

A postal survey of effluent generation and disposal in the Zimbabwean dairy industry

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Abstract

Water is a major utility in the dairy industry, which results in significant effluent volumes being generated, hence the challenge of its disposal cannot be ignored. In Zimbabwe, industry generally is not made to pay the full cost of managing industrial effluents, which inadvertently encourages environmental pollution. This paper presents the results of a postal survey of effluent generation and disposal by the dairy industry. A total of 30 questionnaires were sent out to various milk processors around the country out of which 15 were returned. The useful respondents receive and process 56% of the total milk produced in the country. The data obtained indicated that while some of the plants discharge their effluents into the municipal sewers, others discharge theirs by means of land irrigation. This latter method has the consequence of groundwater pollution. Respondents' knowledge of effluent characteristics was generally low, which is not surprising as there are no stringent penalties for polluting.

Introduction

Milk produced on the dairy farms in Zimbabwe is sold to the dairy-processing industries for conversion into milk products. Some of the milk farmers have small on-site plants, which process some of their milk into various products. From a production level of less than 150×10^6 l at independence in 1980, milk production peaked at 270×10^6 l in 1991 resulting in the country satisfying local demand with some surplus for export. However, the period after the drought of 1992 has been characterised by a decline in milk production such that production level was 175×10^6 l in 1999 (*Zimbabwe Quarterly Digest*, 2000). Eighty per cent (80%) of the milk produced is sold through the Dairibord Zimbabwe Limited (formerly the Dairy Marketing Board) which has processing plants in the major cities.

The volume of effluent arising in a dairy plant is dependent on two factors, the type of dairy product being processed and the degree of water management being exercised and thus the amount of water being conserved. For example, cheese, milk powder and evaporating plants generate larger volumes of effluent than those producing pasteurised milk. According to Hiddink (1990), the water-to-milk ratios for liquid-milk-processing plants in some European countries range between 0.5 to $12.9 \text{ l} \cdot \text{kg}^{-1}$ of milk. In view of the increased cost of water and effluent treatment, any reduction in water consumption is essential. Milk and related products have very high chemical oxygen demand, COD values (milk: $218000 \text{ mg} \cdot \text{l}^{-1}$; skimmed milk: $100\,000 \text{ mg} \cdot \text{l}^{-1}$; whey: $80\,000 \text{ mg} \cdot \text{l}^{-1}$). The sources of effluent in the dairy industry include cleaning of equipment, washing away of product leakage and floors and contaminated and returned products by customers, which are discarded into the drains. The average COD for dairy effluents in the USA was given as $3\,800 \text{ mg} \cdot \text{l}^{-1}$ (Jones, 1974) and that for South Africa was suggested to be similar (Strydom et al., 1993). That for the Zimbabwean dairy industry was given as $3\,300 \text{ mg} \cdot \text{l}^{-1}$ (Ikhu-Omoregbe et al., 2001) which is similar to the above published data.

Like in most process industries, the dairy industry has effluent disposal problems. This problem is acute in Zimbabwe due to the

absence of stringent control of effluent disposal by process industries. Under the Urban Councils Act of 1995, industries could discharge any amount of effluent into the municipal sewage system provided the quality of the effluents is below prescribed limits as set by the city by-laws. Enforcement of these by-laws was not only poor, penalties imposed were not stringent enough to force a change of habit (Jarawaza, 1997). Furthermore, most industries do not pretreat their effluents before discharge into the municipal sewers (Ikhu-Omoregbe et al., 2001).

The purpose of the postal survey is to ascertain the state of effluent production and disposal by the dairy industry in Zimbabwe and its findings are presented in this paper. It is hoped that the results will throw light on effluent management in the Zimbabwean dairy industry and highlight the need for pretreatment at the individual plant level.

Method

A questionnaire was designed and sent to 30 milk buyers whose addresses could be obtained from the National Dairy Society of Zimbabwe. The questionnaire sought information from respondents in the following areas:

- volume of milk received
- types of dairy products produced
- volume of water used in production
- types of chemical used in the particular factory
- the volume and characteristics of effluents generated
- treatment of effluent before disposal
- method(s) of effluent disposal
- cost of effluent disposal
- expressed interest in effluent studies.

The questionnaire was such that respondents were required to give an average daily value of specific parameters. These included water usage, milk reception and effluent discharge volume. These values were then converted to yearly rates by multiplying by a factor of 300, assuming a 300 working-day year as most of the respondents work 6/7 d a week. The 30 milk buyers included the main manufacturers and distributors of fresh milk and dairy products in the country as well as the smaller dairy plants, some of which are located at the farms. The questionnaires were sent to each dairy

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