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EGG WASHING WASTEWATER CHARACTERISTICS AND TREATABILITY

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During the summer and fall of 1978, a research project on egg washing wastewater was conducted by the Agricultural Engineering Department, University of California at Davis. Three egg grading plants were visited on a weekly basis over a 10-week period and samples of the effluent from the egg washing tanks were obtained. These samples were chemically analyzed. In addition, a sufficient quantity of effluent was collected on one occasion to evaluate its biodegradability in aerobic and anaerobic laboratory treatment systems.

Results

A summary of the wastewater characteristics is presented in the table on the next page. By comparing the mean values, one can see that the egg washing wastewaters from the three plants surveyed are very similar. The organic content of the wastewaters was on the average approximately ten times greater than that of domestic wastewater.

A large variation in wastewater quality from week to week is indicated by the wide range of data for each of the three plants. There are a number of factors that might cause this variation including, but not limited to, fluctuations in the following factors: (1) egg breakage in washer; (2) egg cleanliness; (3) overflow rate from washer sump; and (4) rate of processing. On the basis of limited observations, it is believed that the first two factors are the most significant.

Treatability studies were performed using four laboratory-scale activated sludge reactors and two laboratory-scale anaerobic digesters. In general, aerobic treatment was found to be effective in stabilizing the egg washing wastewater. For an influent total chemical oxygen demand (COD - similar to BOD) of 6,000 mg/1, effluent filtrable COD values ranged from about 440 mg/1 to 80 mg/1, corresponding to reactors with 1- to 8-day hydraulic retention times.

Anaerobic treatment also was found to be a technically feasible management alternative. No difficulties were encountered in supporting and maintaining an active population of anaerobic bacteria on the egg washing wastewater. Reduction in COD of 90.7% and 92.3% (based on total influent and filtrable effluent COD) were obtained in anaerobic digesters with retention times of 12 and 18 days, respectively.

Application

Based on these data, several methods for processing egg washing water are feasible. One alternative would be to use a small aerated pond followed in series by a sedimentation basin. Design criteria developed from the aeration data suggest the need for an aeration pond of 15 cubic meters (19.6 cu. yd.) for an average size egg grading plant with an effluent volume of 4,500 liters (1,189 gal.) per day at 6,000 mg/1 COD. For an earthen pond of this volume and 1.5 meters (5 ft.) depth with sloping sides (1:1

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Summary of Egg Washing Wastewater Characteristics

Parameter	Plant 1 Mean	Plant 1 Range	Plant 2 Mean	Plant 2 Range	Plant 3 Mean	Plant 3 Range
Cases processed (before sampling)	453	330-600	580	510-640	617	397-762
pH	10.11	9.3-11.13	10.97	9.76-12.06	10.67	9.52-12.36
Total solids (mg/l)	10,550	4,400-19,820	8,530	3,900-13,700	7,630	3,000-14,770
Total volatile solids (mg/l)	3,440	1,470-7,910	3,060	1,260-4,890	3,030	1,450-4,460
Suspended solids (mg/l)	610	260-1,750	680	260-1,050	610	300-1,300
Volatile suspended solids (mg/l)	430	210-1,170	460	230-570	380	180-900
BOD*	3,120	640-9,200	2,610	480-5,900	2,820	1,220-4,800
COD**	6,560	1,720-15,760	5,050	1,350-7,880	6,080	2,200-8,150
Kjeldahl-Nitrogen (mg/l)	300	80-690	220	90-390	250	140-440
Phosphorus (mg/l)	230	50-830	100	40-190	90	40-200

* Biological oxygen demand.
** Chemical oxygen demand.

batters), the ground surface dimensions would be 4.6 meters X 4.6 meters (15 ft. X 15 ft.). A floating surface aerator of between 1 and 2 horsepower, depending on its efficiency, would be required for continuous aeration. A settling basin must follow the aeration pond in series to remove all grown microorganisms and any remaining raw waste solids. A basin 3 meters (10 ft.) square at the ground surface and 2 meters (6½ ft.) deep should be sufficient. The solids will build up at the bottom of the basin and will probably be partially degraded by anaerobic bacteria. Any long-term solids accumulation will have to be removed periodically. Over 95% of the BOD could be expected to be removed by this relatively simple system. The treated effluent can be irrigated on land or disposed of in a municipal sewage system at a minimal cost.

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