IMPROVING THE PERFORMANCE OF UNIT OPERATIONS OF WATER TREATMENT PLANTS WHERE IRRIGATION TANKS ARE USED AS THE SOURCE

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(08/8047)

Degree of Master of Science

Department of Civil Engineering

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Declaration of the Candidate & Supervisors

Declaration of the Candidate

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Abstract

Worldwide, increasing demand for drinking water to cater to the increasing urban population has led to the use of lakes and reservoirs with unprotected catchments as sources of public water supplies. These water bodies receive drainage water containing large amount of nutrients, mostly from intensive agricultural practices, resulting in algal blooms, which have become a growing environmental problem. Conventional treatment used for surface water may not always produce satisfactory quality water in these situations. In addition, the increasing occurrence of toxins produced by cyanobacteria in such water bodies has become an important public health issue.

"Eastern Coastal Towns of Ampara District (ECTAD) Water Supply Project", where the raw water source is an irrigation tank with high inflows of nutrients was used as a case study. Coagulation, flocculation, dissolved air floatation (DAF), rapid gravity filtration and disinfection are the unit operations that have been designed and constructed, while Pre-chlorination and Powdered Activated Carbon (PAC) adsorption are also currently used in this water treatment plant, which have been introduced to treat taste an odour problems encountered after commissioning the plant.

The case study was carried out to evaluate the efficacy of pre-chlorination, activated carbon adsorption, Dissolved Air Flotation, filtration and disinfection in removal of cyanotoxins, taste and odor causing dissolved organic substances and colour causing substances such as iron and manganese from the source water, in order to provide satisfactory potable water.

The samples were collected at the source, and the inlet and outlets of each unit operations. Samples were collected in the morning and afternoon to capture the diurnal variations in quality. It was decided to carry out four trials during two dry seasons and two wet seasons since the raw water quality reports showed that the quality was significantly varied seasonally.

It was found from this study that raw water in Konduwatuwana Tank has high cyanobacteria content and *Microcystis aeruginosa* is the predominant specie. Main findings of our study were that PAC was effective in removal of Microcystin as well as dissolved organic substances, but needs to be optimized by providing sufficient contact time, and pre-chlorination does not improve the performance. The results of this study were generalized using water quality data of irrigation tanks in Gal oya cascade system, several irrigation tanks in the Kala Oya Basin and another few selected irrigation tanks in the North Central Province (not in the Kala Oya Basin).

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List of Abbreviations

Abbreviation		Description
AAS	-	Atomic Absorption Spectrophotometer
AC	-	Activated Carbon
APHA	-	American Public Health Association
COD	-	Chemical Oxygen Demand
CYN	-	Cylindrospermopsin
DAF	-	Dissolved Air Flotation
DBP	-	Disinfection by-products
ECTAD	-	Eastern Coastal Towns of Ampara District
ELISA	-	Enzyme Linked Immuno Sorbent Assay
FAS	-	Ferrous Ammonium Sulphate
GAC	-	Granular Activated Carbon
HPLC	-	High Performance Liquid Chromatography
IFS	-	Institute of Fundamental Studies
LB	-	Left Bank
LD_{50}	-	Fifty percent Lethal Dosage
MASL	-	Mahaweli Authority of Sri Lanka
MC-LR	-	Microcystin Leucine Arginine
MIB	-	methylisoborneol
NCP	-	North Central Province
NWSDB	-	National Water Supply and Drainage Board
PAC	-	Powdered Activated Carbon
PACL	-	Polyaluminium chloride
RB	-	Right Bank
rpm	-	revolutions per minutes
RSF	-	Rapid Sand Filter
THM	-	Trihalomethanes
UoM	-	University of Moratuwa
WHO	-	World Health Organization
WSS	-	Water Supply Scheme
WTP	-	Water Treatment Plant

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