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EFFECTIVENESS OF PAPAYA SEED AS ADSORBENT FOR REMOVAL OF PB(II) FROM AQUEOUS SOLUTION

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ABSTRACT

The used of papaya seed, fruit waste as the low-cost adsorbent was investigated as replacement for current costly methods of removing metals ions from aqueous solution. The removal of Pb(II) ions from aqueous solution onto physically and chemically treated papaya seed were studied at varying pH of metal ion solution (pH 3 – pH 5), adsorbent dose (0.06 g – 0.10 g) and contact time (15 minutes – 45 minutes) in batch mode. In chemically treated of papaya seed, the acetic acid was used as chemical activating agent to enhance the adsorption capacity of Pb(II) ions onto the adsorbent. Papaya seed from physically treated and chemically treated were also calcined at different temperature of 300°C, 400°C and 500°C to see its effect on surface area and pore size of adsorbent. Batch experiment were carried out to evaluate the adsorption capacity of Pb(II) ions onto papaya seed. The residual Pb(II) ions concentration after adsorption was analyzed using Atomic Absorption Spectroscopy (AAS). Characterization study on surface area and functional group of papaya seed were using Brunauer- Emmett- Teller (BET) and Fourier Transform Infrared (FTIR) respectively. The optimum pH for physically treated and chemically treated papaya seed were achieved at pH 3 and pH 5 respectively. Results indicates the removal efficiency for Pb(II) was about 99% using both treated papaya seed at adsorbent dose 0.10 g. The equilibrium was achieved at 15 minutes which the adsorption become saturated to maximum uptake capacity. Based on three parameter studied, chemically treated papaya seed at 500°C was the best adsorbent on the Pb(II) removal in aqueous solution.

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CHAPTER ONE

INTRODUCTION

1.1 **Research Background**

Nowadays, contamination due to wastewater discharged from domestic waste, agriculture activity, industrial waste and commercial properties become a huge problem and a great global concern (Chavan & Mane, 2013). The various industrial activities including mining, electroplating, manufacturing of batteries or galvanizing, paints, printing and etc. have caused serious environmental impacts toward the living organism especially human (Norhafizah et al., 2011). Wastewater streams from these industries contain many toxic heavy metals. For instance, Lead (Pb), Copper (Cu), Zinc (Zn), Chromium (Cr), Nickel (Ni) and etc. Toxic heavy metals contain in wastewater are non-degradable or persistent in nature. When the wastewater discharged directly into freshwater, they give high risk to aquatic ecosystem. Heavy metals are soluble in wastewater thus they can be adsorbed easily by aquatic organisms. When heavy metals adsorbed above allowable level, they could contribute to serious health diseases and syndromes (Tripathi & Rawat Ranjan, 2015).

The toxic heavy metals which are exist in high concentration must be effectively treated and removed from the wastewater. In recent years, many methods are introduced to treat toxic heavy metals in wastewater including reverse osmosis, chemical precipitation, ion exchange, ultrafiltration and electrodialysis (Tripathi & Rawat Ranjan, 2015). Even though the conventional methods are effective but there are some limitation such as high installation cost, high operational or maintenance cost and large sludge produced (Egila et al., 2011). Then, adsorption method is introduced by researchers as one of advanced treatment technologies for removal of heavy metals. Adsorption process involve mass transfer or transport of mass. Substance is transferred from molten phase to the solid surface in this process. They become physically or chemically bound interactions. Adsorption process is divided into two type; physical adsorption and chemical adsorption. For physical adsorption, Van der Waals forces attraction force the adsorbate to bind with adsorbent. While, chemical reaction between adsorbate and adsorbent are involved in chemical adsorption (Tripathi & Rawat Ranjan, 2015). The strong interaction between adsorbent and adsorbate creates covalent or ionic bond (Shukla et al., 2014).