

# EFFECT OF WATER BASED THERAPY ON WATER QUALITY OF HOT SPRING IN SUNGAI SERAI, HULU LANGAT

NUR SUHAILAH BINTI ABDUL MANAN

FH 2018 32

### EFFECT OF WATER BASED THERAPY ON WATER QUALITY OF HOT SPRING IN SUNGAI SERAI, HULU LANGAT.



By

NUR SUHAILAH BINTI ABDUL MANAN

A Project Report Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Forestry Science in Faculty of Forestry, Universiti Putra Malaysia

2018

i

### DEDICATION

In the name of Allah, the most beneficent and merciful this thesis is dedicated

specially to:

**Beloved Family** 

My father Abdul Manan Bin Ahmad, my mother Nurul Ho Bt Abdullah and m

younger brother Muhammad Suhaili

Supervisor and Academic Advisor

Dr. Mohamad Roslan Bin Mohamad Kasim

Coordinator

Dr. Puan Chong Leong

Examiners

Dr. Siti Nurhidayu Abu bakar and Lt. Kdr. PM Dr. Mohd Hasmadi Ismail

Masters

Faizal and Fatimah

Colleagues

Mohd Imtiaz, Arif Asnami, Siti Nadzirah and other

For the encouragement, inspirations, understanding and support throughout

my study journey in

Universiti Putra Malaysia

May Allah bless them all

Thank you.

#### ABSTRACT

Water is one of the most important substances on Earth which every living things need it to survive. Changes in water that specified by quantity that can be measured defines the water quality meaning. Sungai Serai Hot Spring is located in a village called Kampung Sungai Serai, Hulu Langat in Selangor which is 25km distance from Universiti Putra Malaysia (UPM) and around 30 minutes to get there. The purpose of this research was to determine the water quality before and after the water based therapy occured in Sungai Serai Hot Spring and water quality status of Sungai Serai Hot Spring by using DOE-WQI Index. The DOE-WQI index (calculated based on the Pollution Index of the Department of Environment) that was used for evaluating the water quality status of the hot spring. There were eight selected parameters which are pH, Dissolve Oxygen (DO), Turbidity, Temperature, Total Suspended Solid (TSS), Chemical Oxygen Demand (COD), Ammonia Nitrogen (NH<sub>3</sub>-N) and Biochemical Oxygen Demand (BOD). The three selected sampling points were S1, clean hot spring well without therapy activities, S2, hot spring pool near S1 that occurred therapy activities and S3, the outlet of S2 pool. The samples were taken at each station once a week for six weeks started from 14<sup>th</sup> July 2017 until 14<sup>th</sup> September 2017. The water quality analysis was determined at in-situ (at the field) and ex-situ (laboratory) analyse. The average temperature of this hot spring was 42.6°C and the highest turbidity reading was at S1 throughout the weeks. Water guality status of this research was determined by using DOE-WQI Index and comparisons among sampling points by using the analysis of variance (ANOVA). The water quality index values at the study areas ranged from 56.97 to 78.75 or in Class II and Class III. Based on the Malaysia Interim National Water Quality Standards, Sungai Serai Hot Spring water is suitable for recreational use.

