



UNIVERSITI PUTRA MALAYSIA

***EQUILIBRIUM AND KINETIC STUDIES ON REMOVAL OF PHENOLIC
COMPOUNDS USING ACTIVATED CARBON COATED MONOLITH***

ABDOLHOSSEIN SADRNIA

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**EQUILIBRIUM AND KINETIC STUDIES ON REMOVAL OF PHENOLIC
COMPOUNDS USING ACTIVATED CARBON COATED MONOLITH**

By

TEOH YI PENG

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfillment of the Requirements for the Degree of
Master of Science**

July 2014

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science.

EQUILIBRIUM AND KINETIC STUDIES ON REMOVAL OF PHENOLIC COMPOUNDS USING ACTIVATED CARBON COATED MONOLITH

By

TEOH YI PENG

July 2014

Chair: Prof. Ir. Thomas Choong Shean Yaw, Ph.D
Faculty: Engineering

Activated carbon coated monolith (ACCM) was prepared by dipcoating method using a polymer mixture (furfuryl alcohol, and poly ethylene glycol). The adsorptive performance of phenol, 4-chlorophenol (4-CP), 2,4-dichlorophenol (2,4-DCP) onto the ACCM was comparatively evaluated by batch mode. Experiments were carried out at varying pH, contact time, initial adsorbate concentration and reaction temperature. Regeneration performance of ACCM was also assessed. This study showed an optimum adsorption for 2,4-DCP, followed by 4-CP, and phenol at pH 5. The adsorption equilibrium time for phenol, 4-CP, 2,4-DCP were 600 min, 500 min, and 400 min, respectively. The equilibrium adsorption capacity were increased 50.3 - 62.9 mg/g (phenol), 88.9 - 111.5 mg/g (4-CP), and 89.9 - 117.5 mg/g (2,4-DCP), respectively at an increasing initial concentration of 400 – 600 mg/L. The adsorption was monolayer as depicted by linear and non-linear isotherm models. The adsorption kinetics was best represented by the pseudo-second order kinetics model. The adsorption capacity increases with increasing reaction temperature from 30 to 50°C, showing an endothermic process. Excellent recovery of phenol was observed during regeneration using ethanol, which showed an 81% efficiency after four consecutive cycles.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**KAJIAN KINETIK DAN KESEIMBANGAN KE ATAS PENYINGKIRAN
KUMPULAN FENOLIK MENGGUNAKAN MONOLIT KARBON
BERSALUT TERAKTIF**

Oleh

TEOH YI PENG

Julai 2014

Pengerusi: Prof. Ir. Thomas Choong Shean Yaw, Ph.D
Fakulti: Kejuruteraan

Monolit bersalut karbon aktif (ACCM) digunakan untuk mengkaji prestasi penyerapan ke atas fenolik compound seperti fenol, 4-klorofenol (4-CP) dan 2, 4-diklorofenol (2, 4-DCP). Eksperimen telah dikaji berdasarkan beberapa parameter seperti, pH, masa sentuhan, kepekatan awal fenol dan suhu larutan. Kajian pemulihan juga dijalankan dalam kajian ini. Keupayaan penyerapan bagi CCM terhadap 2, 4-DCP adalah lebih baik berbanding dengan penyerapan 4-CP dan diikuti dengan fenol pada nilai pH 5.. Kajian-kajian masa sentuh menunjukkan masa penyeimbangan penyerapan fenol, 4-CP dan 2, 4-DCP adalah berada pada 600 min, 500 min, dan 400 min. Kajian keseimbangan penyerapan menunjukkan peningkatan julat kepekatan 400 - 600 ppm telah menyebabkan nilai penyerapan meningkat dari 50.3 - 62.9 mg/g bagi fenol, 88.9 - 111.5 mg/g bagi 4-CP, dan 89.9 - 117.5mg/g bagi 2,4-DCP. Kajian isoterma linear dan bukan-linear mendapati data keseimbangan penyerapan fenolik compound adalah mematuhi model isoterma Langmuir. Kajian kinetik menunjukkan model kinetic psuedo tertib kedua mempunyai prestasi yang memuaskan. Kajian termodinamik menunjukkan tindak balas antara fenolik compound dengan ACCM adalah endotermik. Nilai penyerapan meningkat dengan peningkatan suhu dari 30°C sehingga 50°C. Kajian penyah-serapan dan pemulihan menunjukkan CCM berupaya untuk digunakan semula selepas pemulihan. Kesimpulannya, etanol, sebagai bahan penyah-serapan menunjukkan hasil kecekapan pemulihan yang baik sehingga mampu mencapai 81% walaupun berada pada kitaran keempat.

