

## Achieving a BOD below 20 mg litre<sup>-1</sup> for POME: Is it a Myth or a Reality?

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### INTRODUCTION

There are a number of effluent treatment systems available now in the market claiming to give excellent results. This could be a valid claim because in most cases it would have performed satisfactorily with other types of effluents. But the problem often overlooked is the dissimilar characteristics of different types of effluents. Each treatment system has to be separately evolved and custom made to be effective. It could be a costly mistake if we blindly adopt a system with a proven track record of effluent treatment when dealing with another industry. One of the critical characteristics of palm oil mill effluent is its extraordinarily high biochemical oxygen demand (BOD), that can be as high as 30 000 mg litre<sup>-1</sup>. Currently, most mills are struggling to keep it below the existing Department of Environment (DOE) limit of 100 mg litres<sup>-1</sup>. Soon this will have to be lowered to 20 mg litres<sup>-1</sup> to keep pace with the rest of the world.

Some of the existing systems that had been tried out in palm oil industry are as follows: (i) DAF System, (ii) Activated Biological Sludge + Aeration System, (iii) Aerated Lagoon System, (iv) Aerated, Clarification Setting Tanks System, and (v) Biological Media System. So far NONE of the proponents of these systems are willing to guarantee a BOD of less than 20 ppm consistently. It is no use if it irregularly gives good results.

Recently, a new method called the biological chemical mechanical and membrane (BCMM) technology has been tried out under R&D in MPOB Palm Oil Mill Technology Centre (August 2010 – February 2011) and in FELDA's Kilang Sawit Neram (January – August 2012), that seemed to deliver consistent results under the normal mill operating conditions.

BCMM is a tertiary effluent polishing plant developed by Concept Engineering and it consists of (Figures 1, 2 and 3): (i) biological method, (ii) aeration chemical method, (iii) flocculation/polymer, (iv) mechanical method, (v) lamella separator, (vi) continuous sand filter, (vii) membrane method, and (viii) UF

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**Waste Water Treatment (POME) (BCMM System) Malaysia**

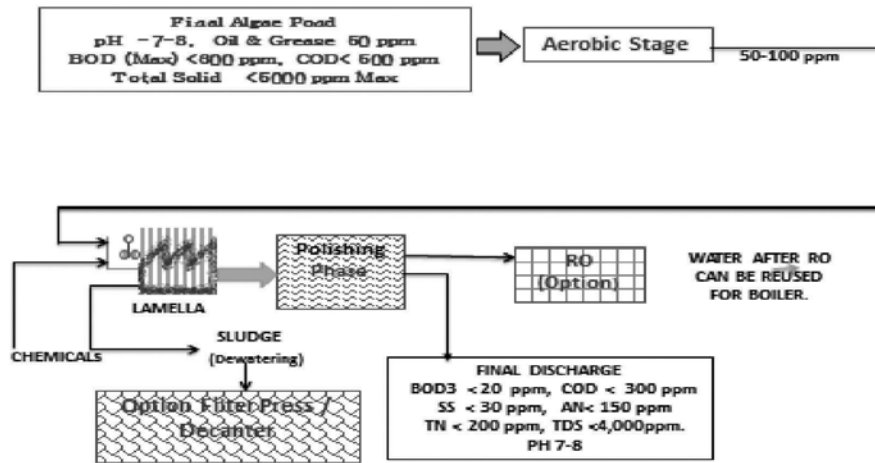


Figure 1. The BCMM plant at FELDA K S Neram.

