

SEQUENCING BATCH REACTOR (SBR) OF PALM OIL REFINERY WASTEWATER

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The choice of a suitable treatment system for palm oil refinery wastewater is made difficult by complexities in both the flow and the composition of this effluent. The typical characteristics of the three types of wastewaters from three different types of refining process used in Malaysia are shown in *Table 1*. Compared to physical-chemical or aerobic-biological, or both, *i.e.* by the dissolved air floatation (DAF) and activated sludge (AS) processes, the SBR Treatment using aerobic method has much advantages and gained its

popularity in treating various type of wastewaters.

ADVANTAGES OF SBR

- Applicable to palm oil physical refinery and oleochemical industrial effluents
- Batch system: All reactions take place in one reactor
- Easy to operate and maintain
- Fully automated, minimal operator attention
- No sludge recycling

TABLE 1. CHARACTERISTICS OF PALM OIL REFINERY EFFLUENT

Parameters**	Category*					
	A		B		C	
	Range	Mean	Range	Mean	Range	Mean
Temperature (°C)	28-44	35	33-52	42	42-70	57
pH	3.8-7.0	5.3	2-6	4.9	1.2-7.0	3
Biochemical Oxygen Demand (BOD)	0-1500	30	760-5400	2640	1420-19600	4178
Chemical Oxygen Demand (COD)	100-3000	890	1440-14600	5729	4000-33100	7696
Total Solids	20-2000	580	1480-14000	2050	2500-45000	15000
Suspended Solids (SS)	20-100	332	790-1800	1,170	425-20,000	2070
Total Nitrogen	20-100	49	7.5-17.5	11.74	0.1-12.5	6.3
Phosphorus	1.0-10	4.1	0.4-3.0	1.3	8-16.5	11.8
Total Fatty Matter	25-600	215	1150-2600	1580	400-16500	3548

- * A Physical refining and dry fractionation
 B Physical Refining and detergent fractionation
 C Physical-chemical refining and detergent fractionation
 ** All in milligrams per litre except pH and temperature

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- More compact and cheaper to build
- Very stable and consistency in performance
- Proven in commercial scale operation

PROCESS OPERATION

A 24-hour cycle of operation can be easily fitted in with refinery's routine operation. The times for the components mode of operations can be predetermined as follows:

- FILL 4 hours
- REACT 20 hours
- SETTLE 2 hours
- DECANT & IDLE 2 hours

A schematic flow diagram of the process is shown in *Figure 1*.

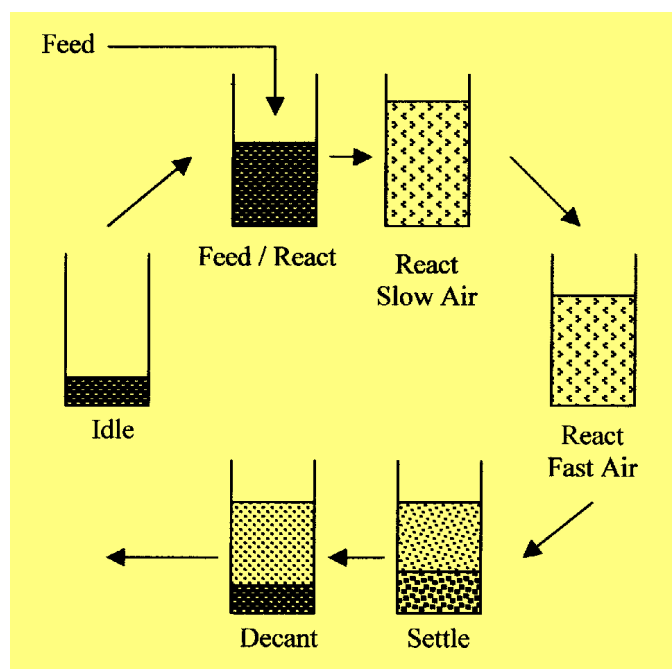


Figure 1. Schematic Representation of SBR Cycle.



Figure 2. Commercial SBR Effluent Treatment Plant.



Figure 3. Top View of Reactor Showing Effective Aeration.

COST ANALYSIS

Among the aerobic treatment systems, SBR is estimated to be most cost-effective.

CONCLUSION

The SBR process has been found to be very cost-effective and efficient in treating palm oil physical refinery effluent. It is very versatile and can sustain high fluctuation in organic loadings. With a well designed operating strategy and with the Dissolved Oxygen and Mixed Liquor Suspended Solid maintaining at above 2.5 mg/L and 2500 mg/L, the process is capable to produce highly purified final discharge with COD and SS consistently less than 100 mg/L and 50 mg/L, respectively. Incorporating a holding tank has made the operation much simpler. The SBR process has been widely adopted by the industry.

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