

International Conference
on Mathematics and Sciences

ISBN : 978-602-19142-0-5

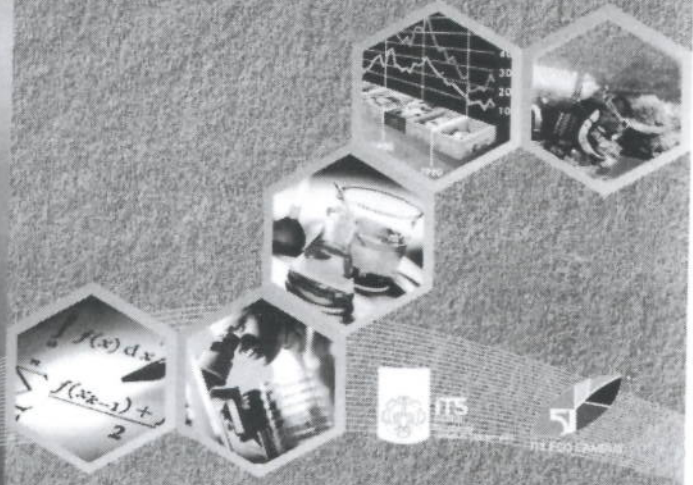
ICOMSG
2011

PROCEEDINGS

PROCEEDINGS

Mathematics and Sciences for Improving Human Welfare

October 12-13, 2011
Majapahit Hotel Surabaya, Indonesia



PREFACE

International Conference on Mathematics and Sciences or abbreviated ICOMSc is a conference which organized by Faculty of Mathematics and Natural Sciences, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia. ICOMSc was firstly held on 12-13 October 2011, at Majapahit Hotel, Surabaya. The conference aims to provide a forum for academics, researchers, and practitioners to exchange ideas and recent developments on mathematics and sciences. The conference was expected to foster networking, collaboration and joint effort among the conference participants to advance the theory and practice as well as to identify major trends in mathematics and sciences.

The conference was attended contributors from Indonesia, Malaysia, Thailand, Philippines, United Arab Emirates, Taiwan, Japan, Australia, Spain, and United States of America. Such a spread of participation from around the world confirms the appropriateness of the “International” label of this conference. There were 130 papers and posters presented in the conference, and there are 111 full papers are published in this proceeding.

Finally, the committee would like to thank all keynote speakers, presenters, participants, sponsors, and all those involved directly and indirectly in the first ICOMSc.

Surabaya, December 2011



Mardi Santoso
Conference Chair

Committees

Honorary Committee

Rector of Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia
Dean of Faculty of Mathematics and Natural Sciences of ITS

Advisory Board

Prof. Yoh Kohori (Chiba University, Japan)
Prof. William S. Price (University of Western Sydney, Australia)
Prof. Ariando (NUS, Singapore)
Prof. Hadi Nur (UTM, Malaysia)
Prof. Ismunandar (ITB, Indonesia)
Prof. Sutawanir Darwis (ITB, Indonesia)
Prof. Rustam E. Siregar (Padjadjaran University, Indonesia)
Prof. Subanar (Gadjah Mada University, Indonesia)
Prof. Budy Kurniawan (University of Indonesia, Indonesia)
Dr. Nurul Taufiqurrahman (LIPI, Indonesia)
Dr. Eniya Listiani Dewi (BPPT, Indonesia)
Prof. Khairil Anwar Notodiputro (IPB, Indonesia)
Prof. Darminto (ITS, Indonesia)
Prof. Nur Iriawan (ITS, Indonesia)
Prof. Taslim Ersam (ITS, Indonesia)
Dr. Subiono (ITS, Indonesia)
Dian Saptarini, MSc. (ITS, Indonesia)

