# Chapter 30

# Electrocoagulation on Palm Oil Mill Effluent (POME)

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**Abstract**

Palm Oil Mill Effluent (POME) is a waste that came from palm oil industry. It is compulsory to treat the waste before being released into the river. The POME carries high contaminant such as biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammonia-nitrogen and phosphorus. The treatment used nowadays such as ponding system is not efficient as it needs a large area of land, high maintenance cost regarding labor, and long retention time. Electrocoagulation is an electrochemical method for the purification of water and wastewaters. Besides, electrocoagulation is a precipitation process of ions such as colloids from organic and inorganic compounds. This precipitation can be achieved by applying electric currents. The method started by analyzing the characteristics of POME sample from Seri Ulu Langat Palm Oil Mill in Selangor. The in-situ and laboratory tests were carried out to quantify the contaminants in POME. In this research, three different electrodes were used in the electrocoagulation process. The results were evaluated by calculating the percentage removal in 30 minutes retention time. The experimental results showed that aluminium (Al) electrode was the best plate to remove COD and ammonia nitrogen. The reduction rate of COD using Al plate was 90% compared to iron (Fe) plate, 86%. As for ammonia nitrogen, Al plate has removed 78% compared to Fe plate with 66% removal. Therefore, from the experimental results, it can be concluded that electrocoagulation treatment is capable of treating POME. Furthermore, electrocoagulation can be an alternatives method to replace the existing operation.

**Keywords:** electrocoagulation, palm oil mill effluent (POME), percentage removal

## Introduction

Palm oil mill effluent (POME) is defined as a thick liquid, with a high organic matter, brownish in colour and unpleasant odour. POME contains a high amount of chemical oxygen demand (COD) and biochemical oxygen demand (BOD) which can affect the aquatic life and the environment. Ponding system has been a popular method to treat the POME, which is not effective due to long retention time.

Palm Oil Mill Effluent (POME) is wastewater that came from the milling process of palm oil which need to be effectively treated before being released to the surrounding or else it will damage the environment. Electrocoagulation is the process of passing an electric current through anode and cathode. The electrocoagulation has a more excellent ability to treat the POME wastewater. Here, the objective of the research is to evaluate the contaminant of palm oil mill effluent (POME) at Seri

Langat Palm Oil Mill, Dengkil, Selangor. The second objective is to propose the best method for the treatment of palm oil mill effluent using electrocoagulation and lastly to determine the best plate element for electrocoagulation treatment. Hence, the aim and objective of this study have been fulfilled from the experimental results of this research study.

## Result and Discussion

This study is about POME in Seri Ulu Langat Palm Oil Mill in Dengkil, Selangor. The scope of this research is to investigate the removal of the contaminant from raw POME at Seri Ulu Langat Palm Oil Mill. All the test was handled on site which is in Seri Ulu Langat Palm Oil Mill and the Environment Laboratory of Civil Engineering, University Teknologi MARA (UiTM) Shah Alam. The testing of electrocoagulation process was conducted using different material which was aluminium (Al), iron (Fe) and zinc (Zn) with electrical current of 5A and 18V. After electrocoagulation process, the treated POME was filtered to remove the produced sludge, and the percentage of heavy metal removed was calculated.

Table 1 shows the raw POME before electrocoagulation. All the parameters showed a significant value of POME that needs to be treated before the effluent being discharged to the river. The concentration of COD was 68600 mg/L, with high turbidity of 15300 NTU and ammonia-nitrogen was 372 mg/L. The biochemical oxygen demand (BOD) and phosphorus also shows high concentration of 27200 mg/L and 690 mg/L, respectively.

Table 1
Raw Pome before electrocoagulation

| ***Parameter*** | ***Unit*** | ***Value*** |
|---|---|---|
| pH | - | 4.29 |
| Turbidity | NTU | 15300 |
| Temperature | °C | 25.93 |
| COD | mg/L | 68600 |
| Ammonia nitrogen | mg/L | 372 |
| BOD | mg/L | 27200 |
| Phosphorus | mg/L | 690 |

Table 2 shows the results of POME after 30 minutes electrocoagulation process. High percentage removal above (≥90%) have been achieved for turbidity with the most top removal percentage was from Al plate, 99.8%. The COD percentage removal was 90.5%, which the highest in the Al plate compared to Zn plate (90.1%) and Fe plate (86.1%). Significant percentage removal of ammonia-nitrogen has been achieved in electrocoagulation process for Al plate, which was 78.1 %. However, the other two plate (Zn and Fe) have completed only 70.1% and 66.1% removal of ammonia-nitrogen, respectively. In the treatment of BOD and phosphorus, all plate (Al, Zn, and Fe) have shown excellent results with (≥98%) and (≥100%) removal of these two contaminants.

Table 2
POME after 30 minutes electrocoagulation process

| Parameters | Unit | Al plate | % removal | Zn plate | % removal | Fe plate | % removal |
|---|---|---|---|---|---|---|---|
| pH | - | 5.88 | - | 5.27 | - | 4.96 | - |
| Turbidity | NTU | 30 | 99.8 | 90 | 99.4 | 210 | 98.6 |
| Temperature | ºC | 26.1 | - | 26.03 | - | 25.99 | - |
| COD | mg/L | 6417 | 90.5 | 6771 | 90.1 | 9531 | 86.1 |
| Ammonia nitrogen | mg/L | 81 | 78.1 | 111 | 70.1 | 126 | 66.1 |
| BOD | mg/L | 418.8 | 98.5 | 423.6 | 98.4 | 433.8 | 98.4 |
| Phosphorus | mg/L | 0 | 100 | 0 | 100 | 0 | 100 |

## Conclusion

Aluminium is the best plate compare to zinc and ferum plate as the percentage removal of contaminant is the highest.Aluminium has the shortest retention time for the treatment of electrocoagulation. Based on the results, electrocoagulation can be an alternatives method to replace the existing operation.

## References

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