

**PHARMACEUTICAL EFFLUENT TREATMENT USING
MICROALGAE *Scenedesmus obliquus* and *Chlorella vulgaris***

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Scenedesmus obliquus and *Chlorella vulgaris*

BY

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF
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BIOLOGICAL SCIENCES, COLLEGE OF SCIENCE AND
TECHNOLOGY, COVENANT UNIVERSITY, OTA.**

OCTOBER, 2020

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfillment of the requirements for the award of the degree of Master of Sciences (M.Sc.) in Microbiology in the Department of Biological Sciences, College of Science and Technology, Covenant University, Ota, Nigeria.

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DECLARATION

I, **KAYODE-AFOLAYAN, OLUSHOLA (18PCQ01823)** declare that this research was carried out by me under the supervision of Prof. Obinna C. Nwinyi of the Department of Biological Sciences, College of Science and Technology, Covenant University, Ota, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

KAYODE-AFOLAYAN, OLUSHOLA

Signature and Date

CERTIFICATION

We certify that this dissertation titled “**PHARMACEUTICAL EFFLUENT TREATMENT USING MICROALGAE**” is an original research work carried out by **KAYODE-AFOLAYAN, OLUSHOLA (18PCQ01823)** in the Department of Biological Sciences, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Prof. Obinna C. Nwinyi. We have examined and found this work acceptable as part of the requirements for the award of Master of Science (M.Sc) in Microbiology.

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DEDICATION

This dissertation is dedicated to God Almighty for the eventual completion of this research without whom this would not have been possible.

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ABSTRACT

Ineffective effluent treatment contributes to the recalcitrance and bioaccumulation of some active pharmaceutical by-products in the environment. In this study, physicochemical analyses were conducted on effluent sampled from a pharmaceutical company in Ota using spectrophotometric methods. These include inductively coupled plasma-coupled emission spectrometry (ICP-OES), and High-performance liquid chromatography (HPLC). The water quality index (WQI) was deduced from the assessed parameters which included conductivity, total suspended solids (TSS), total dissolved solids (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), biogenic/organic constituents, (phosphates, nitrates, and sulphates), and heavy metals. The microalgae utilized for the treatment of the effluents, were sampled from the environment, and grown for seven days in a BG-11 medium. Following the isolation and characterization of the microalgae using microscopic examinations and molecular characterization, two selected microalgae named *Scenedesmus obliquus* (MW824580) and *Chlorella vulgaris* (MW824551) were used in the treatment assay of the pharmaceutical effluents and monitored for 28-days period. The results obtained ranged from BOD (39.10 ± 0.35 - 3.03 ± 0.42), COD (360.70 ± 1.45 - 19.67 ± 2.60), nitrates (13.26 ± 0.69 - 1.27 ± 0.04), sulphates (4.57 ± 0.14 - 0.34 ± 0.03), phosphates (4.50 ± 0.06 - 0.02 ± 0.02) in mg/L. The pharmaceutical residues assay ranged between (567 ± 14.0 - 49.50 ± 2.50) Loratadine, Fluconazole, (2554 ± 14.50 - 141.50 ± 7.50) Ciprofloxacin, (510 ± 5.0 - 64.50 ± 5.50), Diphenhydramine Hcl, (499 ± 4.0 - 37.0 ± 1.5), and Clotrimazole, (1290 ± 15.50 - 95.0 ± 12.50) in ng/L. The WQI for the pharmaceutical effluent is 32.53. After treatment during the 28-day period it was estimated to be 14.14 with a water quality status of 'Excellent'. From the treatment assay it was evident that *Scenedesmus obliquus* reduced the TSS, TDS, BOD, COD effluents better than *Chlorella vulgaris*, however *Chlorella vulgaris* exhibited more competence with the reduction of active pharmaceutical ingredients. In conclusion, it is evident that microalgae-based technologies could be used effectively in the treatment of pharmaceutical effluents before reuse or eventual discharge into receiving waterbodies to prevent environmental pollution and adverse health effects on the fauna and humans.

Keywords: *Pharmaceutical Effluent, Bioremediation, Microalgae, Heavy Metals, Active Pharmaceutical Ingredients.*