Organizing Committee

Prof. Mardi Santoso
Suminar Pratama, PhD.
Dr. rer. pol. Heri Kuswanto
Soleha, MSc.
Arif Fadlan, MSc.
Dr. Muhammad Mashuri
Rahmah Irma Suryaningsih, MSi.
Prof. Agus Rubiyanto
Subchan, PhD.
Dr. Didik Prasetyoko
Dr. Suhartono
Dr. rer. nat. Maya Shovitri
Dr. Melania Suweni Muntini
Dr. rer. nat. Irmira Kris Murwani
Dr. Irhamah
Bandung Arry Sanjoyo, MComp.Sci.
Hamzah Fanzuri, PhD.
M. Muryono, MSc.
Prof. Basuki Widodo
M. Zainul Asrori, MSc.
Jerry Dwi Trijoyo Purnomo, MSc.
M.Sjahid Akbar, MSc.
Lukman Atmaja, Ph.D
Dr. Sony Sunaryo
Heny Faisal, MSc.
M. Agung Pamudjo, SSos.

Conference Secretariat

Dra. Sri Hariyani
Friana Ekawati, AMd.
Yunita Hari listyowati
Ida Srisamsuti, AMd.
Dian Rachmat Saputra, SE
Marsam
Ahmed Usman Ali
Drs. Hadi Siswanto
Muzammil
Drs. Ec. Suparno
Cucuk Waluyo, SSos.
Sumaryono

Contents

Preface	iii
Committees	iv
Conference Program	vii

Keynote Speakers

Gopalan Nair

School of Mathematics and Statistics, The University of Western Australia, Australia
Analysis of Point Patternson the Planean Linear Networks

Hiroyuki Kitahata

Department of Physics, Graduate School of Science, Chiba University
& PRESTO JST, Chiba 263-8522, Japan
Spontaneous Motion of a Droplet Coupled with Chemical Reaction

Intan Muchtadi-Alamsyah

Algebra Research Group, Faculty of Mathematics and Natural Sciences,
Institut Teknologi Bandung
Algebraic Structures in Cryptography

Maria Elena de Bellard

Department of Biology, The california State University Northrige, USA
Evolution of Glia and Neural Crest Cells

Jyh-Chiang Jiang

Theoretical and Computational Chemistry Laboratory
Chemical Engineering Department, National Taiwan, University of Science
and Technology, Taiwan
The Role of Computational Chemistry in Experiments from Elucidation to Prediction

- OS 10 **Brodjol Sutijo S. U., Agus Suharsono**
 Department of Statistics, Faculty of Mathematics and Natural Sciences,
 Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
Tourism Data Modelling by Using Structural Vector Autoregression Approach
- OS 11 **Dian Andriana**
 Research Center for Informatics, Indonesian Institute of Sciences (LIPI),
 Bandung, Indonesia
*Object Oriented Software Design of Capture Fisheries Decision Support
 Systems*
- OS 12 **Margaretha Ohyver, Heruna Tanty**
 Department of Statistics, Faculty of Science and Technology,
 Universitas Bina Nusantara, Jakarta, Indonesia
*The Comparison of Drinking Water Filtration Using Friedman Test in Reduce
 Levels of Cadmium, Chromium, and Cyanide*
- OS 13 **Farid Ma'ruf, Bambang Widjanarko Otok**
 Department of Statistics, Faculty of Mathematics and Natural Sciences,
 Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
*Modelling The Underdeveloped Villages Gorontalo Province 2008 (with
 Multivariate Adaptive Regression Splines Approach)*
- OS 14 **Hasih Pratiwi¹, Subanar¹, Danardono¹, J. A. M. van der Weide²**
¹Department of Mathematics, Gadjah Mada University, Yogyakarta, Indonesia
²Delft University of Technology, Delft, The Netherlands
Ruin Probability in Non-Life Insurance Model
- OS 16 **Kariyam, Edy Widodo**
 Department of Statistics, Islamic University of Indonesia, Yogyakarta,
 Indonesia
*Clustering of Ordinal Data Based on The Weighted Ranking Pattern and Its
 Application*
- OS 17 **Jerry Dwi Trijoyo Purnomo, Sindy Febri Antika**
 Department of Statistics, Faculty of Mathematics and Natural Sciences,
 Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
Multilevel Regression and Its Applications
- OS 18 **Pudji Ismartini, Nur Iriawan, Setiawan, Brodjol Sutijo S. U.**
 Department of Statistics, Faculty of Mathematics and Natural Sciences,
 Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
*Hierarchical Structured Data Analysis Using Hierarchical Model with
 Bayesian Approach*

