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FISHERIES RESEARCH BOARD OF CANADA

TECHNICAL REPORT NO. 14

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CLARIFICATION OF WASTE WATER OTHER THAN STICKWATER FROM BRITISH COLUMBIA FISHING PLANTS

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Introduction

At the request of members of the Fisheries Association of B.C., an initial estimate of the problems, means, and costs of clarifying the total liquid effluent from the fishing plants has been made and is presented here.

The main problems involved are the wide variation in the type of effluent produced by each fishery throughout the year, the large amount of effluent produced, and the dilute solutions of protein and oil which must be handled.

In most cases, the waste water at present is being disposed of into river estuaries or into tidal water. Since pollution controls are becoming more rigorous, and since the fishing industry is vitally concerned in protecting all waters used by commercial species of fish, it is advisable that steps be taken to control the dumping of wastes wherever possible.

Economics and regulations will dictate the level of clarification which will be achieved, and hence will limit to some extent the methods which might be used. For example, the present stickwater recovery system could not be considered for handling liquids having less than one per cent total solids, due to the prohibitive cost of heating the water.

Fortunately, the experience of several industries having similar problems is available to us. Effluent control in industries such as meat and poultry processing, vegetable preparation and urban sewage disposal has been accomplished, and some of their methods can be adapted to overcome the problems facing the fishing plants.

Where odours caused by bacterial degradation of the material present in the raw effluent is a problem, the long retention times required for sedimentation must be avoided. However, concentration of the solids may be achieved by flotation, with retention times of less than an hour. Once the material is concentrated, separation of solids and oil may be accomplished economically by centrifugation. Several companies handle equipment for performing this operation.

Pollution Sources

The main contaminants in the raw effluent are proteinaceous solids and fish oil. The proteinaceous material may be in true solution, in close emulsion with the oil, or in fine particles.

Table 1 contains a list of the source, the volume and content of recoverable material in the waste water from a large B.C. fishing plant.

Table 1

Fishing Plant Effluent

Source of Effluent	Max. volume (Gal/Day)	Recoverable Material (Ton/Day)	
		Meal	Oil
Herring pump water	350,000	5	4
Salmon canning lines	450,000	3	2
Tuna canning lines	370,000	2	1
Ground Fish Plant	650,000	3	-

This table must be taken as only a rough estimate, as the amount of water used and the solid and oil content will vary widely throughout the season, and even from day to day.

Treatment Method

The actual treatment of the water would vary, depending on whether an attempt is to be made to recover the soluble solids. If they are to be partially recovered, the raw effluent would be adjusted in pH to the isoelectric zone of the proteins (about 4.7) with acid prior to treatment. This would cause a precipitation of much of the soluble material. This creates problems of corrosion, and would require that the polished effluent be neutralized before release.

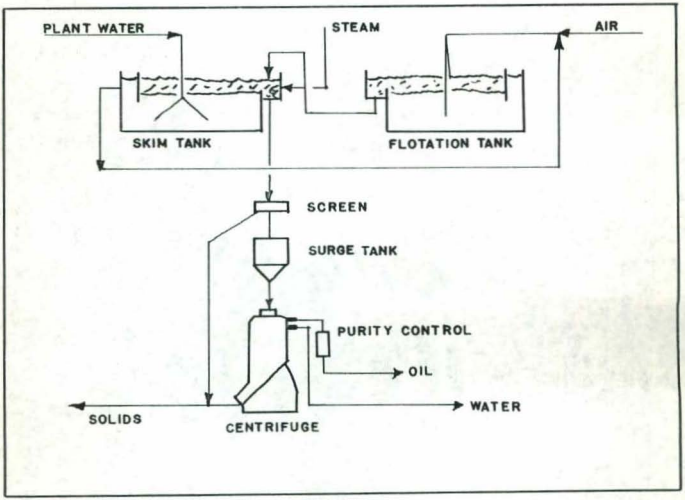

Figure 1 Flow Diagram

The main treatment steps are shown in Figure 1. The raw effluent is screened to remove all large particles. The pH is adjusted if necessary, the effluent is saturated with air at elevated pressure and the pressure is released through an appropriate valve. At this point a flocculant (such as alum) is added to assist in agglomeration of the particles. The air comes out of solution as fine bubbles, attaches itself to the particles and floats them to the surface, forming a sludge. The sludge is skimmed off for further treatment. The polished water may be recycled or released to the river or sewer, and the sludge heated to release the air and coagulate the protein. A centrifuge would then be used to separate the water, oil and solids. These could be either combined with similar material in the reduction plant or processed separately. The type of flocculant employed would depend on the pH of the effluent (i.e. alum at pH 5.5 to 7.5 and ferric chloride below pH 5.5). It is possible that a polyelectrolyte may aid in the process, and this should be investigated.

Economics

A plant large enough to handle the waste from the typical integrated fishing plant would perhaps cost about $50,000. It may be seen from Table II and Table III that if the plant were to operate just on the herring pump water that over one thousand dollars per day could be realized to pay for the equipment required.

Conclusions

The use of flotation units for treatment of fishing plant waste water would overcome much of the present pollution problems, and the value of the recovered material should more than offset the cost of equipping and operating this plant.

The plant could be operated in the manner required to achieve the best economic recovery consistent with the regulations covering the discharge of this effluent.

Table II

Cost Estimate

Product fish meal and oil Production 5 tons meal, 4 tons oil

Units tons

Costed on 12 hours per day, 200 days per year.

350,000 gals per day.

Raw material used	Unit of material	Price per unit	Usage	Rate Total Units	Total cost
Aluminum Sulfate	ton	$43.00	30 ppm	.05 tons	$2.20

Labor Requirements

Operators per shift	1
Hours per shift	12
Hourly rate	$ 2.50 (plus time and a half over 8 hours)
Daily cost	$ 35.00

Other Factory Costs

Supervision, 25% labour	$ 8.75
Fringe benefits, 10% labour	$ 3.50

Operating costs

Estimated from operating data from sewage works.

$ 50.00

Total Factory Costs approximately $100 per day

Table III

Plant Income

Based on 12 hours per day, 200 days per year, 350,000 gals per day

	Recovered material, tons/day	Value per ton	Total Value
Solids	5	$160	$800
Oil	4	$180	$720
		TOTAL	$ 1520