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MUNICIPAL WASTEWATER
CUSTOMER STORY \ MAY 2020
BIOGAS POWER PLANT - SOUTH EAST ASIA

Biogas demonstration

at a biogas power plant in South East Asia

ACTI-Mag™

Case Study Snapshot

Background

LOCATION

A biogas power plant in Malaysia

OBJECTIVES

- Demonstrate ACTI-Mag's ability to increase the quantity of the biogas coming from the anaerobic system.

CHALLENGES

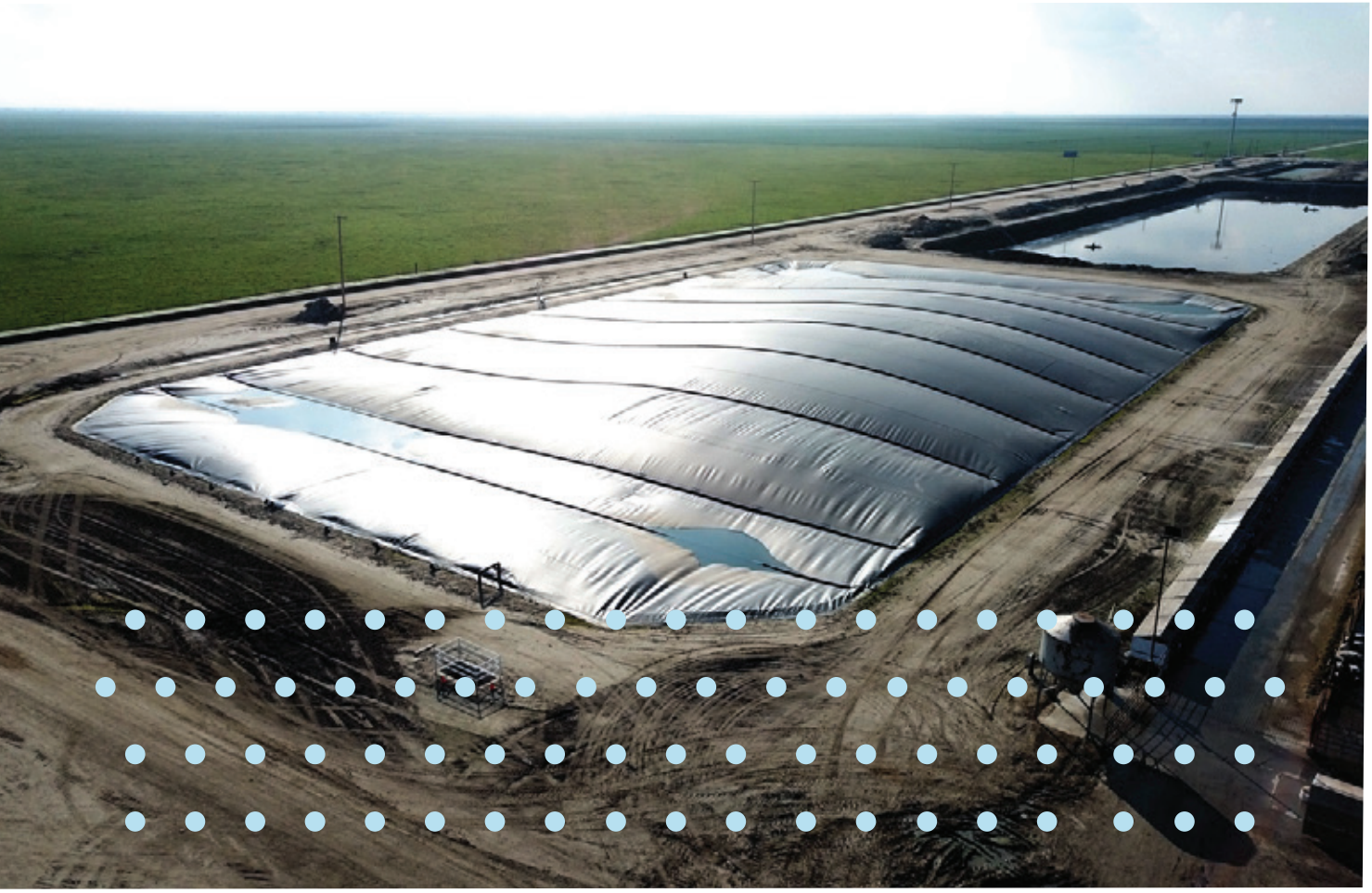
- This plant treats palm oil mill effluent (POME) in a covered anaerobic lagoon, where the biogas generated is collected and converted to electricity.
- The plant approached Calix, via our distributor Maha Chemicals, to see if ACTI-Mag could help boost their biogas production.

SOLUTION

- ACTI-Mag, with its unique high surface area and high localised pH surface, is able to break down complex organic matter by hydrolysis into smaller units. This allows the biological system to convert organic matter into biogas more quickly, and generate more biogas.
- ACTI-Mag increases the quality and quantity of the biogas coming from anaerobic systems, and provides a significant economic boost for biogas power plants, in operation.

BENEFITS

- After a thorough inspection and analysis of the plant's operations and the anaerobic lagoon reactor, a series of samples were taken for bench-top trials. Several balloon and water displacement tests were undertaken to demonstrate ACTI-Mag's ability to enhance biogas production at economical rates.
- The outcome of these tests resulted in a 30-day plant trial to include ACTI-Mag as part of the operations of the biogas plant.



INTRODUCTION

In Asia power generation from waste streams is becoming an important and growing source of renewable energy. With crops like palm oil, cassava, or sugar, large quantities of waste are generated from industrial processes such as crushing and refining.

