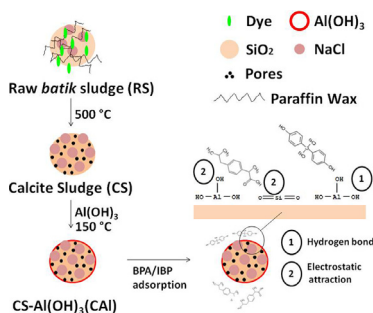


## Regular Article

Mesoporous silica from *batik* sludge impregnated with aluminum hydroxide for the removal of bisphenol A and ibuprofenChoe Earn Choong<sup>a</sup>, Shaliza Ibrahim<sup>b</sup>, Wan Jeffrey Basirun<sup>c,d,\*</sup><sup>a</sup> Department of Civil Engineering, Faculty of Engineering, University of Malaya, Kuala Lumpur 50603, Malaysia<sup>b</sup> Institute of Ocean and Earth Sciences (IOES), University Malaya, Kuala Lumpur 50603, Malaysia<sup>c</sup> Department of Chemistry, Faculty of Science, University of Malaya, Kuala Lumpur 50603, Malaysia<sup>d</sup> Institute of Nanotechnology and Catalysis Research (NanoCat), Institute of Postgraduate Studies, University of Malaya, Kuala Lumpur 50603, Malaysia

## GRAPHICAL ABSTRACT



## ARTICLE INFO

## Article history:

Received 23 October 2018

Revised 4 January 2019

Accepted 16 January 2019

Available online 17 January 2019

## Keywords:

Batik sludge  
Bisphenol A  
Ibuprofen  
Adsorption  
Silica

## ABSTRACT

The present study reports the removal of Bisphenol A (BPA) and Ibuprofen (IBP) using adsorbents prepared from *batik* sludge. The calcite sludge-aluminum hydroxide (CAI) adsorbent was prepared by calcination and followed by aluminum hydroxide impregnation. The *batik* sludge and prepared adsorbents were characterized by FESEM, TGA, XRD, FTIR and BET techniques. The maximum adsorption capacity, adsorption time, different initial solution pH, ionic strength and regeneration study of the adsorbents were also investigated. Furthermore, the sorption behavior of the pollutants were studied by the Langmuir and Freundlich isotherms. The deposition of  $\text{Al}(\text{OH})_3$  enhanced the BPA and IBP adsorption capacity on the CAI surface. The maximum removal capacity of BPA and Ibuprofen were  $83.53 \text{ mg g}^{-1}$  and  $34.96 \text{ mg g}^{-1}$  for the CAI adsorbent. In addition, the kinetic data for BPA and IBP were fitted to the pseudo first order, pseudo second order, Elovich, parabolic diffusion and power function equations to understand the sorption behavior. The adsorption behavior of BPA and IBP was mainly chemisorption. This study shows that CAI is a promising adsorbent for the removal of BPA and IBP.

© 2019 Elsevier Inc. All rights reserved.

## 1. Introduction

Persistent organic pollutants (POPs) are environmental pollutants according to the Stockholm convention, organized by the United Nations Environment Program (UNEP). POPs are not only present in the environment but have long half-lives which could accumulate in the food chain [1,2]. One of the most widespread

\* Corresponding author at: Department of Chemistry, Faculty of Science, University of Malaya, Kuala Lumpur 50603, Malaysia.

E-mail address: [jeff@um.edu.my](mailto:jeff@um.edu.my) (W.J. Basirun).