UNIVERSITI PUTRA MALAYSIA

EXTRACTION OF DRAGON FRUIT (Hylocereus polyrhizus) FOLIAGE ACTIVE COMPOUND FOR WATER TREATMENT

MOHD RASIDE BIN SHAFAD

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By

MOHD RASIDE BIN SHAFAD

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilmant of the Requirement for Degree of Master of Science

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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

EXTRACTION OF DRAGON FRUIT *(Hylocereus polyrhizus)* FOLIAGE ACTIVE COMPOUND FOR WATER TREATMENT

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November 2013

Chairman: Intan Salwani Ahamad, PhD
Faculty: Engineering

Coagulant plays a significant role in water treatment. It is used to remove the turbidity in raw water. Nowadays, natural coagulants have become interest to many researchers due to the facts that they are in abundance source, cheap, has multifunction, biodegradable and safe for human health. In this study, the potential of dragon fruit foliage (DFF) as natural coagulant was investigated. The experiments were done using standard jar test method. The coagulation process using DFF at various parameters for distilled water extraction method was done. It was found that the parameter such as drying temperature, pH, dosage, initial turbidity, and sedimentation time did have effect on coagulation process using DFF. Then, extraction of DFF active compound using different types of extraction method was carried out. It was found that the best method to extract DFF active compound was using distilled water at 60˚C where 94.4% of turbidity removal can be achieved at the dosage of 10 mg/L. Further application using surface water was found that the performance of DFF in turbidity and TSS removal was comparable with commercial alum. Lastly, the performance of DFF in coagulation process was verified using its active compound. It is believed that the main active compound of DFF is carbohydrate. The analysis for total carbohydrate content was consistent with those results obtained from jar test where extraction using distilled water at 60˚C has the highest soluble carbohydrate content and this explain why it has the highest coagulation efficiency. The result from zeta potential analysis and SEM analysis suggest that adsorption and interparticle bridging mechanism is the main mechanism of DFF in coagulation process. As a conclusion, DFF has a bright future and good potential for application in water treatment.

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

PENGEKSTRAKAN SEBATIAN AKTIF DEDAUN BUAH NAGA *(Hylocereus polyrhizus)* UNTUK RAWATAN AIR

Oleh

MOHD RASIDE BIN SHAFAD

November 2013

Pengerusi: Intan Salwani Ahamad, PhD
Faculti: Kejuruteraan

Penggumpal memainkan peranan penting dalam rawatan air. Ia digunakan untuk membuang kekeruhan di dalam air mentah. Kini, penggumpal semula jadi telah menarik minat ramai penyelidik kerana sumbernya yang banyak, murah, kepelbagaian fungsi, mesra alam dan selamat untuk kesihatan manusia. Dalam kajian ini, potensi dedaun buah naga (DFF) sebagai penggumpal semulajadi dikaji. Kajian ini dilakukan dengan menggunakan kaedah ujian balang. Proses penggumpalan menggunakan DFF pada pelbagai parameter untuk kaedah pengekstrakan menggunakan air suling dilakukan. Kajian ini mendapati bahawa parameter seperti suhu pengeringan, pH, dos, kekeruhan awal, dan masa pemendapan memang mempunyai kesan ke atas proses penggumpalan menggunakan DFF. Seterusnya, pengekstrakan sebatian aktif DFF menggunakan pelbagai kaedah pengekstrakan telah dijalankan. Kajian mendapati bahawa kaedah yang terbaik untuk mengekstrak sebatian aktif DFF adalah dengan menggunakan air suling pada suhu 60˚C di mana 94.4% daripada penyingkiran kekeruhan boleh dicapai pada dos 10 mg/L. Aplikasi selanjutnya menggunakan air permukaan mendapati bahawa prestasi DFF dalam penyingkiran kekeruhan dan TSS adalah setanding dengan tawas komersial. Akhir sekali, prestasi DFF dalam proses penggumpalan disahkan melalui sebatian aktifnya. Adalah dipercayai bahawa sebatian aktif utama bagi DFF adalah karbohidrat. Analisis untuk jumlah kandungan karbohidrat adalah konsisten dengan keputusan yang diperolehi daripada ujian balang di mana pengekstrakan menggunakan air suling pada suhu 60˚C mempunyai kandungan karbohidrat larut yang paling tinggi dan ini menjelaskan mengapa ia mempunyai kecekapan penggumpalan yang tertinggi. Hasil daripada analisis potensi zeta dan analisis SEM mencadangkan bahawa penjerapan dan ikatan rantai antara zarah adalah mekanisme utama DFF dalam proses penggumpalan. Kesimpulannya, DFF mempunyai masa depan yang cerah dan mempunyai potensi yang baik untuk diaplikasikan dalam rawatan air.

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I certify that a Thesis Examination Committee has met on 13th November 2013 to conduct the final examination of Mohd Raside bin Shafad on his thesis entitled "Extraction of Dragon Fruit (*Hylocereus polyrhizus*) Foliage Active Compound for Water Treatment" 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.

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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:

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TABLE OF CONTENTS