THE COMPARISON OF DRINKING WATER FILTRATION USING FRIEDMAN TEST IN REDUCE LEVELS OF CADMIUM, CHROMIUM, AND CYANIDE

Margaretha Ohyver¹ and Heruna Tanty²

Bina Nusantara University

¹mohyver@binus.edu, ²herunatanty@yahoo.com

Abstract. Nonparametric statistics is a statistical procedure that is free distribution. One of the methods in nonparametric statistics is the Friedman test. The purpose of this test is to determine whether there are differences in treatment effect based on the samples obtained. Friedman test was applied to the data about the content of Cadmium (Cd), Chromium (Cr), and Cyanide (Cn), in drinking water. This test followed by multiple comparison procedures. The application is made to answer the purpose of this research, i.e. to find a water filter that has the best ability in decreasing levels of Cd, Cr, and Cn. Water filters compared are Granular Activated Charcoal (GAC), Hollow Fiber (HF), and Reverse Osmosis (RO). Based on research, GAC, HF, and RO, has the same ability in lowering the content of Cd in drinking water. RO are the best filter to reduce the content of Cr and Cn. HF is the best filter to reduce the content of Cn.

Keywords : Drinking Water, Friedman Test, Multiple Comparison, Water Filter.

1 Introduction

Water is one of the most important human needs. Without water, humans cannot survive much longer. Water can also be a means of disease transmission. Because it is so important, then the quality of water also needs to be maintained. Here is an overview of the importance of water for humans.

The need for a clean and safe drinking water supply for centers of population has been recognized for over 2000 years. The early Romans recognized that human activities and effluent were a major source of water pollution, and that providing water from relatively unpopulated areas was a solution to the problem. In 312 BC the Romans began development of an aqueduct system to deliver water taken from the Tiber River upstream of the city. It has been said that the availability of a good water supply through their extensive aqueduct system enabled the rise of Rome as a center of civilization, and it has also been speculated that the use of lead for water pipes helped lead to its downfall, through slow poisoning of the population (Howd and Fan, 2008).

The epidemic that occurred in London has led to John Snow as the father of Epidemic. This is due to his efforts in analyzing a cholera epidemic in London that specific diseases were shown to be associated with drinking waters that looked and tasted clean. Snow stated that most people who died of cholera in the summer due to people

THE COMPARISON OF DRINKING WATER FILTRATION...

taking water from the same source, i.e. the well Broad Street. He had the pump handle removed and the epidemic faded away.

Several regions in Indonesia have a water crisis, starting from remote areas to the capital of the country. There is 82% people in Indonesia who consume unhealthy water. It is quite ironic because Indonesia is a country which has 6% of the world water supply (Sutjahjo, 2011).

Cadmium (Cd), Chromium (Cr), and Cyanide (Cn) is an inorganic chemical elements. The existence of these elements can be harmful to humans. Cd can cause allergic dermatitis. Cr can cause kidney disease. Cn can cause nerve damage or thyroid problems.

In Indonesia has been developing the processes of filtration of drinking water. The purpose of these processes is to get drinking water with good quality. Hollow fiber is a filtration process that is widely used in households. By installing this filter, the water can be consumed directly without having to be cooked first. Granular activated charcoal is a drinking water filtration process used by refill drinking water. Reverse osmosis is the filtration of drinking water used by companies that produce drinking water in the form of packaging. The problem is whether the three filtration process has the same ability to reduce the levels of Cd, Cr, and Cn? If they have same ability, then people can choose who has a small fee. So the purpose of this research was to determine the water filter that has the best ability in reduce levels of Cd, Cr, and Cn.

2 Theory

Friedman test is an analysis of variance for nonparametric (Aczel and Sounderpandian (2010)). The test is good if the number of treatment more than two treatment ($k > 2$). If the data have interval scale and the assumption of normality is not met then this test can be done. Another reason that is often used is the researcher may be unwilling to assume that the sampled populations are normally distributed and in some cases only ranks may be available for analysis (Daniel, 1990).