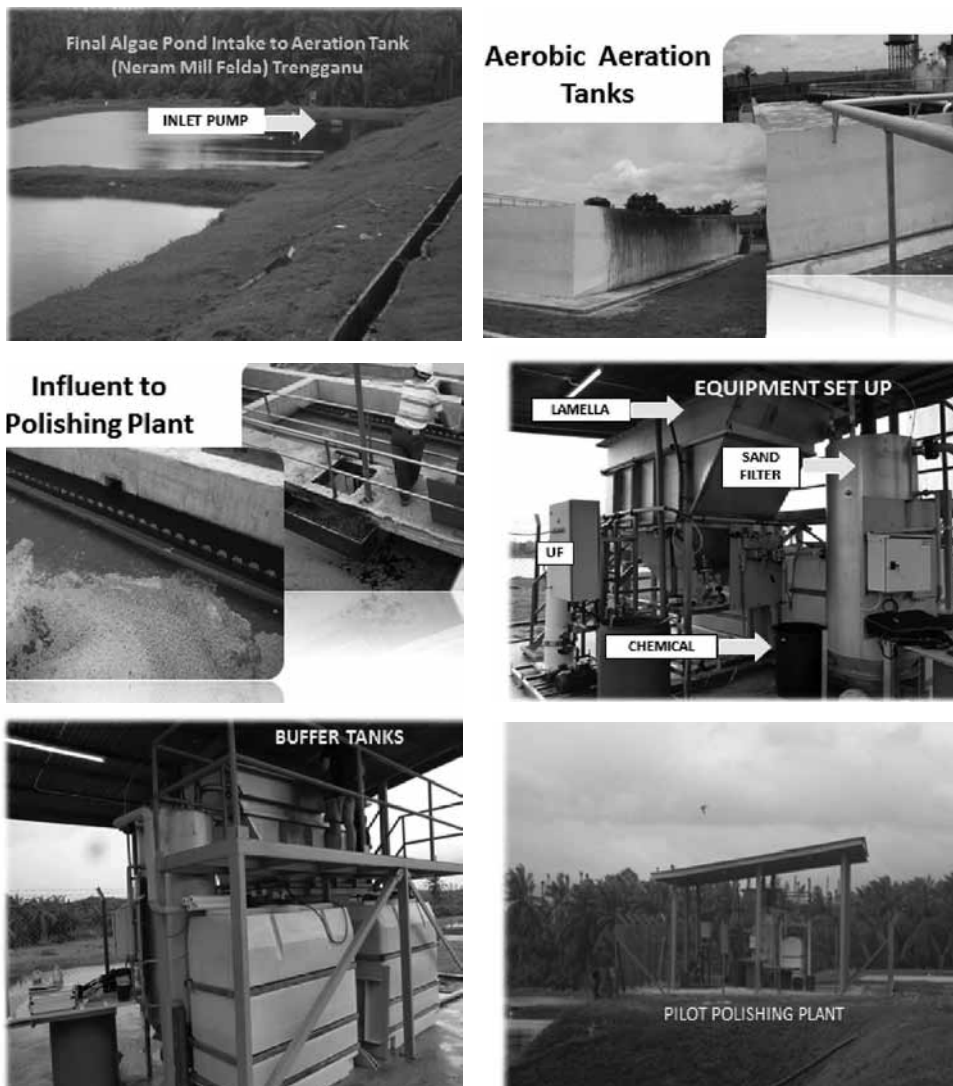


Figure 2. Stages of waste water treatment (BCMM) system.



Figure 3. Stages of waste water treatment (BCMM) system.

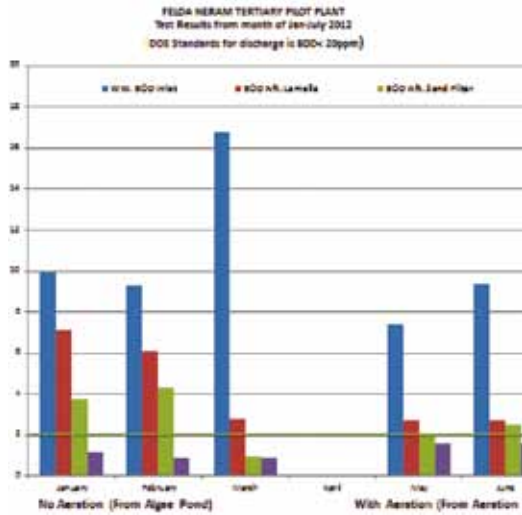


Figure 4.

