

UNIVERSITI TEKNOLOGI MARA

**NITRATES IN RURAL DRINKING WATER SUPPLY AND
ITS POTENTIAL HEALTH RISK**

BENARD MAOH ANAK PETER DATU

BENARD MAOH ANAK PETER DATU

**Project paper submitted in partial fulfillment of the requirements
for the degree of
Bachelor in Environmental Health and Safety (Hons.)
BACHELOR IN ENVIRONMENTAL HEALTH AND
SAFETY (HONS.)**

Faculty of Health Sciences

JUNE 2013

Declaration by Student

Approval by supervisor

Project entitled "Nitrates In Rural Drinking Water Supply and Its Potential Health Risk" is a presentation of my original research work. Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature, and acknowledgement of collaborative research and discussions. The project was done under the guidance of Mr. Hashim Bin Ahmad as Project Supervisor and Mr. Samsudin Bin Zawawi as Co-supervisor. It has been submitted to the Faculty of Health Sciences in partial fulfillment of the requirement for the Degree of Bachelor in Environmental Health and Safety (Hons).

Accepted to be evaluated by:

(En Hashim Bin Ahmad)

Student's Signature:

.....
Benard Maoh Anak Peter Datu
2010633998
Date: 890207-13-6157

Date: 19th July 2013

TABLE OF CONTENTS
ACKNOWLEDGEMENT

TITLE PAGE

PAGE

ACKNOWLEDGEMENT

I would like to express my gratitude to Almighty God for His blessing and allowing me to complete this final year project.

LIST OF FIGURES

My higher appreciation goes to the Project Supervisor, Mr Hashim Bin Ahmad and my Co-Supervisor, Mr. Samsudin Bin Zawawi for guiding and inspiring me until the ideas can be generated to complete papers and all the lecturers who has give their advices and suggestions for this study.

CHAPTER ONE: INTRODUCTION

I would also like to express my gratitude to the Environmental Health Department laboratory staffs, Mr. Azwad and Madam Maziah for giving me the knowledge on laboratory analysis before I fly to Sarawak to carry out this project. Without their knowledge and assistance this study would not been successful.

1.4 Research hypothesis

Do not forget to all my friends who have supported me especially Nur Hasziana Bt Hassim and Sherilene Anne Rogie for their loyalty toward maintaining our friendship.

CHAPTER TWO: LITERATURE REVIEW

My gratitude is also dedicated to my father, Mr. Peter Datu and my late mother, Mdm Betty Tom (recently passed away) as well as members of my family that have encouraged, love and support me. To all who were involved in the completion of this project, I sincerely thank all of you. Hope you receive the due rewards for all that have given and done. Hopefully this study can give benefits to all of us.

2.5 Chemical indicator

2.6 Nitrogen cycle in the environment

2.7 Environmental fate

2.8 Major uses of nitrate,

2.9 Nitrates effect to environment

2.10 Source of nitrate in drinking water

2.11 High nitrate content and the effect to human

2.12 Standards guideline

2.13 Study framework

CHAPTER THREE: RESEARCH METHODS

TABLE OF CONTENTS

TITLE PAGE	PAGE
ACKNOWLEDGEMENT	I
TABLE OF CONTENTS	ii
LIST OF TABLES	iv
LIST OF FIGURES	v
LIST OF APPENDICES	vi
LIST OF ABBREVIATION	vii
ABSTRACT	viii
CHAPTER ONE: INTRODUCTION	
1.1 Introduction	1
1.2 Study background	2
1.3 Problem statement	3
1.4 Research hypothesis	3
1.5 Research objective	3
1.6 Significant of the study	4
1.7 Definition of terms	5
CHAPTER TWO: LITERATURE REVIEW	
2.1 Importance of water	8
2.2 Water quality	9
2.3 Surface water	10
2.4 Water supply	11
2.5 Chemical indicator	11
2.6 Nitrogen cycle in the environment	12
2.7 Environmental fate	14
2.8 Major uses of nitrate	15
2.9 Nitrates effect to environment	15
2.10 Source of nitrate in drinking water	16
2.11 High nitrate content and the effect to human	16
2.12 Standards guideline	17
2.13 Study framework	18

ABSTRACT

NITRATES IN RURAL DRINKING WATER SUPPLY AND ITS POTENTIAL HEALTH RISK

A case study in Kampung Raso 1, Lundu Sarawak

BENARD MAOH ANAK PETER DATU (2010633998)

Introduction: *Nitrates In Rural Drinking Water Supply and Its Potential Health Risk* had been chosen as the topic for this study to explore the status of water supply in terms of its quality and suitability for human consumption. This study takes place at Kampung Raso 1, located at Lundu District, Kuching Division, Sarawak. Kampung Raso 1 is among the villages that still rely on surface water directed over Gravity Fed System pipe to every house within the village. **Objective:** The general objective of the study is to examine the nitrate level in rural GFS drinking water supply. The specific objectives are 1) to compare the nitrates level with the standard set in the Malaysian National Drinking Water Quality Standard (NDWQS), conduct health risk assessment and 3) identify the practices, devices and condition that can contribute to high level of nitrates in drinking water. **Methodology:** 32 water sampling points have been selected to test for nitrate level. These 32 samples represent each house in the village, 100% of total houses in Kampung Raso 1. The water samples were brought to the laboratory for analysis of nitrate. Method 8039 using HACH DR2800 instrument was applied in this study to test for nitrate level. **Results:** The mean \pm SD of nitrate level in drinking water supply of this study was $7.939 \pm 1.194 \text{ mg L}^{-1}$. It ranged between 7.509 to 8.370 mg L^{-1} . Statistical analysis using SPSS One Sample T-Test was used to compare nitrate levels in Kampung Raso 1 with standard set in the Malaysian National Drinking Water Quality Standard (NDWQS). The health risk exposure of nitrate was calculated as Chronic Daily Intake (CDI) and Hazard Index (HI) in this study. The Mean \pm SD for CDI was $0.336 \pm 0.101 \text{ mg kg day}^{-1}$, with the average body weight of 61 and daily water intake of 2.594 L day^{-1} . Hazard Index (HI) was calculated by dividing the CDI value with Reference Dose (RfD). US EPA (2013) state that the reference Dose (RfD) for nitrate is 1.6 mg kg^{-1} . According to New Jersey Department of Environmental Protection 2007 (as cited in Jamaludin *et al.*, 2013), the HI value greater than 1 indicated a potential for an adverse health effect to occur. The HI values for all respondents in this study were less than 1, with the Mean \pm SD was 0.210 ± 0.063 . **DISCUSSION:** The Mean \pm SD for nitrate level, $7.939 \pm 1.194 \text{ mg L}^{-1}$ shows that the level was still considered as normal value. Nitrate concentrations in all water sampling points were below the maximum allowable limit of the Malaysian National Drinking Water Standard (10 mg L^{-1}). **CONCLUSION:** Nitrate level in rural drinking water supply, particularly in the form of gravity feed system pipe at Kampung Raso 1 Lundu, Sarawak is within the acceptable limit. Although nitrate level was low in this study, but effort to minimize any further exposure of nitrate towards human as well as ecosystem and environment should be put as vital concern. Monitoring should be done as frequent as possible. Villages must learn how to manage or minimize the use of fertilizer containing high level of nitrate.

Untuk mengurangkan pendedahan nitrat kepada manusia serta ekosistem dan alam sekitar haruslah dititikberatkan. Pemantauan perlu dilakukan sekerap mungkin. Penduduk kampung perlu belajar bagaimana untuk menguruskan atau mengurangkan penggunaan baja yang mengandungi tahap nitrat yang tinggi.