#### ABSTRAK

Air adalah salah satu bahan yang paling penting di Bumi yang setiap benda hidup memerlukannya untuk terus hidup. Kualiti air bermaksud perubahan dalam air yang ditentukan oleh kuantiti yang boleh diukur. Kolam Air Panas Sungai Serai terletak di sebuah kampung yang bernama Kampung Sungai Serai, Hulu Langat di Selangor yang terletak 25km dari Universiti Putra Malaysia (UPM) dan sekitar 30 minit untuk sampai ke sana. Tujuan kajian ini adalah untuk menentukan kualiti air sebelum dan selepas terapi berasaskan air berlaku di Kolam Air Panas Sungai Serai dan status kualiti air Kolam Air Panas Sungai Serai dengan menggunakan Indeks DOE-WQI. Indeks DOE-WQI (dikira berdasarkan Indeks Pencemaran Jabatan Alam Sekitar) yang digunakan untuk menilai status kualiti air di kolam air panas. Terdapat lapan parameter yang terpilih iaitu pH, Dissolve Oxygen (DO), Turbidity, Temperature, Total Suspended Solid (TSS), Chemical Oxygen Demand (COD), Ammonia Nitrogen (NH3-N) and Biochemical Oxygen Demand (BOD). Tiga stesen pensampelan terpilih adalah S1, perigi air panas tanpa aktiviti terapi, S2, kolam air panas berhampiran S1 yang berlaku aktiviti terapi dan S3, saluran keluar kolam S2. Sampel untuk setiap stesen diambil sekali seminggu selama enam minggu yang bermula dari 14 Julai 2017 hingga 14 September 2017. Analisis kualiti air dilakukan di in-situ (di lapangan) dan analisis ex-situ (di makmal). Suhu purata kolam air panas ini adalah 42.6 ° C dan bacaan kekeruhan (Turbidity) tertinggi berada di S1 sepanjang minggu. Status kualiti air dalam penyelidikan ini ditentukan dengan menggunakan Indeks DOE-WQI dan perbandingan antara stesen sampling dengan menggunakan analisis varians (ANOVA). Nilai indeks kualiti air di kawasan kajian adalah dari 56.97 hingga 78.75 atau dalam kelas II dan kelas III. Berdasarkan Piawaian Kualiti Air Negara Malaysia Interim, Air Panas Sungai Serai sesuai untuk kegunaan rekreasi .

#### ACKNOWLEDGEMENTS

In the name of Allah s.w.t, the most beneficent and merciful. All praise for giving me the opportunity, good health, guidance and patience in completing my research project paper.

I would like to say thank you and express my gratitude and appreciation to my supervisor, Dr. Mohamad Roslan bin Mohamad Kasim for his patience, concern, guidance, comments, suggestion, and opportunity in experiencing the magnificent world of water quality during the course of this research study. I am giving my appreciation also to dr. Puan Chong Leong as final year project coordinator, my examiners Dr. Siti Nurhidayu Abu Bakar and Lt. Kdr. PM Dr. Mohd Hasmadi Ismail and for their comments, critics, guidance and concerns on me.

Thank you also to my family especially my father, Abdul Manan bin Ahmad and my mother, Nurul Ho Bt Abdullah for the supporting term of motivation, financial and understanding during my studies. Special thank to master students, En. Faizal and Cik Fatimah for their guidance in the process period of my project. Thank also to all my colleagues Mohd Imtiaz, Wan Rodhiah, Arif Asnami, Nadzirah Mazlan, my classmates and other who give supports and encouragement toward the completion of this study.

Last but not least, I would like to appreciate and offer my regards to all those who supported me and giving knowledge throughout the year of my studies. Thank you very much for helping me. May Allah S.W.T. bless you all.

۷

### **APPROVAL SHEET**

I certify that this research project entitled "Effect of Water Based Therapy On Water Quality of Hot Spring in Sungai Serai, Hulu Langat." by Nur Suhailah Binti Abdul Manan has been examined and approved as a fulfilment of the requirements for the degree of Bachelor of Science Forestry in the Faculty of Forestry, Universiti Putra Malaysia.

Dr. Mohamad Roslan bin Mohamad Kasim Faculty of Forestry Universiti Putra Malaysia (Supervisor)

Prof. Dr. Mohamed Zakaria Hussin Dean Faculty of Forestry Universiti Putra Malaysia