Palm oil mill effluent contains a high chemical oxygen demand (COD). Under anaerobic conditions, conversion to methane is approximately 25 times more harmful than greenhouse gas carbon dioxide. This poses a critical issue for palm oil mill owners as the emissions are harmful to humans and the environment. Governments are rapidly putting into place new regulations wherein mills are required to install biogas trapping or methane capture facilities.

Additional to a high COD, POME waste, particularly the liquid waste streams, has high suspended solids and quite often a low or acid pH, which means it has to be treated before safe discharge into the environment. This treatment usually includes anaerobic digestion followed by aerobic digestion.

This biogas power plant is treating POME in a covered anaerobic lagoon where the biogas generated is collected and converted to electricity. It is important to note that the lab tests detailed below were done during the low season, where there is usually less gas generated.

The plant approached Calix, via our distributor Maha Chemicals, to see if ACTI-Mag could boost their biogas production while providing interesting cost savings.

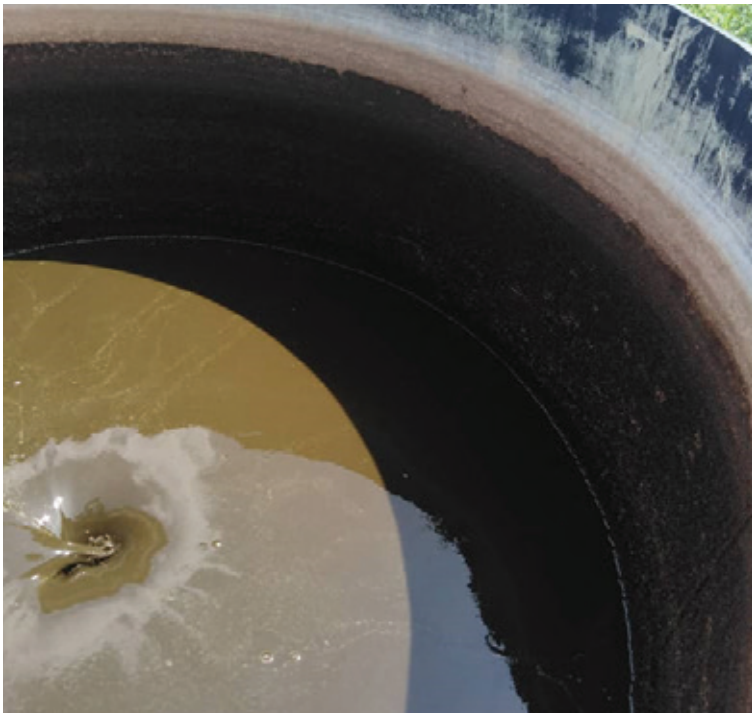
After a thorough plant inspection and analysis of historic data on the operation of the anaerobic lagoon or reactor, we organised a few tests. Methods and results are detailed below, to show how ACTI-Mag can be used to generate more biogas from the waste stream.

Balloon and water displacement tests

In the first test, the raw sample was taken from a pipe before going into the mixing pit.

A sample of the digestate was also taken.

The samples were taken from the plant site and delivered to Maha Chemicals Laboratory to conduct tests on the same day.



BEFORE
Balloon test
1st June 2020
9:00pm

Control sample:
The sample size was 5.5 litres with a ratio of Raw: Digestate= 1:10.

For the control, 5 litres of digestate sample was mixed with 0.5 litres of raw sample, following a simulation of the plant's process.

ACTI-Mag sample:
For ACTI-Mag, the sample size was similar to the control sample, with 1.1ml of ACTI-Mag (200ppm according to the sample size) being added.

Both pH and COD were measured:

Control sample: pH was around 7.40
ACTI-Mag sample: pH was around 7.60

AFTER
Balloon test
9th June 2020
9:00am

After one week, the difference became obvious. The ACTI-Mag sample produced more gas than the control sample.

BEFORE
Water displacement
1st June 2020
10:00pm

Control sample:
5L of digestate sample
+ 0.5L raw sample

The control sample was tested first, in order to allow some reaction during mixing.

ACTI-Mag sample:
5L of digestate sample
+ 0.5L raw sample
+ 1.1ml of ACTI-MAG (200ppm)

MIDDLE
2nd Jun 2020
4:00pm

The observation of the water level in the bottle of the control sample showed less gas had been produced.

Control

The observation of the water level in the bottle of the ACTI-Mag sample showed more gas had been produced.

ACTI-Mag

AFTER
3rd June 2020
2:00pm

The water inside for both control and ACTI-Mag samples was fully pushed out of their respective bottle during the night.

Control

ACTI-Mag

1. Cooling pond (acidification)

2. Cooling pond (acidification)

mixing pump

3. Mixing pit

Ratio
raw:digestate
1:10

4. Digester

5. Aeration pond (aeration in digester)

6. Discharge

Conclusion

It was demonstrated that with the addition of ACTI-Mag, more gas was produced, even during periods of lagoon maintenance. As raw palm oil mill effluent (POME) becomes more available and COD feed increases during the high season, the digestion rate will increase, which will enable more raw POME to be treated on a daily basis. This will have the dual effect of producing more biogas from greater COD input, while enabling more POME to be treated through the system. By optimizing the anaerobic digestion,
we can also expect a 15-20% level increase,
depending on the actual flow of raw POME into the system.

The addition of 200 ppm (200kg per ML) ACTI-Mag in current operations could also result in an increase in biogas yield.
Once more raw POME is available, we will also suggest to change the ratio of digestate/raw POME progressively from 10:1 to 5:1, or until the production of biogas is optimised.

This trial resulted in the start of a 30-day plant trial, which will be monitored by Calix via Maha Chemicals. If results confirm our predictions, ACTI-Mag will be included to this large biogas power plant's operations, to boost biogas generation and conversation to electricity.

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