngaini (✉) · R. Wahi · H. Hussain · N. Q. Bahrin · N. H. Hasana
Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
e-mail: nzainab@unimas.my

© The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2021

M. A. A. Zaini et al. (eds.), *Proceedings of the 3rd International Conference on Separation Technology*, Lecture Notes in Mechanical Engineering,
https://doi.org/10.1007/978-981-16-0742-4_14