

CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME IV

Editors:

Ma'an Alkhatib
Abdullah Al Mamun
Faridah Yusof



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(VOLUME IV)

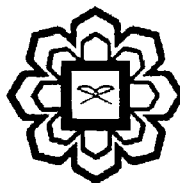
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CHAPTER 28

INTEGRATION OF ARTIFICIAL NEURAL NETWORK AND PRINCIPAL COMPONENT ANALYSIS TECHNIQUES FOR WASTEWATER TREATMENT PLANT EVALUATION

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ABSTRACT

Artificial Neural Network (ANN) as a black box model has the benefit of integrating the various operation conditions of wastewater treatment plant system and modeled it for proper simulation. The model might be improved if the raw data are preprocessed using principal component analysis (PCA) technique prior to imputing into neural net. The paper explore the theory of ANN using feed forward back-propagation algorithm and developed a simulation environment for the prediction of WWTP performance using data acquired from Bandar Tun Razak Sewage treatment plant (STP) Kuala Lumpur. The study found out that effluent Biological Oxygen Demand (BOD_{eff}) prediction by the model is satisfactory for process evaluation. A correlation coefficient (R) and mean square error (MSE) for BOD_{eff} was found to be 0.7990 (1.43) and 0.8276 (1.76) for training and testing data samples, respectively.

Keywords: wastewater treatment plant, artificial neural network, principal component analysis, biological oxygen demand.

INTRODUCTION

The art of wastewater remedial is called wastewater treatment and it is carried out in a specific location termed as Wastewater Treatment Plant (WWTP). Wastewater comprises pathogens, toxics, organic and inorganic materials that pose a serious nuisance to the public and the immediate environment. Pathogenic microorganisms (coliform, streptococci, salmonella, and enteric virus) transmit various diseases, so public concern regarding untreated wastewater is eminent. Therefore, any material present in water and has altered either or both the physical and/or chemical composition of water above the permitted level is termed as water pollutants. Removing pollutants that incorporated in the wastewater is the major goal of any WWTP in the world. The domestic and industrial wastewater contains pollutants such as Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Suspended Solids (SS), Ammonical Nitrogen (NH_3-N), Phosphorus, heavy metals and pathogens etc. To maintain the permissible level of wastewater parameters outlined by law enforcement bodies often become very challenging, due to the complexity nature of the wastewater parameters and their interactions. Influent characteristics of WWTP vary from one plant to another, which usually depends on the life style of the people around the plant, variation on diurnal