IOP Conf. Series: Materials Science and Engineering **293** (2017) 012013 doi:10.1088/1757-899X/293/1/012013

Adsorption Isotherm of Chromium (Vi) into $Zncl_2$ Impregnated Activated Carbon Derived by Jatropha Curcas Seed Hull

M Mohammad[1], I Yakub[2], Z Yaakob[3], N Asim[1], K Sopian[1]

[1]Solar Energy Research Institute (SERI), Universiti Kebangsaan Malaysia, 43600, Bangi, Selangor, Malaysia
[2]Department of Civil Engineering, Fakulti Engineering, Universiti Malaysia Sarawak
[3]Department of Chemical and Process Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia

masita@ukm.edu.my

Abstract. Hexavalent chromium is carcinogenic and should be removed from industrial wastewater before discharged into water resources. Adsorption by using activated carbon from biomass is an economic and conventional way on removing the heavy metal ions from wastewater. In this research, activated carbon is synthesized from *Jatropha curcas* L. seed hull through chemical activation with $ZnCl_2$ and carbonized at 800 ^oC (JAC/$ZnCl_2$). The activated carbon has been characterized using FTIR, SEM-EDX, BET and CHNS-O analyzer. Adsorption isotherms have been analysed using Langmuir and Freundlich models to determine its removal mechanism. The maximum adsorption capacity of Cr (VI) metal ions onto JAC/$ZnCl_2$ activated carbon is 25.189 mg/g and following Langmuir isotherm model which is monolayer adsorption.

1. Introduction

Chromium exists in almost anywhere on earth, including seawater and plants, but its hexavalent state (+6) has been proven to be the most poisonous and carcinogenic to both human and animal [1]. Because of its high corrosion-resistant and hardness, chromium has been used in many metal industries, ranging from printing machine to aerospace manufacturing. Many researchers have tried other materials to replace this element in the industry but none of the materials can surpass the excellent layer quality and cost-effectiveness it holds [2].

Hexavalent chromium can be reduced to trivalent chromium that is insoluble in water and can be separated easily [3]. This reaction is manipulated by many of the removal techniques in industrial wastewater, including acidification with sulphuric acid, chemical reduction with sulphite sulphur compounds and neutralization with a sodium hydroxide solution. The other way is through a separation process such as ion exchange and membrane [4]. However, these methods produce a huge amount of sludge that will end up in the landfill, which creates another environmental concern [2]. Besides ion exchange and membrane separation techniques, adsorption method has attracted many attentions nowadays [5]. This is because of the ability to recover and reuse precious chromium that is adsorbed using activated carbon, instead of contributing to soil and river pollution by sending the waste sludge to landfills. Some of the materials that have been used as an adsorbent of chromium (VI) were marine algae, KNb3O8 compound and sol-gel hydrotalcite-like compounds [5, 6, 7]. Besides,