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A BIOLOGICAL TREATMENT SYSTEM

FOR

FELLMONGERY WASTES

A thesis presented in partial fulfilment of the

requirement for the degree

MASTER OF TECHNOLOGY

in Biotechnology

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SUMMARY

Traditionally fellmongery wastes from freezing works have been treated by ponding before discharge to the nearest watercourse. Unfortunately, this does not always produce a satisfactory effluent.

These studies seek to provide a method of improving the quality of fellmongery effluent.

The lime and sulphide components of fellmongery wastes limited many of the chemical and biological systems considered. Biofiltration offered a simple and inexpensive method of treatment. Batch and continuous loadings were considered, the batch loadings being subjected to a range of recirculation ratios. Emphasis was directed at determining the mechanism of sulphide removal from the waste during treatment.

Batch operation (8 hour/day per 5 day-week) was shown to be marginally superior to a continuous operation on the basis of COD removal. Both systems exhibited 90 - 100% sulphide removal, which was shown to occur by a biological mechanism. Thiobacillus thioparus, an autotrophic sulphur-oxidising bacteria, was the main agent of sulphide removal, sulphate being the end product of the oxidation process. Thiorhodaceae, the purple sulphur bacteria, was also isolated from the filter during continuous operation. The mechanism of sulphide removal from fellmongery wastes was incompletely defined.

Effluent pH was shown to be independent of changes in influent pH. A decrease in pH during treatment was due to the increases in sulphate concentration and the precipitation of lime by carbonation reactions.

Biological filtration of fellmongery wastes provided a satisfactory method for the simultaneous reduction of COD, sulphide concentration and lime concentration.

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INTRODUCTION

INTRODUCTION

The fellmongery process involves the removal of wool from sheep and lamb skins prior to tanning. The pelts also must be free from epidermis, sweat and fat glands, muscle tissue, blood vessels, fat cells and collagen fibrous tissue. The process consists of the following operations:-

(1) Washing of pelts.
(2) Lime/Na_2S paint application.
(3) Wool removal; manual pulling.
(4) Liming; removal of residual wool, pelt conditioning, carried out in a "dolly" or drum.
(5) Deliming and bating; removal of lime liquor and extraneous pelt matter, "dolly" or drum processing.
(6) Pickling; preservation; "dolly" or drum processing.

Thirty-nine fellmongeries, which were operating in New Zealand at the end of 1972 (42), were all departments of meat processing works.

Fellmongering, as a completely separate process from tanning, is relatively unique to New Zealand. The majority of foreign fellmongeries are integrated with the tanning process. This situation arose from New Zealand's early trading role as a producer of raw materials for the more industrially developed countries of Western Europe. Thus New Zealand exports only partially processed pelts, although this is likely to change in the future. Approximately 36 million pelts, valued at $N.Z. 48.7 million, were exported in 1971; the majority to Britain, the U.S.A., the Netherlands and France (84).

The lamb and sheep kill of a meat processing works will influence the size of the associated fellmongery. The pelt throughput of the fellmongery determines the volume of effluent discharged.

The organic portion of fellmongery waste is represented by its high BOD, while the sulphide and lime components constitute the bulk of the inorganic fraction. The waste is characteristically alkaline. An effluent with such characteristics is not readily amenable to biological treatment, although biological filtration is an exception. Costly chemical treatments are required to achieve a satisfactory product for discharge.

After a primary sedimentation treatment the majority of fellmongery effluents are discharged to ponds or to the main meat processing waste stream. Additions of fellmongery effluent to existing effluent streams only serve to increase their respective volumes and organic loads. Treatment by ponding necessitates large land areas, and results in the emission of unpleasant odours during treatment.

Discharge of untreated fellmongery waste to sewer systems or receiving waters is undesirable owing to the toxic effect of the sulphide and lime components on biological life present in both systems. The corrosive effect is well recognised, and accordingly sulphide concentrations entering sewers are set at low limits by local authorities. The high BOD of the waste will cause severe depletion of dissolved oxygen in receiving waters if insufficient dilution is present.

With an increasing public awareness of environmental conservation, treatment of effluents such as fellmongery, will become mandatory. Waste treatment systems must be selected on the basis of economy and performance characteristics. In addition, maintenance and degree of attention must be minimal. A system with a specific mechanism for simultaneous removal of BOD, sulphide and lime is desirable. Several processes when combined together may accomplish this, but biological filtration exhibits the potential to accomplish these objectives in a single operation. Accordingly, these studies were concerned with the investigation of the performance of a biological filter treating fellmongery waste. The nature of the mechanism of sulphide removal and the alkalinity of the waste were also the subject of a detailed study.