

**A STUDY OF THE LOW COST FILTER MEDIA TO BE
USED IN THE MODIFICATION OF AN ANCIENT
URINE FILTRATION SYSTEM IN SRI LANKA**

K. R. C. S. Wickramasinghe

(09/8090)



University of Moratuwa, Sri Lanka.
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Degree of Master of Science

Department of Chemical and Process Engineering

**University of Moratuwa
Sri Lanka**

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Thesis/ Dissertation submitted in partial fulfillment of the requirements for the
degree Master of Science

Department of Chemical and Process Engineering

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Sri Lanka

April 2013

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ABSTRACT

Algal blooms have been identified as one of the most devastating issues in the urban water bodies. Enrichment of nutrient such as Nitrogen, Phosphorus and Potassium stimulate algal blooms. Even though the fraction of urine in domestic waste water is less than 1% of the total volume while human urine contributes 80% of the nitrogen and 55% of the phosphorus in urban water bodies. Hence, most of the countries have adopted modern urine treatment technologies. Nevertheless, most of the urine streams have still been diverted the urban water bodies.

In ancient Sri Lanka, a simple pot system had been used to filter urine before discharging into soil. Low cost materials such as sand, charcoal, calcite had been used as filter media in the pot system. This research focuses on investigating the feasibility of using such filter materials in a modern low cost filter for urine filtration. Alternatively brick powder was selected owing its higher adsorption capacities.

Being a mixture of hundreds of organic and inorganic compounds, urine is quite sensitive to the variations of its pH value. It was noted that at elevated pH values (especially after 8.5 of pH) light amber colour turbid clouds are formed in urine. Increase of turbidity (suspended solids in other terms) improves the filtration efficiency of sand beds. Therefore the minimum calcite bed height that increases the urine pH above 8.5 was investigated.

Sand samples collected from various locations in the country were analysed for their suspended matter (TSS) removal capacities. It was found that TSS removal of sand shows direct relationship to the sand particle size. Naththandiya silica sand which has considerably small mean particle size (703-97 μm) shows the highest TSS removal.

Charcoal prepared from Kohomba branches shows the highest adsorption capacity (Iodine number 18182 mg/g) among 12 charcoal types investigated.

Breakthrough curves for sand, brick powder and charcoal was drawn using both urine and urea. Simultaneously, batch experiments were carried out both for brick powder and Kohomba charcoal. Langmuir adsorption isotherm model is best fitted for both brick powder-urea and charcoal-urea systems.

Keywords: Source separated urine, charcoal, brick powder, urea adsorption isotherms

DEDICATION

I might not come into this place without my parents who have dedicated their life for making me an educated and a successful person. I would like to express my love and appreciation for the encouragement and the sacrifices made by my parents.



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ACKNOWLEDGEMENT

It is a great pleasure to express gratitude to those who were behind me in completing my work successfully. Completion of this thesis has been one of the most momentous academic challenges I have ever had to face. Without the support, patience and guidance of the following people, this study would not have been completed.

In the first place my sincere thanks go to my supervisor Dr. Jagath Premachandra for his continuous in-depth guidance throughout my research.

Then I must offer my sincere thanks to Prof. K.R.R Mahanama, Head, Department of Chemistry, University of Colombo and Dr. Shantha Walpolage, the postgraduate coordinator, Department of Chemical & Process Engineering, University of Moratuwa, for the valuable comments given, as my progress review committee members.

I am indebted to Dr. Shantha Amarasinghe, Head of the Department of Chemical and Process Engineering, University of Moratuwa, for providing me necessary facilities to conduct the Researches without interruptions.



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I must cordially mention the name of Mr. Niluka Pushpakuma who initiated this research project and kindly allowing me to proceed.

This project was funded by University of Moratwa Senate Research Grant (Number: 311) and it was a great financial encouragement for my research work.

I would like to extend my sincere gratitude to Prof. Suren Wijeykoon, in charge of the Environmental engineering laboratory, Dr. P. G. Rathnasiri, in charge of Energy Engineering laboratory, Dr. Maraliya Ismail, in charge of Industrial Chemistry Labratry, Prof. Padma Amarasinghe, in charge of particulate technology laboratory, for allowing me to conduct my experiment in the laboratories.

All the non academic staff members including Ms. Dinusha Martino, Ms. Amali, Mr. Masa Korala, Mr. Jayaweera, Ms. Indika, Mr. Shantha Pieris and Ms. Sanjeevani are mentioned with gratitude.

I also thank to Prof. Prishantha Gunawardhana, professor at the post graduate institute of archeology, University of Kelaniya and Ven Warakagoda Soratha Thero, for directing me during the archeological survey.

My special thanks go to the post graduate and under graduate students those who supported in collecting sand samples from various part of the country.

Further, I would like to thank all the post graduate students and the technical staff those supported me by providing urine samples without any hesitation all the time.

It is my pleasure to remind Dr. Prashantha, senior lecturer, University of Sri Jayawardhanapura, for sharing his chemical analysis experiences in order to continue my experiments.