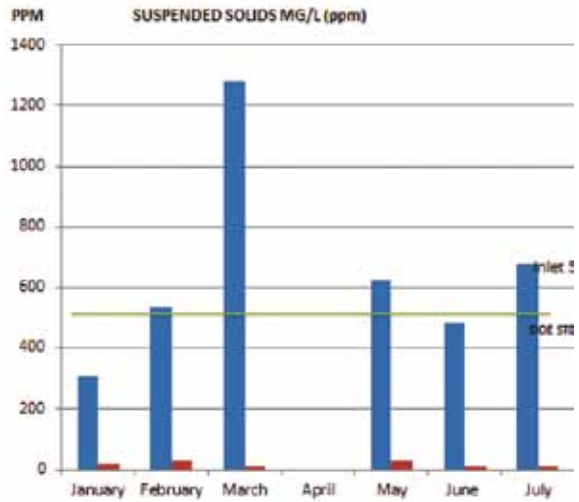


Figure 5.

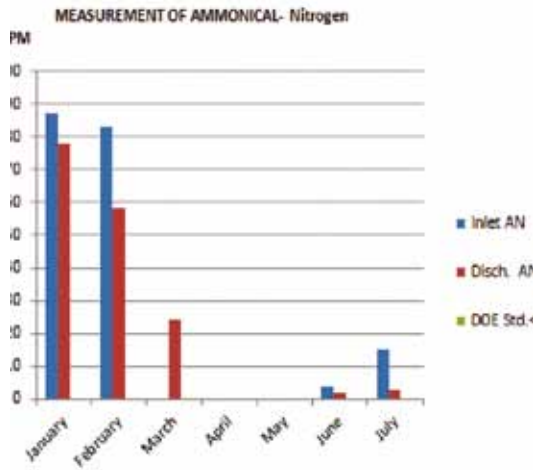


Figure 6.

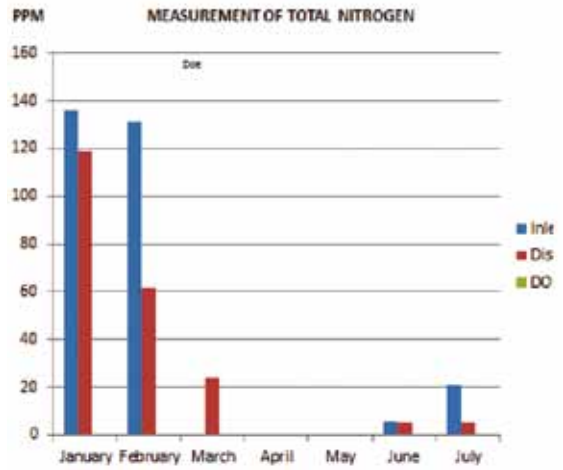


Figure 7.

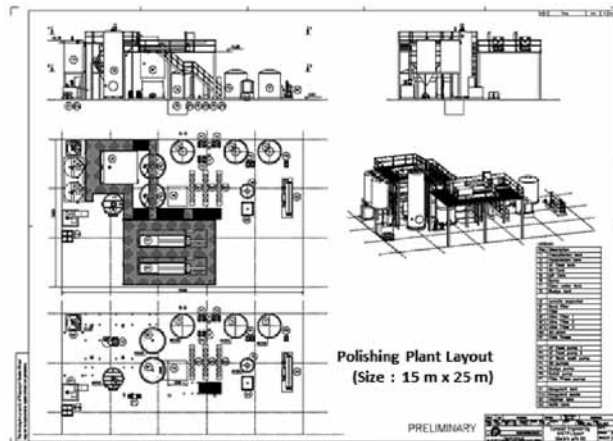


Figure 8. FELDA K S Neram tertiary treatment plant layout.

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**TEST RESULTS FROM PILOT PLANT LAF-FELDA NERAM  
5 m<sup>3</sup> hr<sup>-1</sup> R&D Polishing Plant (Neram mill FELDA)**

