

THE EFFECTIVENESS OF GARBAGE ENZYME AND EFFECTIVE  
MICROORGANISMS (EM) SOLUTION IN WATER TREATMENT.

OOI YING CHEING

FACULTY OF MARITIME STUDIES AND MARINE SCIENCE  
UNIVERSITI MALAYSIA TERENGGANU

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PERPUSTAKAAN SULTANAH NUR ZAHIRAH  
UNIVERSITI MALAYSIA TERENGGANU (UMT)  
21030 KUALA TERENGGANU

1100088850		

Lihat sebentar

HAK MILIK  
PERPUSTAKAAN SULTANAH NUR ZAHIRAH UMT

THE EFFECTIVENESS OF GARBAGE ENZYME AND  
EFFECTIVE MICROORGANISMS (EM) SOLUTION IN WATER TREATMENT.

By

OOI YING CHEING  
UK 16962

Research Report submitted in partial fulfillment of  
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DEPARTMENT OF MARINE SCIENCE  
 FACULTY OF MARITIME STUDIES AND MARINE SCIENCE  
 UNIVERSITI MALAYSIA TERENGGANU

**DECLARATION AND VERIFICATION REPORT**  
**FINAL YEAR RESEARCH PROJECT**

It is hereby declared and verified that this research report entitled:  
**THE EFFECTIVENESS OF GARBAGE ENZYME AND EFFECTIVE MICROORGANISMS (EM) SOLUTION IN WATER TREATMENT.**  
 by **OOI YING CHEING**, Matric No. **UK16962** have been examined and all errors identified have been corrected. This report is submitted to the Department of Marine Science as partial fulfillment towards obtaining the Degree of Marine Science, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

Verified by:

  
 .....  
**DR. HING LEE SIANG**  
 Penyelaras Program  
 Sarjana Muda Sains (Sains Samudera)  
 Jabatan Sains Marin  
 Fakulti Pengajian Maritim dan Sains Marin  
 Universiti Malaysia Terengganu  
 (UMT)

Principal Supervisor

Name: Dr. Hing Lee Siang

Official stamp:

Date: 27/4/11

.....  
 Second Supervisor (where applicable)

Name:

Official stamp:

Date: .....

  
 .....  
 Head of Department of Marine Science

Name: Dr. Razak bin Zakariya

Official stamp:

**DR. RAZAK ZAKARIYA**  
 Ketua Jabatan Sains Marin  
 Fakulti Pengajian Maritim dan Sains Marin  
 Universiti Malaysia Terengganu  
 (UMT)

Date: 27/4/11

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## LIST OF ABBREVIATIONS

%	-	Percentage
°C	-	Degree Celsius
ANOVA	-	Analysis of Variance
BOD	-	Biological Oxygen Demand
COD	-	Chemical Oxygen Demand
DO	-	Dissolved Oxygen
EM	-	Effective Microorganisms
EMRO	-	Effective Microorganisms Research Organization
g	-	Gram
GE	-	Garbage Enzyme
L	-	Liter
mg	-	Milligram
mg/L	-	milligram per liter
mL	-	Milliliter
NH <sub>3</sub>	-	Ammonia
NO <sub>2</sub>	-	Nitrite
NO <sub>3</sub>	-	Nitrate
RAS	-	Recirculating Aquaculture Systems
ss	-	Suspended Solids
UMT	-	University Malaysia Terengganu

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## ABSTRACT

Laboratory incubation experiments were conducted to study the influence of Effective Microorganisms (EM) and Garbage Enzyme (GE) on the removal of ammonia ( $\text{NH}_3$ ). Accumulation of nitrite ( $\text{NO}_2$ ) and nitrate ( $\text{NO}_3$ ) from the reduction of  $\text{NH}_3$  were observed for duration of 96 hours. Analysis were made each 24 hours to determine the changes of concentration using Indophenols Blue Colorimetric Method for  $\text{NH}_3$  analysis, Photometric Detection Method for  $\text{NO}_2$  analysis and Screening Method for  $\text{NO}_3$  analysis, certified from APHA standard method. Both studies showed promising removal efficiency of  $\text{NH}_3$  with removal efficiency above 90 % at 96<sup>th</sup> hour after treatment with EM/GE. The result indicates positively that nutrient recycling is possible by converting  $\text{NH}_3$  to  $\text{NO}_3$  with treatment of EM/GE. It is deduced that treatment with GE with concentration ranging from 0.4 % - 0.8 % as a new alternative in treatment of  $\text{NH}_3$ . The performance of GE in treatment of  $\text{NH}_3$  can be enhanced through enzymatic engineering in future research.

## Keberkesanan Enzim Sampah dan Larutan Mikroorganisme Berkesan

### Dalam Rawatan Air

#### **ABSTRAK**

Eksperimen inkubasi ini telah dijalankan dalam skala makmal untuk mengkaji pengaruh Mikroorganisme Berkesan (EM) dan Enzim Sampah (GE) dalam pengurangan ammonia ( $\text{NH}_3$ ). Akumulasi nitrite ( $\text{NO}_2$ ) dan nitrate ( $\text{NO}_3$ ) melalui pengurangan ammonia telah diperiksa sepanjang 96 jam. Perubahan kepekatan  $\text{NH}_3$  dikaji dalam tempoh setiap 24 jam dengan menggunakan kaedah Indophenols Blue Colorimetric,  $\text{NO}_2$  analisis dengan menggunakan kaedah Photometric Detection, manakala analisi  $\text{NO}_3$  dengan menggunakan kaedah Screening dimana kaedah-kaedah ini telah disetujui oleh kaedah standard APHA. Kedua-dua kajian ini menunjukkan kecekapan EM/GE dalam mengurangkan  $\text{NH}_3$  sebanyak 90 % dalam masa 96 jam. Keputusan ini telah menunjukkan kebolehan EM/GE dalam penukaran  $\text{NH}_3$  kepada  $\text{NO}_3$  yang penting dalam kitaran nutrient. Kajian ini menyimpulkan bahawa GE pada kepekatan 0.4 % - 0.8 % sebagai alternatif dalam perubatan  $\text{NH}_3$ . Pretasi GE dalam perubatan  $\text{NH}_3$  boleh ditingkatkan lagi melalui kejuruteraan enzim pada masa akan datang.