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Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

WATER RESOURCES ENGINEERING PROGRAMME

FINAL YEAR PROJECT PROPOSAL

"Design Of An Artificial Neural Network Model To Predict Optimum Coagulant Dosage In A Water Treatment Plant"

CASE STUDY: Bungokho Water Works

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A final year project proposal submitted to the Department of Mining and Water Resources Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science degree in Water Resources Engineering

DECLARATION

I **ETYANG NATHAN** hereby declare that, this report is a true work of my hands and has never been presented by any person or institution for an academic award

Signature: .....

Date: ....29th May, 2017.....

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ABSTRACT

The prevailing challenges faced by the water industry is the requirement to produce high quality treated water as stipulated by the regulatory authorities and also achieve production requirements at a lower cost. However, ensuring optimized dosing of the coagulant at conventional water treatment plants has the potential achieve both of these objectives.
This will result in water quality improvement and also generate chemical cost savings where potential overdosing of coagulant is minimized.

However, optimum coagulant dosage at Bungokho water works is evaluated using a Jar test, of which this process is highly time-consuming for operators where results can only be obtained after several hours and does not allow adjustment of alum dose rates to keep pace with rapidly changing raw water quality. Low dosage or under dosing generally results in poor removal of the raw water turbidity, thus failure to meet the water quality targets and less efficient operation of the water treatment plant. Additionally, excessive coagulant or overdosing, leads to more sludge forming (which are difficult to dewater), chemical wastage and an increase in the operational cost of the treatment.

This paper addresses the problem of determination of optimal coagulant dosage from raw water characteristics such as turbidity, pH and colour using Artificial Neural Networks. With the use of ANN, it introduces criteria given for selection and optimization is done very fast, efficiently before the water is supplied to the public. Artificial Neural Networks have been preferred for this project for their ability to learn and map recognisable patterns within years of the experimental data and their ability to model non-linear phenomena.
The performance of the ANN model was tested using statistical analyses it and proved to be outstanding with MSE of 0.5008, Coefficient of determination of 0.4936, RMSE of 0.4542 and MBE of 0.2063.
The model was developed and programed using Matlab 2013 environment.

APPROVAL

This is to certify that the project proposal work has been carried out under my supervision and this report is ready for submission to the Board of examiners and senate of Busitema University with my approval.

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LIST OF ACRONYMS/ABBREVIATIONS

ANN	-	Artificial Neural Network
MLP	-	Multi-Layer Perceptron
NTU	-	Nephelometric Turbidity Unit
mg/ l	-	milligrams per litre
NWSC	-	National Water and Sewerage Corporation
P^H	-	Power of Hydrogen ion
WHO	-	World Health Organisations
RMSE	-	Root Mean Square Error
MBE	-	Mean Bias Error
MATLAB	-	Mathematical Laboratory
MSE	-	Mean Square Error

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CHAPTER ONE

1.0 INTRODUCTION

This chapter entails relevant information about the project, problem statement, and justification, objectives of the study, purpose of the study and the scope of the study.

1.1 BACKGROUND

The water industry is facing increased pressure to produce higher quality treated water at a lower cost. Optimization of the coagulant dosing step at conventional water treatment plants will potentially achieve both of these objectives. (*N. Valentin, et al., 1997*)

This can be done by ensuring that the optimum coagulant dose is consistently applied to variable raw water quality thus resulting in water quality improvement and also generate chemical cost savings where potential overdosing of coagulant is minimized.

However, the main difficulty is to determine the optimum coagulant dosage related to the influent of raw water. Low dosage or under dosing generally results in poor removal of the raw water turbidity, thus failure to meet the water quality targets and less efficient operation of the water treatment plant. Additionally, excessive coagulant or overdosing, leads to more sludge forming (which are difficult to dewater), chemical wastage and an increase in the operational cost of the treatment.

Currently at Bunghoko water works which is the case study of this project uses manual method of determining coagulant dose that is; jar testing. Jar test is a laboratory technique where sample of water to be treated are poured into series of glass beaker and various dosage of coagulant are added to the beaker (Ali, Muyibi, Salleh, Alam and Salleh, 2010). It is empirical process which involves manual calculation of the relationship between the parameter given and selection. Disadvantages associated with jar testing are the necessity to perform manual intervention, slow process and the limitation to feedback control.

This paper addresses the problem of determination of optimal coagulant dosage from raw water characteristics such as turbidity, pH and colour using Artificial Neural Networks. With the use of ANN, it introduces criteria given for selection and optimization is done very fast, efficiently before the water is supplied to the public.

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