Experience in utilizing Geotube for Methane avoidance as part of Palm Oil Mill effluent treatment

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OPERATIONAL ACTIVITIES: MILL

FRESH FRUIT BUNCH (FFB)

STERILISATION

FRUITLETS

STRIPPING (THRESHING)

EMPTY FRUIT BUNCH (EFB)

PRESSING

CLARIFICATION

KERNEL PLANT

BOILER FUEL

KERNEL CRACKING

NUT (FIBRE)

SHELL

DRIED KERNEL

STORAGE BUNKER

DESPATCH

EFFLUENT POND

CPO STORAGE TANK
As sludge will formed during anaerobic process, desilting will have to be carryout either through pond insolation or on line basis. Thus a park for Geotube is been created to accommodate sufficient tubes for desilting at all time.
Desilting approaches

Isolate Pond approach

Continuous desilting approach
Basic Geotube operation
Sludge condition into and filtrate from Geotube

Sludge from Pond Can range from Solid content of 3 to 8% and COD from 80 to 30 kg/cu meter

filtrate from Geotube Can range from Solid content of 1.5 to 3% and COD from 40 to 10 kg/cu meter
A case study on filtration performance

<table>
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<th>Day</th>
<th>% COD REMOVED</th>
<th>% SS REMOVED</th>
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<tr>
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<td>19</td>
<td>17</td>
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<td>31</td>
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<tr>
<td>ave</td>
<td>51</td>
<td>48</td>
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</tbody>
</table>

Note: More works need to be done here to quantify removal rate
Geotube Park at a Mill
Geotube under curing and Cured Tube for Despatch to Estate as bio fertilizer
Mass balance for Dry solid & COD

- Sludge parameter feed
- +/- 60 kg/cu meter Dry Solid
- +/- 60 kg COD/ cu meter

Implied 866 cu meter sludge has been pumped through geotube with 50% retention.

130 mt bio solid at 20% dry solid & 80% Moisture
Equivalent 26 mt Dry solid

COD reduce in tube = 30 kg x 866 cu meter
= 25,980 kg COD per geotube

+/- 30 kg/cu meter dry solid
+/- 30 kg/cu meter COD
POME Solid as Bio-fertilizer

Test result:
% Nutrients value, N:P:K:Mg = 1.3 : 0.8 : 0.8 : 0.4

Equivalent Fertilizer value = RM 80 to 100 / ton Bio solid

Each tube will have fertilizer value of RM10,400 to RM13,000
Literature on open pond methane emissions give some typical values such as 0.028 kgCH₄/kgCPO (IFEU 2007), 12.1-13 kgCH₄/tPOME (Neste internal calculations, Yacob 2006, Schmidt 2007), 160 kgCO₂ₑ/tPOME and 511 kgCO₂ₑ/tCPO (ISCC 205 2011; based on 3.25 kg POME per kg CPO and BLE 2010 and IFEU 2007). Many palm oil mills which sell their products to the biofuel industry, use amount of CPO or amount of POME for assessing methane emissions from open pond treatment of POME. The methods are good and justifiable for cases where costly continuous and representative monitoring of actual POME characteristics and actual emissions is not done. As Yacob et al mention, there is large variation in the properties of POME and volume discharged to the ponds. Annual production volume on the other hand is reliable and readily available data at all mills.

Literature data on actual measurements of closed and open tank anaerobic treatment systems of POME are available and some of them are close to the theoretical maximum methane yield (Stichnothe 2010, Yacob 2005) of 0.25 kgCH₄/kgCOD. In open pond conditions, the verification of methane formation by actual measurements faces some more challenges (Yacob 2006), but a correlation between methane production rate and total CODₑ removal for anaerobic pond was established at 0.238 kgCH₄/kgCOD. During Yacob’s 52 week observation period the average CODₑ of raw POME was approximately 56 000 mg/l.

Case Study of a 400,000 mt FFB per annum Mill

400,000 mt FFB per annum at 0.70 ratio of POME to FFB will produce 280,000 cu meter
Figure from 1 tube example – 1 tube of 165 cu meter reduce COD by 25,980 kg COD
Our mill in 2014 collected 100 tubes, thus COD reduce = 2598 mt.

Refer to Neste’s data 12.1 – 13 kg CH4/mt POME, a total of 280,000 cu meter x 12.1 = 3,388,000 kg or 3,388 mt CH4 methane emission during open pond treatment.

Refer to Neste’s data of 0.238 kg CH4/ kg COD, 1 tube of 25,980 kg will have capability to produce 25,980 x 0.238 kg = 6,183 kg CH4 or 6.183 mt CH4
With 100 tubes = 618.3 mt CH4 captured or reduced by tubes.

This 618.3 mt equal to 618.3/3,388 mtx100% = 18.25% CH4 captured or reduced.
Advantages of Geotube compare to other desilting system

– Having the option of not adding any flocculants/polymer.
– Flexibility on speed of desludging/desilting by adding additional pump unit and some piping.
– Solid dryness can be control to some extend.
– Timing of evacuation can be plan and speed of evacuation can suit situation.
– Lower capital cost.
– Simple to operate after some learning curve.

Disadvantages of Geotube

– Bigger land area required
– Slightly higher operating cost
Thank You