

MOBILE FILTER PRESS FOR EFFLUENT POND CLEANING

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The palm oil industry generates large volumes of palm oil mill effluent (POME) - 52 million tonnes by 392 palm oil mills in 2005 (0.7 t per tonne fresh fruit bunch processed). Due to the high organic content of POME, anaerobic, followed by aerobic, digestion are employed to reduce its biological oxygen demand (BOD) to 50 mg per litre before discharged into public waterways. Despite the good BOD removal by the processes, the volume of the residual sludge remains considerable. It is estimated that 1800 m³ per year of sludge are produced by a mill processing 500 t per day of fresh fruit bunch (FFB) with another 7200 m³ of undigested suspended solids from the influent stream, resulting in a total of 9000 m³ a year. The sludge in a biological pond would require proper management to prevent its deposition at the bottom which would then slow down the organic matter decomposition compromising the BOD removal efficiency.



Figure 1. Conventional pond cleaning by excavator.



Figure 2. Mobile filter press.

The sludge can be removed by a dragline, excavator or vacuum tanker with agitator. Pumping is the preferred method today due to simple equipment needed. This system may work well if the sludge can be temporarily diverted to an alternate storage area, which is the main constraint to the practice in the mill. A better sludge dewatering technique has been developed by MPOB recently for better pond cleaning at a lower cost. The system is designed to be mobile so that it can be moved about anywhere in the mill.

DESCRIPTION OF TECHNOLOGY

The mobile filter press comprises a sludge transfer pump, containerized pre-treatment tank, polymer dosing system, membrane filter press and solid handling device. The pump, tank and polymer system are transported as one on a standard 6 m

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TABLE 1. TYPICAL RESULTS FROM A MEMBRANE FILTER PRESS TEST UNIT

Type of sludge	Anaerobic, aerobic, facultative and stabilization ponds
Flux achieved	25-30 litres per m ² per hr
Conditioning agents	PAC, cationic, non-ionic, anionic and MPS202 blended polymer
Filtrate clarity	< 5 NTU depending on type of sludge, polymer and dose. Clarity was further improved following treatment with UF membrane or activated carbon
Solid moisture content	40%-50% depending on floc type, dose and squeeze pressure
Filtration cycle	40 min filtering and 30 min squeezing

TABLE 2. ECONOMICS OF A MOBILE FILTER PRESS SYSTEM TREATING EXCESS SLUDGE (450 m³ per day) 288 WORKING DAYS PER YEAR

Equipment cost	RM 2 500 000
Capital cost per year (depreciation over 5 years)	500 000
Operating costs	
Energy, 0.75 kW per m ³	24 000
Manpower, 2 MP per day	28 000
Filter plate replacement (after 3 years)	25 000
Filter cloth replacement (after 1 year)	10 000
Chemicals (flocculent) RM 500 per day	144 000
Repair & maintenance 2.5% of capital	62 000
Hauling charges	30 000
Total O&M costs	323 000
Estimated contract value*	RM 1 440 000
Payback period	4 years

Note:

- Based on RM 60 000 per contract for one pond. The service provider can complete two jobs a month based on 15 days per job (contract). Therefore, the anticipated contact value in a year is RM 60 000 × 2 × 12 = RM 1 440 000.



Figure 3. Filtrate and treated filtrate.



Figure 4. Solid cake.

(20 ft) hauler, while the filter press is fixed on a 6 m (20 ft) trailer pulled by a standard prime mover.

At the site, the filter press is placed as close as possible to the effluent pond. The sludge is pumped into a pre-treatment tank using a floating transfer pump. Along the transfer line, the sludge is conditioned using a specially formulated polymer (MPS202) to neutralize the charge on the particles. The mixture then enters a slow mixing chamber where the particles form stable aggregates to assist cake formation in the dewatering process. The conditioned sludge is then pumped to the filter press using a low pressure, positive progressive pump to enhance the filter cake quality. As each chamber fills with the sludge, the liquid passes through a cloth placed across the drain channel, through the drain ports and exits through the

corner of each plate. After the chamber is filled with solid, the membrane of the filter plate is inflated, squeezing more water out of the solid to give a high solid content cake. After the squeeze, the filter plates are moved apart to drop the cake.

The filter cake is dropped onto a conveyor below the filter plates and carried to a container. The filtration is repeated as required by the pre-determined operational schedule to complete the pond cleaning in the specific time frame.

ECONOMICS

The investment cost for the mobile filter press for sludge dewatering is about RM 2.5 million and the payback period about four years.

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