Appreciation is extended to MS. Subashini Bandara who provided excellent help me by proof reading.

Last but not the least I would like to thank all the colleagues, Staff members of Post Graduate Division, Examination branch, Senate Research Committee office and Accounts division for the help and cooperation given.



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Most importantly, none of these would have been possible without the love and patience of my family. I am deeply indebted to my parents, sister and brothers who always supported, encouraged and believed in me, in my entire endeavor.

K.R.C.S. Wickramasinghe

CONTENTS

DECLARATION OF CANDIDATE & SUPERVISOR.....	I
UNIVERSITY OF MORATUWA	I
ABSTRACT	II
DEDICATION.....	III
ACKNOWLEDGEMENT	IV
CONTENTS.....	VI
LIST OF FIGURES	IX
ABBREVIATIONS	XII
1 INTRODUCTION.....	1
1.1 BACKGROUND OF THE RESEARCH.....	2
1.1.1 Eutrophication in water bodies.....	3
1.1.2 Sanitation	5
1.1.3 Ecological sanitation approach	6
1.1.4 Ancient sanitation systems in Sri Lanka	9
1.2 OBJECTIVES OF THE RESEARCH	10
1.3 SIGNIFICANCE OF THE RESEARCH	10
2 LITERATURE REVIEW.....	12
2.1 HUMAN URINE.....	12
2.2 SOURCE SEPARATION OF URINE	15
2.3 TREATMENT PROCESSES FOR SOURCE SEPARATED URINE.....	16
2.3.1 Hygienisation	16
2.3.2 Volume reduction.....	17
2.3.3 Stabilization	17
2.3.4 P – Recovery	18
2.3.5 N – Recovery.....	18
2.3.6 Nutrient removal	19
2.3.7 Removal of micro pollutants.....	19
2.4 ANCIENT POLLUTION PREVENTION METHODOLOGIES.....	20
2.4.1 Ancient urinals in Sri Lanka	20
2.4.2 Ancient urine pots	22

2.5	LOW COST FILTER BED MATERIALS.....	23
2.5.1	Sand.....	24
2.5.2	Brick powder.....	24
2.5.3	Charcoal.....	25
2.5.4	Calcite.....	27
2.6	ADSORPTION ISOTHERMS.....	28
2.6.1	The Langmuir isotherm.....	29
2.6.2	Freundlich isotherm.....	30
2.6.3	Temkin isotherm.....	30
2.7	FIXED BED ADSORPTION.....	31
2.7.1	Breakthrough curve.....	31
3	EXPERIMENTAL.....	33
3.1	MATERIALS.....	33
3.2	MATERIAL COLLECTION AND PREPARATION.....	33
3.2.1	Sand.....	33
3.2.2	Brick powder.....	34
3.2.3	Charcoal.....	34
3.2.4	Calcite.....	35
3.2.5	Fresh urine.....	35
3.2.6	Urea.....	35
3.3	EXPERIMENTAL APPARATUS FOR FIXED BED EXPERIMENTS.....	35
3.3.1	Type 1: Burettes.....	36
3.3.2	Type 2: 100 cm glass column.....	36
3.3.3	Type 3: 75 cm glass column.....	37
3.4	MEASUREMENTS OF EXPERIMENTAL PARAMETERS.....	38
3.4.1	Analytical methods for urine.....	38
3.4.2	Analytical methods for sand, charcoal and brick powder.....	39
3.5	ANALYSIS OF KEY EFFLUENT PARAMETERS OF URINE.....	39
3.6	STUDING VARIATION OF URINE TURBIDITY AND COLOUR WITH PH VALUE.....	40
3.7	EFFLUENT PH VARIATION WITH CALCITE BED HEIGHT.....	40
3.8	SIEVE ANALYSIS OF SAND.....	40

3.9	BED EXPERIMENTS FOR SORTING THE SAND SAMPLES ACCORDING TO THE FILTRATION PERFORMANCE.....	41
3.10	BREAK THROUGH CURVES OF NATHTHANDIYA SILICA SAND.....	41
3.11	SIEVE ANALYSIS OF BRICK POWDER	42
3.12	BREAK THROUGH CURVE OF BRICK POWDER	42
3.13	BATCH ADSORPTION ISOTHERMS OF BRICK POWDER FOR UREA	42
3.14	SELECTING A SUITABLE TYPE OF FEEDSTOCK FOR CHARCOAL	43
3.15	BREAK THROUGH CURVE OF KOHOMBA CHARCOAL USING URINE.....	43
3.16	BATCH ADSORPTION ISOTHERMS OF KOHOMBA CHARCOAL FOR UREA.....	43
4	RESULTS AND DISCUSSION	45
4.1	URINE ANALYSIS	45
4.1.1	Responses of colour and turbidity for different pH values of urine.....	48
4.2	PH VARIATION WITH CALCITE BED HEIGHT	50
4.3	SAND AS A FILTER MEDIA	51
4.3.1	Selecting a suitable type of sand	51
4.3.2	Break through curve for different particle sizes of sand	56
4.4	BROCKEN BRICKS AS AN ADSORBENT	57
4.4.1	Break through curve for different particle sizes of brick powder	58
4.5	ADSORPTION ISOTHERMS OF UREA FOR BRICK POWDER	59
4.5.1	Langmuir isotherm	60
4.5.2	Freundlich isotherm	61
4.5.3	Temkin isotherm	61
4.6	BREAKTHROUGH CURVE FOR A BRICK POWDER BED USING UREA.....	62
4.7	ANALYSIS OF CHARCOAL	63
4.7.1	Urine break through curve for a charcoal bed of Kohomba.....	65
4.8	ADSORPTION ISOTHERMS OF UREA FOR CHARCOAL.....	65
4.9	BREAK THROUGH CURVE FOR A CHARCOAL BED USING UREA	66
5	CONCLUSIONS	69
6	FUTURE WORKS.....	71
7	REFERENCES.....	72
8	APPENDIX 1.....	75

