STUDY OF FILTER CRACKING & COLOUR PROBLEM IN THE KALATUWAWA WATER TREATMENT PLANT

M.Eng. IN ENVIRONMENTAL ENGINEERING AND MANAGEMENT

Submitted By

ENG. K.L. CHITRAWARDANE

Supervised By

MR.RAMESH PERERA

Department of Civil Engineering

University of Moratuwa

Sri Lanka

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STATEMENT:

"This thesis was submitted to the Department of Civil Engineering of the University of Moratuwa, Sri Lanka, as a partial fulfilment of the requirement of the degree of Master of Engineering in Environmental and Management"

DECLARATION:

This thesis has not been previously presented in whole or part to any University or Institute for a higher degree

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K.L.Chitrawardane

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ABSTRACT

Raw water of reservoirs has high colour and low turbidity while river water normally has low colour and high turbidity. Organic matters carried with run off water accumulate at the bottom of reservoirs. Reservoir waters being stationary provides a friendly environment for algal growth and colour development from decomposition of those and some inorganic ion such as Iron & Manganese from soil.

So treatment of reservoir water is to be focused on colour removal rather than turbidity removal. It has been found that colour removal requires high coagulant dosage than turbidity removal and purification of reservoir water gives rise to operational problems in the conventional treatment systems such as short filter run with filter clogging and filter bed cracking.

Kalatuwawa Water Treatment Plant has been constructed in 1954 with design capacity of 20 mgd. It is a conventional type treatment plant having the following processes, Aeration, Pre-chlorination, Coagulation, Flocculation, Sedimentation, Filtration Post chlorination and pH correction.

Raw water is drawn off to the treatment plant from the Kalatuwawa impounding reservoir and the treated water is conveyed to Greater Colombo area under gravity feed and contributes 16 mgd to the total supply of Greater Colombo.

In the course of filtration, clean filter media gradually gets clogged. After about one month, small cracks on the surface of filters starts to appear and these cracks develop into large openings with mud ball formation in continuation of the filtration process. So it has been difficult to reduce the colour to acceptable level during high colour period as settled water passes through openings without filtration. This has been a long-standing problem, which has not received a proper solution so far.

Objective of this study was to investigate the reasons for filter clogging & filter cracking and find solutions to overcome this problem with improvement of colour removal efficiency. The analysis of the problem was divided into two parts. In the first part, the possible contributory factors from the reservoir up to filters were investigated. Physical & operational factors which may contribute to the problem in the filters themselves were investigated in the second part.
A pilot filter was set up in parallel to the existing filters and run more than one year with increased back wash rate and air scouring and found to be operating without clogging and cracking problem in media.

Similarly the applicability of clay and settled sludge as coagulant aid, and PAC as colour adsorbent was investigated for the purpose of improving settling and colour removal efficiency in order to reduce the filter load during high colour period. The chemical analysis done for raw water reveals that colour of Kalatuwawa water has developed primarily from organic substances with iron. Organic colour substances come from

decomposition of vegetation and Iron from bottom soil. This study investigated the possibility of filter clogging and cracking due to algal growth in the reservoir water and found no significant algal count in raw water to clog filters

Through Jar test analysis, it appears that clay and settled sludge can be applied as a coagulant aid in conjunction with Alum and these reduce colour in the settled water to satisfactory level with use of optimum dosage. Addition of Powered Activate Carbon as adsorbent to flocculation basin was found to reduce colour to minimal amount. Applying pre- chlorination is necessary to remove iron from water, as aeration alone is not able to do so.

Increased back wash rate up to $36m^3/m^2/hr$ with air scouring system gives adequate bed expansion and cleaning to filter media. Therefore this study leads to the conclusion that increased backwash rate with improvement of settling would solve the cracking and clogging problem of the filters. Similarly it requires the rehabilitation and modification of filter under drain system

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AAS	-Atomic Absorption Spectrophotometer
AWWA	-American Water Work Association
DO	-Dissolved Oxygen
JWWA	-Japanese Water Work Association
NTU	–Nephelometric Turbidity Unit
NWS&DB	- Nation Water Supply and Drainage Board
MGD	-Million Gallon Per Day
PAC	- Powdered Activated Carbon
Redox	– Reduction –Oxidation
TCM	- Tri Chloro Methane
THM	- Tri Halo Methane

TABLE OF CONTENTS **Page**