	WITHOUT AERATION							WITH AERATION						
	FLOCCULANT: POLY ALUMINIUM CHLORIDE (PAC) 12 JAN 2012							FLOCCULANT: FERRIC CHLORIDE (FeCl) <sub>3</sub> +POLYMER SYNERGY1598 C 15 MAY 2012						
	BOD	SS	TS	COD	pH	AN	TN	BOD	SS	TS	COD	pH	AN	TN
Final pond inlet	99	310	3 283	613	8	87	136	74	628	-	-	-	-	-
Ex- lamella	71	229	3 016	454	7.3	84	125	27	73	-	-	-	-	-
Ex- sand filter	38	191	2 924	462	7.3	92	139	21	63	-	-	-	-	-
Ex-ultra filter	12	19	2 723	299	7.8	78	119	16	28	2 500	150	7	-	-
	FLOCCULANT: POLY ALUMINIUM CHLORIDE (PAC)131 20 JAN 2012							FLOCCULANT: FERRIC CHLORIDE (FeCl) <sub>3</sub> +POLYMER SYNERGY1598 C 18 JUN 2012						
	BOD	SS	TS	COD	pH	AN118	TN	BOD	SS	TS	COD	pH	AN	TN
	Final pond inlet	93	535	2 877	480	8.12	83	131	94	482	4 410	413	7.76	4
Ex- lamella	61	268	2 774	569	7.46	76	118	27	129	3 980	921	7.78	2	6
Ex- sand filter	43	216	2 611	360	7.59	72	112	25	40	1 948	281	7.81	2	7
Ex-ultra filter	9	28	2 340	222	7.68	58	62	16	11	3 819	209	7.97	2	5
	FLOCCULANT FERRIC CHLORIDE (FeCl) <sub>3</sub> +POLYMER KIMERA C493 21 JAN 2012							FLOCCULANT: FERRIC CHLORIDE (FeCl) <sub>3</sub> +POLYMER SYNERGY1598 C 6 JUL 2012						
	BOD	SS	TS	COD	pH	AN	TN	BOD	SS	TS	COD	pH	AN	TN
	Final pond inlet	168	1 280	-	-	-	-	-	172	680	4 394	508	8.87	15
Ex- lamella	28	64	-	-	-	-	-	20	67	3 913	225	8.57	3	6
Ex- sand filter	10	46	-	-	-	-	-	15	40	3 902	215	8.56	3	6
Ex-ultra filter	9	9	2 319	234	7.92	24	39	9	10	3 884	205	8.57	3	5

Note: All units in mg litre<sup>-1</sup> except pH.  
 BOD - biological oxygen demand.  
 COD - chemical oxygen demand.  
 SS - suspended solids.  
 TS - total solids.  
 AN - ammoniac nitrogen.  
 TN - total nitrogen.



technology. This has the capacity for reducing and maintaining BOD below 20 ppm before effluent is discharged or to be reused for cleaning purpose.

In our R&D studies, Concept Engineering focused on the following: stability and reliability of this technology in maintaining and achieving BOD <20 ppm consistently, in compliance with the DOE Standard for palm oil mill effluent (POME) discharge. The system also efficiently removes the suspended solids to comply with the DOE Standard of SS below 400 mg litre<sup>-1</sup>, ammoniac nitrogen below 150 mg litre<sup>-1</sup>, total nitrogen below 200 mg litre<sup>-1</sup> and also improves the clarity of the discharged water as shown in figures. Consideration was also given to operational and maintenance cost as well as the possibility of whether the water can be recycled for boiler use without further treatment, per cost m<sup>3</sup> of POME.

## CONCLUSION

From the trials conducted we were able to draw the following conclusions:

- the system was very stable in consistently achieving BOD less than 20 mg litre<sup>-1</sup> at the point of discharge complying with the expected DOE limit of less than 20 mg litre<sup>-1</sup>;
- the suspended solids (SS) measured less than 30 mg litre<sup>-1</sup> after ultra-filtration at discharge point complying with the limit of less than 400 mg litre<sup>-1</sup>;
- ammoniac nitrogen (AN) concentration of less than 80 mg litre<sup>-1</sup> and total nitrogen (TN) of less than 119 mg litre<sup>-1</sup> also were well below the DOE limit of 150 mg litre<sup>-1</sup> and 200 mg litre<sup>-1</sup> respectively;
- total dissolved solids did not change much. It remained high at more than 3000 mg litre<sup>-1</sup> indicating that it cannot be used as a make-up water for the boilers without further treatment.
- the pH remained lightly alkaline between 7 to 9; and
- the system was easy to operate. The chemical cost was about 20 sen m<sup>-3</sup>.