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I certify that a Thesis Examination Committee has met on 23 July 2014 to conduct the final examination of TEOH YI PENG on his thesis entitled "Equilibrium And Kinetic Studies on Removal of Phenolic Compounds Using Activated Carbon-Coated Monolith" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

Tinia Idaty Mohd. Ghazi, PhD

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Department of Chemical and Environmental Engineering
Faculty of Engineering
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Suraya Abdul Rashid, PhD

Associate Professor
Department of Chemical and Environmental Engineering
Faculty of Engineering
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Department of Chemical and Environmental Engineering
Faculty of Engineering
Universiti Putra Malaysia
(Internal Examiner)

Marappa Gounder Ramasamy, PhD

Professor
Universiti Teknologi Petronas
Malaysia
(External Examiner)



NORITAH OMAR, PhD

Associate Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 18 August 2014

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Thomas Choong Shean Yaw, Ph.D

Professor
Faculty of Engineering
University Putra Malaysia
(Chairman)

Luqman Chuah Abdullah, Ph.D

Professor
Faculty of Engineering
University Putra Malaysia
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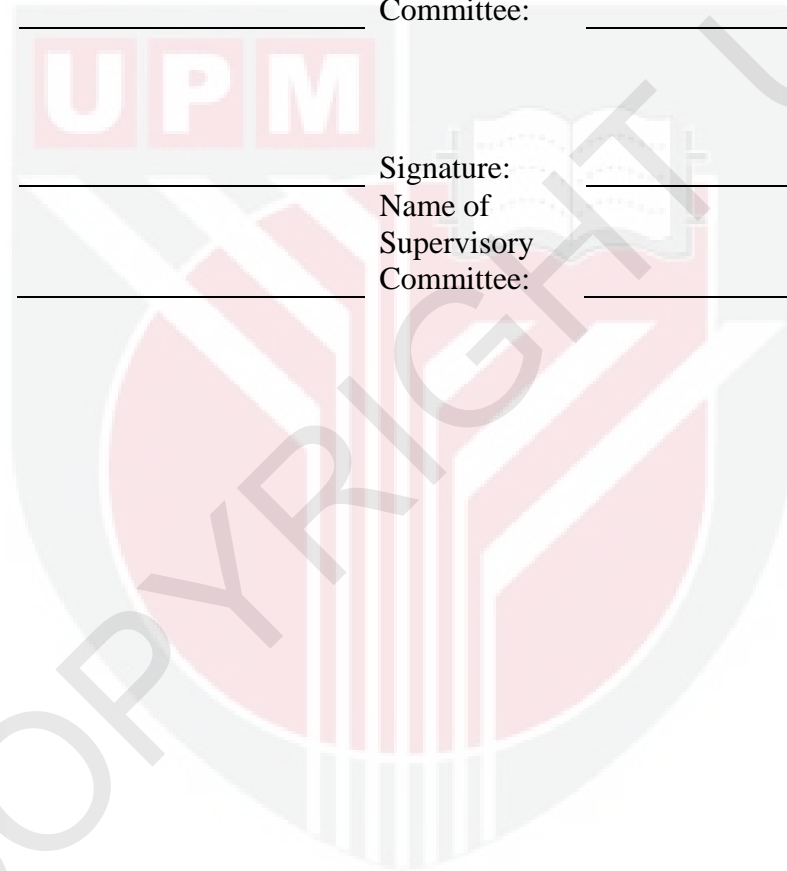


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