ABSTRACT

This study was carried out on River Atuwara in Ota, Ogun State, Nigeria with the aim of developing a coefficient of re-aeration model applicable to River Atuwara and other rivers in the Nigerian environment. This was achieved by sourcing for data once every month from 22 sampling locations of interest within a pre-selected segment of the river over a period covering the dry and wet seasons. The data collected include hydraulic data (depth, width, velocity and time of travel) and water quality data such as Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD). Excel Spreadsheet and MATLAB were used for data processing. Regression analysis was carried out where stream velocity and depth were the regressors and the re-aeration constant k_2 (as a function of BOD, DO and Temperature) was the dependent variable.

A coefficient of re-aeration, k_2, (Atuwara re-aeration model) was developed and validated statistically. Its performance was also verified by comparing the model with 10 other internationally recognized models. It was found that even though Atuwara model performed better than Agunwamba model and most of the other well cited models, both Atuwara model and Agunwamba model could be safely adopted for future water quality modelling researches in the Nigerian environment.

Results of detailed water analysis of samples from River Atuwara shows high level of pollution hence it is unfit for human consumption without adequate treatment. It is recommended that River Atuwara and similar rivers in the country should be regularly monitored for quality control.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Fresh water sources can be broadly categorized into groundwater and surface water (Chapman, 1992). Surface water can again be sub-divided into ''running'' surface water bodies and ''stationary'' surface water bodies. Examples of the former include rivers, streams, and brooks while examples of the latter include lakes and ponds. The most abused of all surface water bodies are the running surface water bodies because people tend to believe that by disposing their wastes into these running water, they have been rid of their waste disposal problems. In spite of its relative abundance, water is still a very scarce resource when it is needed in its fresh form because 97.5% of all available water is salt water (Krantz and Kifferstein, 2007; UNESCO, 2006). Of the remaining 2.5%, 70% of it is frozen in the polar ice caps. The other 30% is mostly present as soil moisture or is trapped in underground aquifers. In the end, only 0.007% of all water on earth is readily accessible as fresh water for direct human use (UNESCO, 2006; Krantz and Kifferstein, 2007).

1.1.1 Water Sources Distribution in Nigeria

Record shows that 29% of Nigerians live in the rural areas, 33% reside in small towns and 38% live in the urban areas (FGN, 2000). World Bank (2005) also revealed that 91% of Nigerians living in the rural areas (which translate to 37 million Nigerians, using the 2006 census data) had no access whatsoever to treated water. Most Nigerians derive their water from surface water (springs/stream/rivers), hand dug wells, rain harvesting, pipe borne water, boreholes and vendors (FGN, 2000). It is estimated that 48% (about 67 million) Nigerians harness surface water for their domestic needs, 57% (79 million) use groundwater, 20% (27.8 million) harvest rain,