

PRODUCTION OF ACTIVATED CARBON FROM WASTE WATERMELON
PEEL USING MICROWAVE PYROLYSIS

By
LIM XIN YI

A PITA research submitted in partial fulfilment of
the requirements for the award of the degree of
Bachelor of Technology (Environment)

SCHOOL OF OCEAN ENGINEERING
UNIVERSITI MALAYSIA TERENGGANU
2016



**SCHOOL OF OCEAN ENGINEERING
UNIVERSITI MALAYSIA TERENGGANU**

VERIFICATION AND APPROVAL FORM

This PITA research report entitled *Production of Activated Carbon from Waste Watermelon Peel Using Microwave Pyrolysis* prepared and submitted by Lim Xin Yi, Matric No. UK29551 in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (Environment) has been examined and is recommended for approval of acceptance.

Approved by:

.....
Supervisor

Name: Dr. Lam Su Shiung

Official Stamp:

Date: 6/6/2016.....

LAM SU SHIUNG
Pensyarah
Pusat Pengajian Kejuruteraan Kelautan
Universiti Malaysia Terengganu
21030 Kuala Terengganu

.....
Head of Environmental Technology Program

Name: Prof. Dr. Ir. Ahmad bin Jusoh


Official Stamp:

PROF. DR. IR. AHMAD BIN JUSOH
Dean
School Of Ocean Engineering
Universiti Malaysia Terengganu

Date: 7/6/2016.....

DECLARATION

I hereby declare that this PITA research report entitled *Production of Activated Carbon from Waste Watermelon Peel Using Microwave Pyrolysis* is the result of my own research except as cited in the references.

Signature : 

Name : LIM XIN YI

Matric No. : UK29551

Date : 21 June 2016

ACKNOWLEDGEMENTS

First of all, I would like to extend my deepest gratitude to my final year project supervisor, Dr Lam Su Shiung. I am thankful for his insight, supervision, cooperation and advices throughout my final year. I am grateful that I managed to accomplish the final year project within the last two semesters in my final year and I successfully produced my final year project report.

My sincere appreciation also goes to Mr Liew Rock Keey for all the guidance and encouragement which make the process can be done smoothly. Furthermore, great appreciation also goes to all the staffs in thermodynamic lab, wastewater lab and KAP lab for their cooperation and assistance during this period.

As for the final year project supervisor, Dr Wan Rafizah, I thank you for all the advises and guidance that make sure us can complete our project on time. Last but not least, I would like to extend my appreciation to the most precious person in my life, my mother as well as friends and family for their love, care, and moral support from time to time.

The final year project was very enriching and fruitful as the personnel listed above had been very helpful in sharing their technical knowledge of the different jobs, and their scope of duty.

PRODUCTION OF ACTIVATED CARBON FROM WASTE WATERMELON PEEL USING MICROWAVE PYROLYSIS

ABSTRACT

Activated carbon represents a porous carbon material with high surface area and porosity. Due to its characteristic of high level of adsorption capacity, it is used widely in many industrial applications such as water treatment, catalysis, fuel cells, and others. A large quantity of watermelon are produced every year in Malaysia which have led to the large quantities of fruit wastes generation and brought adverse impacts to the environment. The waste watermelon peel is normally used as cattle feed and fertilizer while the remaining quantity will be disposed through combustion or landfilling. Recently, pyrolysis is a promising technique to convert the agricultural waste into a useful material instead of discarded to the environment. This study is aimed to evaluate the feasibility of microwave pyrolysis process for the preparation of good quality of activated carbon from waste watermelon peel via chemical activation method. The influences of impregnation ratio on the adsorption capacity, carbon yield, BET surface area, porosity, and thermal stability of activated carbon were investigated. The impregnation ratio is found to have significant effect in producing good quality of activated carbon. It is because impregnation ratio is important for pores development on the activated carbon which in turns affects the adsorption capacity. Impregnation ratio from 100 wt% to 300 wt% were used in each sets of experiment to determine the effects on the quality of activated carbon. In conclusion, waste watermelon peel was anticipated to be a suitable raw material in producing high quality of activated carbon with high content of carbon, thermal stability, BET surface area, and porosity.

PENYEDIAAN KARBON AKTIF DARI SISA KULIT TEMBIKAI MELALUI MICROWAVE PIROLISIS

ABSTRAK

Karbon aktif merupakan satu bahan karbon berliang yang mempunyai keluasan permukaan yang tinggi. Disebabkan oleh sifatnya yang mempunyai kapasiti penyerapan yang tinggi, karbon aktif sesuai digunakan dalam pelbagai jenis aplikasi dalam industry seperti rawatan air, pemangkinan, sel-sel bahan api, dan sebagainya. Setiap tahun, kuantiti tembikai yang dihasilkan di Malaysia adalah sangat besar dan menyebabkan kuantiti sisa kulit tembikai yang besar telah dihasilkan lalu membawa impak negative terhadap alam sekitar. Sisa kulit tembikai yang telah dihasilkan akan menjadi sebagai makanan lembu dan baja manakala baki kuantiti yang besar akan dilupuskan melalui pembakaran atau dikumpulkan di tapak pembuangan sampah. Oleh itu, pirolisis adalah teknik yang lebih sesuai untuk menukar sisa pertanian ini kepada bahan yang berguna daripada pembuangan ke alam sekitar. Kajian ini bertujuan untuk menilai kemungkinan penyediaan karbon aktif yang berkualiti tinggi melalui proses pirolisis mikrogelombang dengan kaedah pengaktifan kimia. Pengaruh yang ketara daripada nisbah penghamilan kepada kapasiti penyerapan, hasil karbon, luas permukaan BET, keliangan, dan kestabilan terma karbon aktif sudah disiasat. Nisbah penghamilan dijangka mempunyai kesan yang besar dalam penghasilan karbon aktif yang berkualiti tinggi. Oleh kerana nisbah penghamilan adalah penting untuk liang pembangunan pada karbon aktif dan ia mempengaruhi kapasiti penyerapan. Nisbah penghamilan yang diguna adalah pada nisbah 100 wt% kepada 300 wt% dalam setiap set uji kaji untuk menentukan kesan pada kualiti karbon aktif. Kesimpulannya, sisa kulit tembikai telah dijangka menjadi bahan mentah yang sesuai dalam menghasilkan karbon aktif yang berkualiti tinggi dengan kandungan karbon yang tinggi, kestabilan terma, luas permukaan BET, dan keliangan.