The objective is to determine whether there are differences in treatment effect based on the samples obtained. The assumptions are as follows.

1. The data consist of b mutually independent samples (blocks) of size k . The typical observation X_{ij} is the j th observation in the i th sample (block). The data may be displayed as in the Table 1.
2. The variable of interest is continuous.
3. There is no interaction between blocks and treatments..
4. The observations within each block may be ranked in order of magnitude.

The Hypotheses and the test statistics are given below.

$$H_0: M_1 = M_2 = \dots = M_k$$

H_1 : At least one equality is violated

$$\chi_r^2 = \frac{12}{bk(k+1)} \sum_{j=1}^k R_j^2 - 3b(k+1) \quad (1)$$

As a continuation of Friedman test, multiple comparisons procedure can be used. The objective of this procedure is to find any treatment that has different capabilities.

THE COMPARISON OF DRINKING WATER FILTRATION...

This procedure was defined with $|R_j - R_{j'}| \geq z \sqrt{\frac{bk(k+1)}{6}}$, where R_j and $R_{j'}$ are the j th and $ke-j$ 'th treatment rank totals.

Tabel 1 Data Structure for Friedman Test

Block	1	2	3	...	j	...	k
1	X_{11}	X_{12}	X_{13}		X_{1j}		X_{1k}
2	X_{21}	X_{22}	X_{23}		X_{2j}		X_{2k}
3	X_{31}	X_{32}	X_{33}		X_{3j}		X_{3k}
⋮							
I	X_{i1}	X_{i2}	X_{i3}		X_{ij}		X_{ik}
⋮							
B	X_{b1}	X_{b2}	X_{b3}		X_{bj}	...	X_{bk}

3 The Result

The data in this study is the content of Cd, Cr, and Cn, in the water. That water was obtained from the refill drinking water around Bina Nusantara University. And then analyze using Friedman test.

The value for test statistic for Cd is 4.0513. By comparing $\alpha = 0.01$ and $p - value = 0.1319$ then failed to reject H_0 . This means that all of these filtration have the same ability to reduce levels of Cd. The value for test statistic for Cr is 15.1667. By comparing $\alpha = 0.01$ and $p - value = 0.0005089$ then reject H_0 . This means that not all of these filtration processes have the same ability to reduce levels of Cr. The value for test statistic for Cn is 16,2703. By comparing $\alpha = 0.01$ and $p - value = 0.0002931$ then reject H_0 . This means that not all of these filtration have the same ability to reduce levels of Cn.

Multiple comparison test performed for Cr and Cn. The following are the results for Cr. (1) The difference between the total ranking for GAC and RO is less than 13.10336. (2) The difference between the total ranking for GAC and HF is less than 13.10336. (3) The difference between the total ranking for RO and HF is greater than 13.10336. Based on the results for Cr, it is know that GAC, RO, and HF have the same ability. But RO has different capabilities with HF. Based on median, it is known that RO has the smallest value.

The following are the results for Cn. (1) The difference between the total ranking for GAC and RO is greater than 13,10336. (2) The difference between the total ranking for GAC and HF is greater than 13,10336. (3) The difference between the total ranking for RO and HF is less than 13,10336. Based on results for Cn, it is known that GAC has different capabilities with RO and HF. While RO and HF have the same ability. Based on median, it is known that GAC has the highest value.

THE COMPARISON OF DRINKING WATER FILTRATION...

4 Conclusion

The conclusion for this research are as follows. GAC, HF, and RO has the same ability to reduce Cd. RO is the best in reduce level of Cr and Cn. HF is the best in reduce level of Cn.

References

- [1] Aczel, A.D. and Sounderpandian, J., Complete Business Statistics, McGraw-Hill/Irwin, 2010.
- [2] Daniel, W.W., Applied Nonparametric Statistics, 2nd Edition, Duxbury Press, 1990.
- [3] Howd, R. A. and Fan, A.M, Risk Assessment for Chemicals in Drinking Water, Wiley, 2008.
- [4] Sutjahjo, S.H, Musim Kemarau Panjang, Krisis Air menghadang, Metrotvnews, 2011.