ID:4023

The Remediation of Water Contaminated with Hydrocarbons in an Activated Sludge Bioreactor

El Hanafi Nawel[1*], Ighilahriz Kahina[2], Zaabar Aida[1], Aoudjit Farid[1], Moulla Nabil, Messoudi Farida, Lounici Hakim[1]

[1] Laboratory of Materials and Sustainable Development (LMDD), Faculty of Science and Applied Sciences, University of Bouira, 10000 Bouira, Algeria

2 Central Direction Research and Development, SONATRACH Avenue du 1er Novembre - 35000 Boumerdès (Algeria).

*Corresponding author's email: n.elhanafi@univ-bouira.dz

ABSTRACT

Industrial wastewater presents a potential means of contamination, encompassing a diverse array of organic contaminants like hydrocarbons, alongside inorganic pollutants like cyanides and sulphates, among others. It is incumbent upon us to undertake their treatment in an effort to mitigate their deleterious environmental influence. The objective of this investigation is to remediate water that contains hydrocarbons through the utilization of bioreactor that employs activated sludge. An assessment of the efficacy of the aforementioned bioreactor was carried out by scrutinizing diverse physico-chemical indicators of contamination, such as pH, turbidity, COD, BOD_5, and so forth, throughout the course of the treatment procedure. The COD findings unveiled a reduction of 51% (from 1135 mg O_2/L to 555 mg O_2/L). In regards to BOD_5, the efficacy of the treatment exhibits a limited capacity, yielding only 32%.

Keywords: Industrial wastewater treatment, Bioreactor, Activated sludge, Hydrocarbons

1 Introduction

Wastewater contains many different pollutants. These organic pollutants, inorganic or microbial substances are extremely hazardous to the environment and health human being. The appropriate type of treatment depends on the composition of the wastewater. Petroleum hydrocarbons, oils and greases, phenol, ammonia, sulphide and others organic compounds are some of the many pollutants that make up wastewater of the oil industry. In the water discharged from the petroleum industry, all of these compounds are present in a very complex form and are directly or indirectly harmful to the environment. There is a need to use new water treatment technologies to help the oil industry preserve the environment. However, conventional activated sludge, which is the most common biological process as a secondary treatment for industrial wastewater, is sufficient to meet these stringent requirements. The general objective of this work is to study the possibility of treating synthetic wastewater loaded with organic matter (hydrocarbons) by an activated sludge bioreactor.

2 Experimental

To purify tap water that contains the pollutant, the following steps are performed:

1) Put a volume of 2.5 L of activated sludge into the membrane bioreactor mix with 20L of tap water that contains the pollutant, (the sludge is reactivated at the laboratory level for approximately 30 days); **2)** Start the stirring and aeration system, then, let the mixed liquor in the bioreactor (about 2 hours) before the first samples. After, take the samples required to analyze the operating parameters of the Bioreactor. **3)** Transmit a quantity of mixture to the clarifier until it is filled, afterwards, leave to decant for about 2 hours and take the samples for analysis the physico-chemical parameters of the purified water; **4)** In the end, recycle the settled sludge to the bioreactor with a QR flow rate = 5,084 ml /S

©2024 Copyright held by the author(s). Published by AIJR Publisher in "Abstracts of the Second International Congress on Energy and Industrial Processes Engineering: Volume 2" (ICEIPE'24) 14-16 May 2024. Organized by the Research Laboratory of Matter's Valorization and Recycling for Sustainable Development (VRMDD), University of Sciences and Technology Houari Boumediene (USTHB), Algiers, Algeria.

DOI: 10.21467/abstracts.170 ISBN: 978-81-970666-1-0 (eBook)

3 Results and Discussion

3.1 Change in Chemical Oxygen Demand (COD)

The results obtained are given in the figure 1

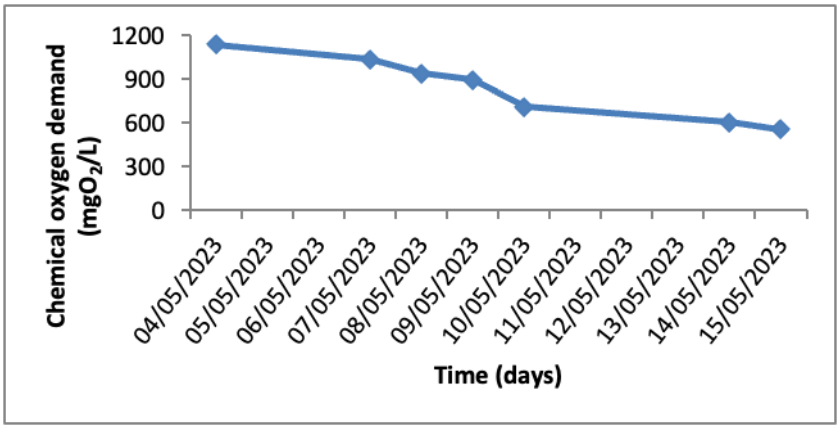

Figure 1: Variation in chemical oxygen demand (COD).

The COD results obtained show that the COD value on day 1 is 1135 mg O_2/L, and over the course of treatment, a decrease to 555 mg O_2/L was observed, resulting in corresponds to a treatment efficiency of 51.1%. This performance indicates the quality of the water which is not very satisfactory, but it has reached 50%. This effectiveness demonstrates the high purification power of microorganisms that require oxygen to meet their metabolic requirements, including the degradation of organic pollution.

4 Conclusion

The aim of this study was, therefore, to study the degradation of a water sample that contains hydrocarbons by the activated sludge biological process. Follow-up of the analysis of physico-chemical parameters of pollution, i.e.: pH of the water, temperature, conductivity, (MES), (MVS), COD... etc., allowed us to assess the performance of the bioreactor used decontamination of water and environmental preservation. Observation of bacterial growth reveals that microorganisms use the hydrocarbons (toluene and n-heptane) as an essential source for their development. The good nutrition of the sludge during reactivation allowed the increase of its sound efficiency in the degradation of organic matter.

Reference

[1] Attiogbe, f.k., Glover-amengor, m., Nyadziehe, k.t. (2007). Correlating biochemical and chemical oxygen demand of effluent sa case study of selected industries in Kumasi, Ghana. W. Afr. J. Appl. Ecol.

[2] IACOPOZZI, I., INNOCENTI, V., MARSILI-LIBELLI, S. & GIUSTI, E., (2007). A modified Activated Sludge Model, No. 3 (ASM3) with two-step nitrification–denitrification. Environ Model Softw, 861, p.849.

ISBN: 978-81-970666-1-0

Series: AIJR Abstracts

DOI: 10.21467/abstracts.170