

CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME IV

Editors:

Ma'an Alkhatib
Abdullah Al Mamun
Faridah Yusof



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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(VOLUME IV)

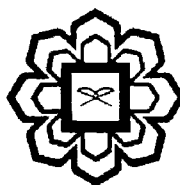
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**Department of Biotechnology Engineering
Faculty of Engineering
International Islamic University Malaysia**



IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
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Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Ma'an Alkhatib, Abdullah Al Mamun & Faridah Yusof: Current Research and Development in Biotechnology Engineering at IIUM Volume IV

ISBN: 978-967-418-136-9

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

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CHAPTER 24

DESIGN OF AN ADSORPTION SYSTEM FOR THE REMOVAL OF PHENOL FROM WATER USING ACTIVATED CARBON

Ma'an Alkhatib, Ahmad Tariq Jameel, Mohammad N. A. Alherbawi

Department of Biotechnology Engineering, Faculty of Engineering, International Islamic University Malaysia, Gombak, 50728 Kuala Lumpur, Malaysia.

ABSTRACT

The pollution of water resources due to organic contaminants - specifically phenols - has been causing worldwide concern. In this project, an adsorption column for the removal of phenol from water by activated carbon was modelled using COMSOL Multiphysics' software. The column was designed to be (0.5 m) in height with a diameter of (0.05 m) and the initial velocity and concentration entering the column were assumed to be (0.045 m/s) and (1.1 mmol/ m³) respectively. The concentration of phenol in this model was successfully reduced to (0.02 mmol/ m³) which is in line with the Malaysian standard. Moreover, the effect of various parameters such as particle radius, flow rate and bed porosity on effluent concentration was studied in detail. Besides, Langmuir and Freundlich models were used to determine the parameters which quantify the adsorption process.

Keywords: adsorption, phenols, COMSOL Multiphysics, Langmuir, Freundlich

INTRODUCTION

Several treatment methods, including chemical and biological, have been applied for the removal of organic compounds from waste water, but they have achieved limited success, due to the fact that the amount and variety of chemicals in waste water is ever increasing due to the expansion of chemical, pharmaceutical, and other industries. Thus, a considerable effort has been directed to model more efficient and effective technologies for their removal. Adsorption columns using activated carbons were modeled and developed, because of the high surface area, high microporous structure, and high reactivity of activated carbons. and the results have indicated that they are the potential adsorbents for the removal of organic compounds from the waste water (Bansal and Goyal, 2005).

The presence of organic contaminants, such as Phenol, in the water is of a great concern due to their toxicity to human and other living things. The health effects of phenol exposure to humans is almost exclusively limited to case reports of acute effects of oral exposure, or occupational exposures, including some exposure by inhalation, however, severe chronic poisoning manifested in systemic disorders such as digestive disturbances including vomiting, difficulty swallowing, ptyalism (excess secretion of saliva), diarrhea, and anorexia (Baker *et al.*, 1978; Brace *et al.*, 1987).

Phenol poisoning is associated with headache, fainting, dizziness, and mental