

## Treatment of Oak Farm Dairy effluent by Electro Water Separation (EWS).

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### Summary

The effluent solution from a dairy farm was received for testing with EWS flotation tank. The initial effluent BOD concentration was 1890ppm, Turbidity was 1566 FNU, FOG was 165ppm. The pH of the solution was modified to 6.74. To enhance the conductivity, the effluent was dosed with 300 ppm salt, reaching conductivity at 1475 mS/cm<sup>2</sup>. Four separate runs of 15min, 30 mins, 45min and 60 mins were done with 3L sample each for turbidity, BOD and FOG testing. For 15 and 30 min run the voltage was set at 15.5v and for 45min and 60 min run the voltage was set at 10V.

Major results are:

- BOD concentration at end of 15 min at 15.5V was 685ppm. A reduction of 64% from initial.
- Turbidity was 233 FNU after 15 mins at 15.5V – a 85% reduction and 139 FNU after 30 mins at 15.5V – 91% reduction from initial.
- FOG concentration after 15 minutes residence time was 77.9 ppm – a 53% reduction and 39.50 after 30 min – 76% reduction.
- Much better results were obtained for 45min residence time at 10V, where Turbidity was down to 176 – 89% reduction, FOG down to 5.6ppm – 96.6% reduction and BOD down to 758ppm – a 60% reduction.

### Objectives

To treat BOD, FOG, Turbidity in dairy effluent using EWS.

### Method

Duration: 15min, 30min, 45min and 60min.

Equipment: Batch EWS reactor, volume 3L with 1.5in Ti mesh cathode and 1 in MMO anode.

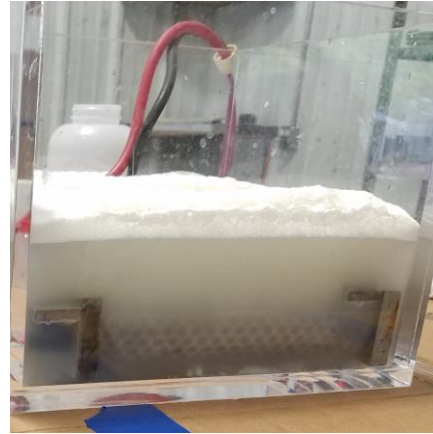
Sampling: 1 L water sample is kept in closed airtight glass amber bottle and stored at 2°C for testing.

- Independent variables:
  - Water quality.
  - Applied voltage
- Dependent variables:
  - Turbidity, BOD, FOG concentration in effluent.
  - Standard water quality parameters.

## Procedure

A 4 litres reactor, was filled with 3L of effluent for 15, 30 and 45min residence time and 4L for 60min residence time. The initial characteristics of the water is shown in Table 1.

Four separate tests were performed and each were tested for turbidity, BOD and FOG. The voltage was set at 15.5V using external power supply for 15min and 30min residence while a voltage of 10V was set for 45min and 60min. Current reading was taken at every 15 minutes. All the samples were tested for Turbidity using portable turbidity meter. Samples taken at end of 15 min, 30min, 45min and 60 mins treatment were sent to offsite lab for testing BOD and FOG.



*Figure 1. A 4L EWS reactor during treatment. Froth generated is clearly visible.*

## Results and Discussion

The pH of the solution was adjusted to 6.74. For better conductivity TDS was increased to 850ppm by addition of common salt. The final conductivity was 1475 mS.cm<sup>-2</sup>.

The characteristics of water being treated is listed in Table 1. Different sample volume was taken for 60min to verify that the amount of gas produced in 45min run was optimum.

A BOD reduction of 60% was achieved in 45 mins. The turbidity reduction of 89% was achieved in 45 mins. FOG reduction was 97% after 45min. Final FOG concentration was 5.6ppm down from 165ppm initial.

At higher voltage of 15.5V, in 30 mins BOD reduction was 64%, FOG reduced by 76% and turbidity reduced by 91%.

Larger sample volume of 4L was taken for 60min to verify that the amount of gas produced in 45min run was optimum, which was confirmed since the FOG, BOD reduction was lower than for 3L sample as can be seen from Table 2.

**Table 1. Characteristics of water being treated by EWS at different time during the process.**

<i>Residence time</i>	<i>Min</i>	<i>0</i>	<i>15</i>	<i>30</i>	<i>45</i>	<i>60</i>
<b>Sample Volume</b>	<b>L</b>	-	<b>3</b>	<b>3</b>	<b>3</b>	<b>4</b>
<b>Voltage</b>	<b>Volt</b>	-	<b>15.5</b>	<b>15.5</b>	<b>10</b>	<b>10</b>
<b>Current initial</b>	<b>Amp</b>	-	30.5	30.5	17.5	15.6
<b>Current final</b>	<b>Amp</b>	-	41	55	21.9	19.7
<b>Turbidity</b>	<b>FNU</b>	1566	233	139	176	302
<b>FOG</b>	<b>mg/l</b>	165	77.9	39.5	5.6	55.7
<b>BOD</b>	<b>mg/l</b>	1890	685	706	758	1050

**Table 2. Percentage reduction at different residence time at different operating voltage and volume.**

<i>Residence Time</i>	<i>Min</i>	<i>15</i>	<i>30</i>	<i>45</i>	<i>60</i>
<b>Sample Volume</b>	<b>L</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>4</b>
<b>Voltage</b>	<b>Volt</b>	<b>15.5</b>	<b>15.5</b>	<b>10.0</b>	<b>10.0</b>
		% Reduction	% Reduction	% Reduction	% Reduction
<b>Turbidity</b>	<b>FNU</b>	85%	91%	89%	81%
<b>FOG</b>	<b>mg/l</b>	53%	76%	97%	66%
<b>BOD</b>	<b>mg/l</b>	64%	63%	60%	44%