LIST OF FIGURES

Figure 1.1 World Water Scarcity	2
Figure 1.2 Cultural eutrophication in (a) Kothmale Reservoir (b) Beira Lake	4
Figure 1.3 The disadvantages of conventional sanitation approach	6
Figure 1.4 Advantages of ecological sanitation approach	7
Figure 1.5 Possible Ecological Sanitation Treatment technologies	8
Figure 2.1 Ruins of urinals near Jethawanarama Museum	20
Figure 2.2 (a) Male toilet and (b) Female toilet	21
Figure 2.3 (a) Public Toilet and (b) Urine Collection Pit	21
Figure 2.4 Urine Pots	22
Figure 2.5 Breakthrough curve for fixed bed adsorption	32
Figure 3.1 Stainless steel Container	34
Figure 3.2 Schematic diagram of the experimental fixed bed type 1 and 2	36
Figure 3.3 Experimental apparatus used for fixed bed analysis of sand, charcoal and brick powder (a) Type 1 (b) Type 2 (c) Type 3	37
Figure 3.4 Schematic diagram of the experimental fixed bed type 3	38
Figure 4.1 Variation of Turbidity and colour of urine with the pH value	48
Figure 4.2 (a) Turbidity increase of a fresh urine sample at pH 8.5 (b) Same urine sample after one hour	49
Figure 4.3 Effluent pH variation of urine with the increase of calcite bed height	50
Figure 4.4 Apparent colour of 20 urine samples (after sending through the sand bed) and the mean particle sizes of sand samples	54
Figure 4.5 (a) urine sample after adjusting the pH value (b) same urine sample after sending through sand	54
Figure 4.6 Turbidity of 20 urine samples (after sending through the sand bed) and the mean particle sizes of sand samples	55
Figure 4.7 TSS of 20 urine samples (after sending through the sand bed) and the mean particle sizes of sand samples	56
Figure 4.8 Break through curves for different sand particle sizes (Nathathandiya silica sand)	57
Figure 4.9 Sieve analysis for brick powder sample	58

Figure 4.10 Break through curves for brick powder	59
Figure 4.11 Break through curves for the composite brick powder samples.....	59
Figure 4.12 Langmuir isotherm for urea-brick powder system	60
Figure 4.13 Freundlich isotherm for urea-brick powder system.....	61
Figure 4.14 Temkin Isotherm for urea-brick powder system	62
Figure 4.15 Break through curve for the composite brick powder samples using urea	63
Figure 4.16 Break through curve for a charcoal produced from Kohomba (using the urine as the solution)	65
Figure 4.17 Langmuir isotherm for charcoal-urea system	66
Figure 4.18 Freundlich isotherm for charcoal-urea system	67
Figure 4.19 Temkin isotherm for charcoal-urea system	67
Figure 4.20 Break through curve for the charcoal sample (using urea).....	68



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LIST OF TABLES

Table 1.1 World water distribution	1
Table 2.1 Composition of typical human urine - Inorganic compounds.....	13
Table 2.2 Composition of typical human urine -Organic compounds	14
Table 2.3 Composition of typical human urine -Organic ammonium salts	15
Table 4.1 Analysis of Urine	45
Table 4.2 summary of sieve analysis for washed sand samples	52
Table 4.3 Properties of urine samples after sending through sand beds	53
Table 4.4 Isotherm Constants and R^2 values (for Brick Powder)	62
Table 4.5 Iodine numbers of charcoal produced from locally available materials	64
Table 4.6 Isotherm Constants and R^2 values (for charcoal).....	68
Table 5.1 Typical water quality parameters of urine	69



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ABBREVIATIONS

Abbreviation	Description
AD	Anno Domini
BC	Before Christ
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
IBDU	Isobutylaldehyde-diurea
IBU	Isobutyraldehyde
K	Potassium
N	Nitrogen
NASA	National Aeronautics and Space Administration
P	Phosphorus
TS	Total Solids
TSS	Total Suspended Solids
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UV	Ultra Violet



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