Date: January 2018

## TABLE OF CONTENTS

DEDICATION ABSTRACT ABSTRAK ACKNOWLEDGEMENTS APPROVAL SHEET LIST OF TABLES LIST OF FIGURES LIST OF ABBREVIATIONS		Page ii iv v vi ix x xi
CHAPT 1   1 1 1	TER NTRODUCTION 1.1 General Background 1.2 Problems Statement 1.3 Objectives of Study 1.4 Hypothesis	1 2 3 4
2 L 2 2 2 2	<ul> <li>JTERATURE REVIEW</li> <li>2.1 Definition of Hot spring</li> <li>2.2 Water Quality of Hot Spring</li> <li>2.3 Water pollution in Hot Spring</li> <li>2.4 Water Quality Index (WQI) of Hot Spring Water</li> <li>2.5 Water Quality Parameters for Hot Spring Water</li> <li>2.5.1 Temperature</li> <li>2.5.2 Turbidity</li> <li>2.5.3 pH</li> <li>2.5.4 Dissolve Oxygen (DO)</li> <li>2.5.5 Biochemical Oxygen (BOD)</li> <li>2.5.6 Chemical Oxygen Demand (COD)</li> <li>2.5.7 Ammonia-Cal Nitrogen (NH3N)</li> <li>2.5.8 Total Suspended Solid (TSS)</li> </ul>	5 5 7 9 10 11 12 13 14 15
3 M 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	METHODOLOGY 3.1 Study Site 3.2 Parameters 3.3 Sampling Method 3.3.1 Sampling Stations 3.3.2 Sampling Frequency 3.3.3 Sampling Procedure 3.3.4 Sampling Analysis Methods 3.4 Data Collection and Statistical Analysis	16 18 19 19 21 21
4 F 4	RESULTS AND DISCUSSION 4.1 Water Quality Index Parameter Status 4.1.1 Dissolve Oxygen (DO) Concentration 4.1.2 pH 4.1.3 Ammoniacal Nitrogen 4.1.4 Biochemical Oxygen Demand (BOD) 4.1.5 Chemical Oxygen Demand (COD)	22 22 24 25 26 27

G

	<ul> <li>4.1.6 Total Suspended Solid (TSS)</li> <li>4.1.7 Temperature</li> <li>4.1.8 Turbidity</li> <li>4.1.9 Water Quality Index (WQI)</li> <li>4.2 Data Analysis</li> </ul>	28 30 31 32 33
5	CONCLUSION AND RECOMMENDATIONS 5.1 Conclusion 5.2 Recommendations	36 37
	REFERENCES	38
	APPENDICES	
	Appendix A : Study Area	40
	Appendix B : Measurement Tools Appendix C : Equation for the Estimation of Various Subindex	42
	Values	47
	Appendix D : Raw Data	48

C

# LIST OF TABLES

Table		Page
2.1	Classes Water Quality Index Classification (DOE, 2005)	8
2.2	Classes in Malaysian Water Quality Index (DOE, 2005)	8
3.1	Parameters for In-situ and Ex-situ	18
3.2	Sampling Analysis Method for Water Quality Analysis	21
4.2.1	One-way Analysis of Variance (ANOVA) of Water Quality Index	34
4.2.2	Correlation Analysis between WQI and Number of People	
	Undergo Water Based Therapy	35

C

Figure		Page
3.1	Sungai Serai Hotspring	17
3.2	Study Site	17
4.1	DO concentration by stations and weeks	23
4.2	pH by stations and weeks	25
4.3	Ammoniacal Nitrogen by station and weeks	26
4.4	Biochemical Oxygen Demand by stations and weeks	27
4.5	Chemical Oxygen Demand by stations and weeks	28
4.6	Total Suspended Solid by stations and weeks	29
4.7	Temperature by stations and weeks	31
4.8	Turbidity by stations and weeks	32
4.9	Water Quality Index by stations and weeks	33

## LIST OF FIGURES

C

## LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DOE	Department of Environment
DOE-WQI	Department of Environment-Water Quality Index
NH3N	Ammonia-Cal Nitrogen
SIAN	Sub-index of Ammonia-Cal Nitrogen
SIBOD	Sub-index of Biochemical Oxygen Demand
SICOD	Sub-index of Chemical Oxygen Demand
SIDO	Sub-index of Dissolved Oxygen
SIpH	Sub-index of pH
SITSS	Sub-index of Total Suspended Solids
SPSS	Statistical Package for Social Sciences
TSS	Total Suspended Solids
WQI	Water Quality Index

## CHAPTER I

#### INTRODUCTION

#### 1.1 General background

Sungai Serai Hot Spring is a well known hot spring in Hulu Langat that located in Selangor. This hot spring is open for visitors everyday 24 hours. It is located 25km far from Universiti Putra Malaysia (UPM) and it is about around 30 minutes to reach there.

