ISSN 1913-1844 (Print)
ISSN 1913-1852 (Online)

MODERN APPLIED SCIENCE

Vol. 9, No. 7 July 2015 Special Issue

CANADIAN CENTER OF SCIENCE AND EDUCATION

Editorial Board

Contents

Contents

Modern Applied Science; Vol. 9, No. 7; 2015
ISSN 1913-1844 E-ISSN 1913-1852
Published by Canadian Center of Science and Education

The Effect of Crosslinker and Pore Generated on Selective Adsorbent (Cu^{2+}) based on Grafting of Acrylic Acid onto Cassava Starch

Judy R. B. Witono[1], Henrietta[1] & Y. I. P Arry Miryanti[1]

[1] Department of Chemical Engineering, Parahyangan Catholic University, Indonesia

Correspondence: Judy R. B., Witono, Department of Chemical Engineering, Parahyangan Catholic University, Bandung, 40141, Indonesia. E-mail: judy@unpar.ac.id/jretti@yahoo.com

Received: May 4, 2015 Accepted: June 5, 2015 Online Published: June 30, 2015

doi:10.5539/mas.v9n7p36 URL: http://dx.doi.org/10.5539/mas.v9n7p36

Abstract

The technology development in many industries nowadays, such as electronic industry produces heavy metal wastes which may pollute our environment. The use of adsorbent as a heavy metal removal from soil and water is one of the efficient process which can be considered to be used. In addition the release of the adsorbate becomes an important way as well because usually those heavy metals still have a high value. The objective of this research is to develop adsorbent based on cassava starch. So, the release process will become easier and will not produce another waste. The adsorbent was produced through the grafting of acrylic acid onto cassava starch by using Fenton initiator. To construct a stable 3-D network, the crosslinker (CL) N,N'- methylenebisacrylamide was added. The variable observed were the amount of CL added (0.5%; 1.5%; 2.5% and 3.5%) and the treatment of generating more pores on starch copolymer. The treatments on starch copolymer observed were single freezing, second freezing, and citric acid modification and carbonization methods. Analysis performed on the adsorbent was % add-on, water absorption and metal adsorption (especially Cu^{2+} ion) capacity. The result showed that the used of 2.5% CL produced the highest add-on (47.66 %), the highest water absorption capacity and the highest metal adsorption capacity (0.29g Cu^{2+}/g adsorbent) The citric acid modification also produced the highest pores on the adsorbent.

Keywords: adorbent, carbonization, cassava starch, crosslinker, freezing, heavy metal

1. Introduction

The adsorbent used nowadays in waste water treatment become more popular, since many industries produce a heavy metal disposal which most of time still has a high value. Petroleum-based adsorbent start to be replaced by biomass-based adsorbent like from orange waste (Pérez-Marín, A.B. et al. 2010), banana stem (Anirudhan, T.S. et al. 2012), sawdust (Naiya, T.K. et al. 2008) and other biomass (Arief, V.O. et al. 2008) which is known as biosoption. The basic mechanisms production of this adsorbent is through carbonization. The disadvantage using this type of adsorbent is the small size of the adsorbent which create a separation problem on the operation.

On the other side the use of natural product including biomass for the based-material of many products is an interesting aspect that should be considered in the near future. Indonesia is one of the country which produce a lots of natural resources whicharenotonly usefulas a foodbutalsoas anindustrial rawmaterial. One of the natural resources which has a unique properties as a natural polymer is starch. It can be disintegrated, assembly or modified into many kind of products. Starch can be found in almost every plant as seed, grain, cereal, tuber, root and legume. One of the starch resources which is easy to grow without intensive cultivation and also in dry area is cassava roots.

The degree of hydrolysis may control the pore size in the starch granule as have been done by Chen, G., et al. (2012) and Zhang, B., et al. (2012) using α-amylase and glucoamylase. And Qian, J., et al. (2011) combined ultrasonic and enzymatic hydrolysis in an attempt to enlarge the pores. The problem on this treatment is on the determination of the optimum degree of enzymatic hydrolisis and also sometimes the adsorbent dissolves in the mixture creating an additional waste.

In this work, the adsorbent is produced by attaching the acrylic acid monomer onto the macromolecule starch backbone and together with the crosslinker which is integrated inside the network creates a strong 3-D network