

UTILIZATION OF YEAST METABOLITES FOR BIOATTRACTION OF COCKROACH

OMOREGBEE AIGBOSIOMWAN

A dissertation submitted in partial fulfillment of the
requirements for the award of the degree of
Master of Science (Biotechnology)

Faculty of Biosciences and Bioengineering
Universiti Teknologi Malaysia

JANUARY 2013

*To my beloved family,
thank you for being there for me*

ACKNOWLEDGEMENTS

In preparing this thesis, I was in contact with many people of different fields. Without their help, I believe this project would not have been the same as presented here.

First and foremost, I wish to seize this opportunity to express my sincere appreciation to my thesis supervisor, Dr. Chan Giek Far for her guidance, encouragement, advice, time and a wealth of new knowledge that will be invaluable to my future endeavors.

I wish to also thank my research colleagues (Fahmi and Hasima), the Management and Staff of the Microbiology and Instrument Laboratories, Shelly Restaurant (FAB Meranti), Kolej Tun Ghafar Baba and Kolej Dato' Onn Jaafar residential halls for their wonderful support.

Last but by no means the least, I wish to thank my beloved family for standing by my side both in rain and shine.

ABSTRACT

Cockroaches are among the most persistent pests that thrive in protected locations all over the world. Cockroach control using insecticides and other chemicals are not desirable because they are toxic to organisms and the environment. Pests can develop resistance to the chemicals, and chemical raw materials are from unsustainable source. This study was aimed to identify the novel potential of locally isolated yeasts, namely *Pichia kudriavzevii* M12 and *Candida ethanolica* M2 in cockroach attraction. The yeasts were fermented in potato dextrose broth (PDB) up to a week and tested for bioattraction of cockroaches at six locations at the student residential halls at Universiti Teknologi Malaysia (Johor, Malaysia). Either the 1-day or 4-day fermented broth from the yeasts were placed as the baits on sticky trap overnight in order to attract cockroaches. Freeze drying on the fermented broth was carried out and the resultant powder was sprinkled on the cockroach trap and tested for cockroach attraction. PDB was used as control. The 4-day fermented PDB of *P. kudriavzevii* M12 was found to be the better cockroach attractant, which trapped the highest number of both nymphs and adult cockroaches (an average of 48 cockroaches per catch). Successive attraction was done consecutively at the same location after two weeks, which resulted in a decrease of almost 80% of the cockroach population at the studied location. The metabolites in the 4-day fermented PDB of *P. kudriavzevii* M12 were profiled by liquid chromatography-mass spectrometry (LC-MS/MS), thus revealing the presence of secondary metabolites from the yeast strain for cockroach attraction. A total of 44 exometabolites with diverse properties and structures were identified and many were intermediates and products of the central metabolic pathway such as lipids, carboxylic acids and esters. In conclusion, *P. kudriavzevii* M12 showed a great potential as an eco-friendly cockroach attractant and the attraction could be as a result of the metabolites produced.

ABSTRAK

Lipas adalah antara perosak yang paling sering ditemui di pelbagai lokasi yang dilindungi di seluruh dunia. Kawalan terhadap lipas menggunakan racun serangga dan bahan kimia lain tidaklah diterima disebabkan oleh ketoksikan kepada organisma dan persekitaran. Perosak boleh membangunkan rintangan kepada bahan kimia, dan bahan-bahan mentah kimia adalah dari sumber yang tidak mapan. Kajian ini bertujuan untuk mengenal pasti potensi baru yis tempatan terpencil, iaitu *Pichia kudriavzevii* M12 dan *Candida ethanolica* M2 sebagai tarikan lipas. Yis telah ditapai dalam *potato dextrose broth* (PDB) sehingga seminggu dan diuji untuk tarikan lipas di enam lokasi di kediaman pelajar di Universiti Teknologi Malaysia (Johor, Malaysia). Sampel yang telah ditapai selama 1 hari dan 4 hari diletakkan sebagai umpan perangkap yang lekit untuk menarik lipas selama semalaman. Kering beku sampel yang ditapai telah dijalankan dan serbuk yang terhasil dipercikkan pada perangkap lipas dan diuji untuk tarikan lipas. Eksperimen kawalan dijalankan menggunakan PDB sahaja. Sampel yang ditapai selama 4 hari oleh *P. kudriavzevii* M12 didapati menjadi umpan lipas yang lebih baik, yang berjaya memerangkap bilangan tertinggi anak dan lipas dewasa (purata 48 lipas setiap tangkapan). Tarikan dilakukan berturutan di lokasi yang sama selepas dua minggu, yang mengakibatkan pengurangan populasi lipas sebanyak hampir 80% di lokasi yang dikaji. Metabolit dalam sampel PDB yang ditapai pada hari ke-4 oleh *P. kudriavzevii* M12 telah dikajikan menggunakan kromatografi cecair-spektrometri jisim (LC-MS/MS) mendedahkan bahawa terdapatnya metabolit sekunder dari yis. Sebanyak 44 metabolit dengan ciri-ciri dan struktur yang pelbagai telah dikenalpasti dan sebahagiannya adalah perantara dan produk laluan metabolik pusat seperti lemak, asid karbosilik dan ester. Kesimpulannya, *P. kudriavzevii* M12 menunjukkan potensi yang besar sebagai umpan lipas yang mesra alam dan tarikan adalah disebabkan oleh metabolit yang dihasilkan.