INTRODUCTION

Water is vital both as a solvent in which many of the body’s solutes dissolve and as an essential part of many metabolic processes within the human body. Potable water production and supply are essential ingredients in the community and to human beings and other living things. Waterborne diseases (diarrhoea, typhoid, and cholera) that are widely spread in developing countries and in sub-Saharan are caused mainly by poor sanitation and hygiene practices, which involve collection, treatment and disposal of solid and liquid wastes. In wastewaters (liquid wastes) microorganisms are removed by disinfection treatment processes using Chlorine dioxide, Chlorine compounds (monochloroamine, dichloroamine), Ozone and ultra-violet radiations. The stringent potable water standard and effluents quality limits by Environmental Regulatory Authorities, increasing energy cost and reports of outbreak of water-borne diseases in many parts of Africa have brought a greater challenge to Water experts (Water Science, Environmental and Water Engineers). These actions have caused Environmental and Water Engineers to look for effective methods of treating water and wastewaters rather than relying on conventional water and wastewater treatment methods.

In the last two decades several studies have been conducted on the performance of electrochemical treatment process as a wastewater treatment method. The electrochemical treatment process has been effectively used in the treatment of various industrial, municipal, domestic—institutional and domestic wastewaters. Wastewater generated from industrial processes such as distillery industry (Manisankar et al., 2004), textile industries (Naumczyk et al., 1996) and dye processing industry had been treatment using electrochemical treatment process. Chen (2004) presented documents on the design development,
construction and applications of electrochemical techniques in water and wastewater treatment. In the
documentation a particular focus was given to selected techniques such as electrodeposition, electro-
coagulation, electroflotation and electrooxidation with little data on treatment of wastewaters from
pharmaceutical industries. Over 300 related publications were reviewed with 221 cited or analysed.
Literature (Li et al., 2014, Zheng et al., 2015) have provided more information on efficacies of various
electrochemical treatment of water and wastewaters. The main focus of this study is to conduct a simple
literature review on treatment wastewaters from pharmaceutical and related industries and establish ef-
cicacies of electrochemical treatment technique in removing selected pollutants form raw water.

BACKGROUND
Carbon resin electrodes were developed from used dry cells (Oke et al., 2007a, b and c). Electrolysing
equipment was developed from local materials. Synthetic (simulated) wastewaters were prepared using
procedures and methods specified in APHA (1998). Fractional factorial ($2^{K-P}$) experiments were utilized
at random to determine influence of selected factors (separation distance between the electrodes, volume
of the wastewater used, applied current, temperature of the wastewater, treatment time, concentration
of the pollutant, concentration calcium of hypochrte ($\text{Ca(OCl)}_2$) added and depth of the electrode into the
wastewater used) on efficiency of electrochemical process in removing Biochemical Oxygen Demand
concentration at five days ($\text{BOD}_5$) as follow-up on previous study (Oke et al., 2007c). The choice of the
parameters to be studied was done on the basis of the theoretical data about several factors that deter-
mine the efficiency of an electrochemical method and the scarce knowledge concerning carbon-resin /
aluminium electrodes. An electrochemical treatment plant on a laboratory scale using public electricity
source was setup (Figures 1a and b). $\text{BOD}_5$ determinations in wastewaters were carried out following
procedures in APHA (1998) using respirometric method (CAMLAB HACH, model number 2173B $\text{BOD}$
manufactured by Hach Chemical Company). The procedures and steps were repeated for blanks (to serve
as controls). Efficacies of the system were computed using equation (1)

$$Y = 100 \left( \frac{C_0 - C_f}{C_0} \right)$$

Where; $Y$ is the efficacy of the system (electrochemical treatment process), $C_0$ is the initial $\text{BOD}_5$ and
$C_f$ is the final $\text{BOD}_5$. Table 1 presents arrangement of Fractional factorial ($2^{K-P}$) experiments. Effects
of the selected factors on the efficacy of the electrochemical treatment process were computed using
contrast method (Guttman et al., 1971; Gardiner and Gettinby, 1998; Davore and Farnum, 1999, Davore,
2000) as stated in equation (2)

$$ef = \sum_{i=1}^{K-P} l_i Y_i$$

Where; $K$ is the number of the factors (8), $P$ is the fraction of the factorial experiment (3), $l_i$ is the
level (-1 or 1), and $ef$ is the effect of the factor. Number of experiments required for both factorial and
fractional factorial were computed using the following equations:
Related Content

Tradeoffs Between Forensics and Anti-Forensics of Digital Images

Classification of Sentiment of Reviews using Supervised Machine Learning Techniques
[www.irma-international.org/article/classification-of-sentiment-of-reviews-using-supervised-machine-learning-techniques/169174](www.irma-international.org/article/classification-of-sentiment-of-reviews-using-supervised-machine-learning-techniques/169174)

Performance Analysis of Hard and Soft Clustering Approaches For Gene Expression Data

Could Educational Technology Replace Traditional Schools in the Future?
[www.irma-international.org/chapter/could-educational-technology-replace-traditional-schools-in-the-future/183955](www.irma-international.org/chapter/could-educational-technology-replace-traditional-schools-in-the-future/183955)

Complexity Analysis of Vedic Mathematics Algorithms for Multicore Environment
[www.irma-international.org/article/complexity-analysis-of-vedic-mathematics-algorithms-for-multicore-environment/186857](www.irma-international.org/article/complexity-analysis-of-vedic-mathematics-algorithms-for-multicore-environment/186857)