

# EVALUATION OF THE PHYSICO-CHEMICAL PROPERTIES OF SUGER INDUSTRY EFFLUENTS IN MOZAMBIQUE

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Wastewater generated by the sugar industry exhibits complex characteristics and poses a significant challenge for environmental engineers in their efforts to devise effective treatment and reuse strategies. The primary objective of this study is to assess the physicochemical properties of wastewater from the Mozambique Sugar Mill. This facility was selected due to the substantial volumes of water utilized in its production processes (approximately 900 m<sup>3</sup>/h), as well as the effluent management model that will be implemented. Samples were collected over a six-month period, with bimonthly intervals, and various physical and chemical parameters were analysed. The findings were compared against the regulatory standards established by Mozambique (Decree 18/2004) and benchmarked against values suggested by the World Bank in several reports.

The novelty of this research lies in proposing an optimal method for treating these effluents in a more environmentally sustainable manner. The results indicate that most sugar-producing countries, where liquid effluent control standards are in place, limit organic loads to a BOD (biological oxygen demand) concentration ranging between 15 and 60 mg/L [1].

To assess biodegradability, the BOD:N ratio is one of the key indicators for measuring pollution levels in wastewater, as well as in monitoring drinking water quality, by comparing the biological demand for oxygen, nitrogen, and phosphorus. A minimum BOD:N ratio of 100:5:1 is typically required for aerobic treatment processes, while anaerobic processes demand a COD:N ratio of at least 350:7:1. Table 1 presents some characteristic results, demonstrating that, in general, most of the outcomes for industrial effluent treatment fall within the ranges associated with primary and secondary treatment processes. [2-4].

Table 1. Effluent parameter values of some authors

Parameters	[1]	[8]	[11]
Temperature (° C)	40	29.3-44.3	24.3
pH	5.5	6.7-8.4	4.0
Turbidity (NTU)			621
BOD (mg/L)	970	654.4-1968.5	431.9
COD (mg/L)	3682	1100.3-2148.9	1536.8
Conductivity (μS/cm)	2230	540.3-925.9	534
Phosphate (mg/L)	5.9	1-19	15
Nitrogen (mg/L)		11.9-40.6	30

The physicochemical characteristics of the wastewater from the sugar industry analysed in this study significantly exceed the threshold values established by the applicable legislation (Decree 18/2004), although certain parameters are not explicitly addressed in the legal document. Based on the data obtained and the large volumes of effluent produced (900-1000 m<sup>3</sup>/h), the use of aerobic lagoons is recommended. With a hydraulic retention time exceeding 120 hours or up to 7 days, such lagoons would facilitate the reduction of effluent temperature to ambient levels and promote aerobic processes, which could significantly decrease the pollutant load, as referenced in [3].

The study also revealed that the pH levels of the wastewater were compliant with the regulatory standards outlined in the legislation governing environmental quality and effluent emissions for the sugar industry (Decree 18/2004). According to Mozambican regulations, the COD/BOD ratio is set at 5. However, in this study, the ratio ranged between 1.4 and 2.0, which is considerably below the established limit, indicating a high level of biodegradability in the effluent [4].

Consequently, biological treatment technology is suggested for managing these effluents. The BOD:N ratio is utilized to assess biodegradability, as it is one of the most critical indicators for evaluating pollution levels in wastewater. For aerobic treatment processes, a minimum BOD:N ratio of 100:5:1 is required, while anaerobic processes necessitate a COD:N.

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## APPRECIATIONS

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