Pollution effects of brewery wastes: Ruaraka River

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ABSTRACT

This paper reports the results of a two-year study on the pollutional effects of brewery wastewater on the Ruaraka River. As a preliminary investigation to an extensive river pollution study, samples were taken twice weekly between August 1988 and June 1990 from two sampling points immediately upstream and downstream of the point of discharge of the Tusker Brewery wastewater into the river. The samples were analysed for BOD and COD as well as other parameters.

The results of this preliminary investigation showed that whilst the average BOD of the river water was about 6.9 mg/l at the section just above the wastewater outfall, the average BOD of the river water at the sampling point immediately below the outfall was about 115.6 mg/l. Similarly, the average COD concentrations for the upstream and downstream sections were 34.7 mg/l and 240.4 mg/l respectively. If the brewery wastewater was treated in an anaerobic pond having only 45 per cent BOD reduction efficiency before discharge, it is estimated that the average BOD concentration of the river water at the downstream section would only be about 65mg/l. Treatability studies carried out on the wastewater showed that it would be possible to achieve a BOD reduction of 45 per cent or more in laboratory scale anaerobic pond units.

INTRODUCTION

Dilution in receiving waters is by far the most commonly used method for the ultimate disposal of wastewater effluents. The fundamental principle governing effluent disposal is to make treatment plants do part of the work and let nature complete it. Serious pollutional problems often arise when nature is called upon to do far more than its share of the work. This is presently the case with respect to the disposal of the wastewater effluent from the Tusker Brewery plant at Ruaraka, Kenya into the Ruaraka River.

Wastes from the brewery industries are known to have the advantage of containing materials with very high re-use values.
monitoring the characteristics of the brewery wastewater; and treatment studies of the wastewater in laboratory-scale anaerobic ponds.

**River quality monitoring**

Samples were taken from the river at points immediately upstream and downstream of the point of brewery wastewater discharge and analysed for BOD, COD, SS and DS. This was carried out twice a week, from August 1988 to June 1990 and the results obtained form the basis of discussion presented in this paper.

**Brewery wastewater sampling and analysis**

Between October 1988 and May 1989, samples were collected from the Tusker Brewery plant twice a week and analysed for Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Suspended Solids (SS), Dissolved Solids (DS), pH, alkalinity, nitrate and Nitrate nitrogen, albuminoid ammonia, and chloride contents.

**Treatment studies**

A laboratory model anaerobic pond (dimensions 0.2 m x 0.4 m x 0.6 m deep) was used for the treatment of the brewery wastewater. During start-up the pond was initially half filled with raw sewage from Kariobangi sewage treatment works and topped up with the brewery waste. The pond was then completely covered with black polythene sheets and left for about two weeks before continuous feeding with the brewery waste commenced. Sampling of the influent and effluent of the pond commenced a week after continuous feeding began. The samples were analysed for BOD, COD, SS, pH, and alkalinity in accordance with the Standard Methods for the Examination of Water and Wastewater.

**RESULTS AND DISCUSSION**

Detailed discussion on the results of the investigation covering the characteristics and treatability of the brewery waste has been presented in earlier publications (ref. 3 and 4). The results showed that the average BOD concentration for the brewery wastewater was 6800 mg/l while the average BOD concentration of the effluent from the laboratory model anaerobic pond, operating at an average 5-day detention time, was 3700 mg/l.

Discharging the untreated wastewater into the river gives the river water characteristics shown in Figures 2, 3, and 4 for the upstream and downstream sections.
Fig 2: Variations in BOD at the upstream and downstream sections of the discharge point

Fig 3: Variations in COD at the upstream and downstream sections of the discharge point

The average BOD concentration of the river water at the sampling point immediately downstream of the point of discharge was 115.6 mg/l as compared to an average upstream value of 6.9 mg/l. Analysis showed that if wastewater was to be treated in an anaerobic pond prior to discharge, the expected average BOD of the river water at the downstream section would be about 65 mg/l. Following through the analysis down the river channel produced the BOD profiles shown in Figure 5. It is clear from the analysis that with the current practice of discharging the effluent untreated, the river would only attain a BOD level of 65 mg/l at a distance of more than 7 km from the point of discharge, assuming that its assimilative capacity is not already exceeded by the heavy organic load.

CONCLUSION

It was generally observed that the management of Tusker Brewery plant had little or no knowledge of the characteristics of the wastewater being generated from the industry. This study has shown that the brewery wastewater is biodegradable and a simple treatment in an anaerobic pond with only 45 per cent BOD reduction efficiency is sufficient to avert the serious pollutional problems currently caused to the Ruaraka River by the wastewater.
It is appropriate to point out that sampling of the river water at different sections downstream is continuing and the results will be useful in developing mathematical models for the pollutional profile of the river.

REFERENCES