Water is a transparent and nearly colourless chemical substance that is the main constituent of Earth's springs, lakes, oceans and the fluids of most living organisms. Water cover about three-quarters of the Earth surfaces and constitutes about 70 percent of the total weight of the living organism. Every living organism need water to survive such as flora and fauna including human all need water to stay alive of maintaining the fluids inside their body. Besides, human also need water in their daily life such as bathing, washing clothes, cooking and many more. From all of these points we can know water is very important to the Earth.

Water is the basis of life and the hot spring water also act as one of the important water for human to use. In this modern world, the more the people know about the good of the hot spring water, the more the activities will occur in the hot spring such as water based therapy and this will leads to higher rate of water pollution of the hot spring water. The results showed the used water from the hot springs had levels of turbidity which significantly greater than those obtained from freshly unused water (Mazibuko and Mwendera, 2006).

From the title of this research, it is known as a research about the water quality of the hot spring in Sungai Serai, Hulu Langat after occurs the water based therapy in the hot spring and this research also was a study to be alert of the pollution of the hot spring water. Natural hot springs that have been discovered by human are usually full with many activities such as water based therapy, cooking, drinking and also used for some disease treatment. Since hot spring water has been used for so many activities, there are some issues happen about the water quality status of the hot spring and this might affect the people who use the polluted hot spring water. Based on short conversation with visitors, they took the hot spring water for domestic consumption.

#### **1.2 Problem Statement**

Sungai Serai Hot Spring is a hot spring that always has visitors come and do water based therapy. As we all know that hot spring water is rich in mineral and it can helps in our health. People have used geothermal water (hot spring) and mineral water for cozy bathing, medical purposes and cooking, as being implemented previously (Javed et al., 2009).

Water based therapy is one of the basic methods of treatment widely used in system of natural medicine (Mooventhan, 2014). When there are increasing

of water based therapy or other activities occurs in the hot spring water, there are some issues happen about the water quality of the hot spring is dropping. On the other hand, Sun (2017) reported a news about the Australia Environment Protection Authority said that the wastewater of water based therapy in hot spring is one of the cause of environmental concerns. The results showed that the used water from the hot springs had levels of turbidity, colour, nitrites, nitrates, total and faecal coliform that were significantly greater than those obtained from freshly unused water (Mazibuko and Mwendera, 2006).

Usually people do not know their water based therapy activity can give huge impacts towards the hot spring. So, it is important to study about the water quality of hot spring that occured water based therapy and can let the people know and see the effect of their water based therapy on the hot spring. The purpose of this research is to see the effects of water based therapy on the water quality of hot spring due to the less study about it has been done based on what Mazibuko and Mwendera (2006) said, not much has been done to examine the possible impacts of such uses on the water resources.

### 1.3 Objectives of study

The objectives of this study were:

- To compare the water quality at three different sites of Sungai Serai Hot Spring.
- II. To determine the water quality status of Sungai Serai Hot Spring.

# 1.4 Hypothesis

The hypothesis of this study was:

 The water based therapy activities causes the decreasing of water quality of hot spring.



### REFERENCES

Chaitow L, (2002), Water Therapy For Health and Beauty, *Hydrotherapy*,1st ed, Pavillion Book Company Ltd, United Kingdom.

Cinti, D., Pizzino, L., Voltattorni, N., Quattrocchi, F., and Walia, V., (2009). Geochemistry of thermal waters along fault segments in the Beas and Parvati valleys (north-west Himalaya, Himachal Pradesh) and in the Sohna town (Haryana), India. *Geochemical Journal*, 43, 65-76.

David Lambert Group (2007). The field guide to geology, *Library of Congress Cataloging*, pg 29.

Diyanah (2014), Water Quality of Panchor Hot Spring in Serian, Sarawak, retrieved from

https://ir.unimas.my/8289/1/Water%20Quality%20of%20Panchor%20Hot %20Spring%20in%20Serian,%20Sarawak(24pgs).pdf on March 15<sup>th</sup>, 2017.

[EnvirSci Inquiry] Lehigh River Watershed (2011), Stream Flow, retrieved from

http://www.ei.lehigh.edu/envirosci/watershed/wq/wqbackground/streamflo wbg.html on November 14<sup>th</sup>, 2017.

EPA. (2012, March), Channel Processes: Suspended Sediment Transport, In Water: Science & Technology, retrieved from <u>http://water.epa.gov/scitech/datait/tools/warsss/suspend.cfm</u> on November 14<sup>th</sup>, 2017.

EPA. (2012). 5.5 Turbidity. In Water: Monitoring & Assessment, retrieved from <u>http://water.epa.gov/type/rsl/monitoring/vms55.cfm</u> on March 15<sup>th</sup>, 2017.

Fondriest Environmental (2013), Fundamentals of Environmental Measurements. Retrieved from <u>http://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen/</u>. on September 27<sup>th</sup>, 2017.

Javed, A., Iqbal, J., Asghar, U., Khan, F. A., Munshi, A. B., and Sddiqui, I., (2009), A study to evaluate therapeutic properties of minerals of Manghopir Hot Spring, Karachi. *J.Chem.Soc.Pak* 31(3), 396-401.

Jeremias M (2010), Dissolved Oxygen and Biochemical Oxygen Demand in the waters close to the Quelimane sewage discharge, 6-28.

Langland, M. & Cronin, T. (Eds.). (2003), A Summary Report of Sediment Processes in Chesapeake Bay and Watershed, In Water-Resources Investigations Report 03-4123, New Cumberland, PA: U S Geological Survey, Retrieved from http://pa.water.usgs.gov/reports/wrir03-4123.pdf on October 19<sup>th</sup>, 2017.

 $\bigcirc$ 

Loveless, Ward, Farr and Smedley (2016), Wonder Water: The Value of Water: Introduction, retrieved from <u>http://www.eurogeosurveys.org/wp-content/uploads/2016/03/Water-Book-Layout\_full-low-double-no-print.pdf</u> on October 19<sup>th</sup>, 2017.

M Mazibuko, P & Mwendera, Emmanuel (2006), An Assessment Of The Impacts Of Hot Spring Usage On Water Quality In Swaziland, ResearchGate, Berlin.

Matz, H., Orion, E., and Wolf, R., (2003). Balneotheraphy in dermatology. *Dermatologic Theraphy*, 16, 132-140.

Mazor, E., B.T. Verhagen and E. Negreanau, 1974. Hot springs of the ignenous terrain of Swaziland. Isotyope Techniques in Groundwater Hydrology, 2, 29-47.

Nasermoaddeli, A., and Kagamimori, S., (2005). Balneotherapy in Medicine: A Review. *Environmental Health and Preventive Medicine*, 10, 171–179.

Ohtsuka, Y., Yabunaka, N., Watanabe, I., Noro, H., Fujisawa, H., and Agishi, Y., (1995). Thermal strees and diabetic complications, *International Journal of Biometeorology*, 38(2), 57-59.

Unknown (n.d.), Water Quality Monitoring: Dissolved Oxygen, Friends of Five Creeks, retrieved from <u>http://www.fivecreeks.org/monitor/do.shtml</u> on November 14<sup>th</sup>, 2017.

Wetzel, R.G. (2001), Limnology: Lake and River Ecosystems (3rd ed.), San Diego, Academic Press.

Wepa-db.net. (2017), Interim National Water Quality Standards For Malaysia, retrieved from http://www.wepa-db.net/policies/law/malaysia/eq\_surface.htm on March 15<sup>th</sup>, 2017.

Zaini, Latiffah, Saat and Wood (2013), Determination Of Hot Springs Physico-Chemical Water Quality Potentially Use For Balneotherapy, *The Malaysian Journal of Analytical Sciences*, 17(3), 436 – 444.