WASTE WATER TREATMENT FOR SUGAR INDUSTRY FROM SEQUENTIAL BATCH REACTOR

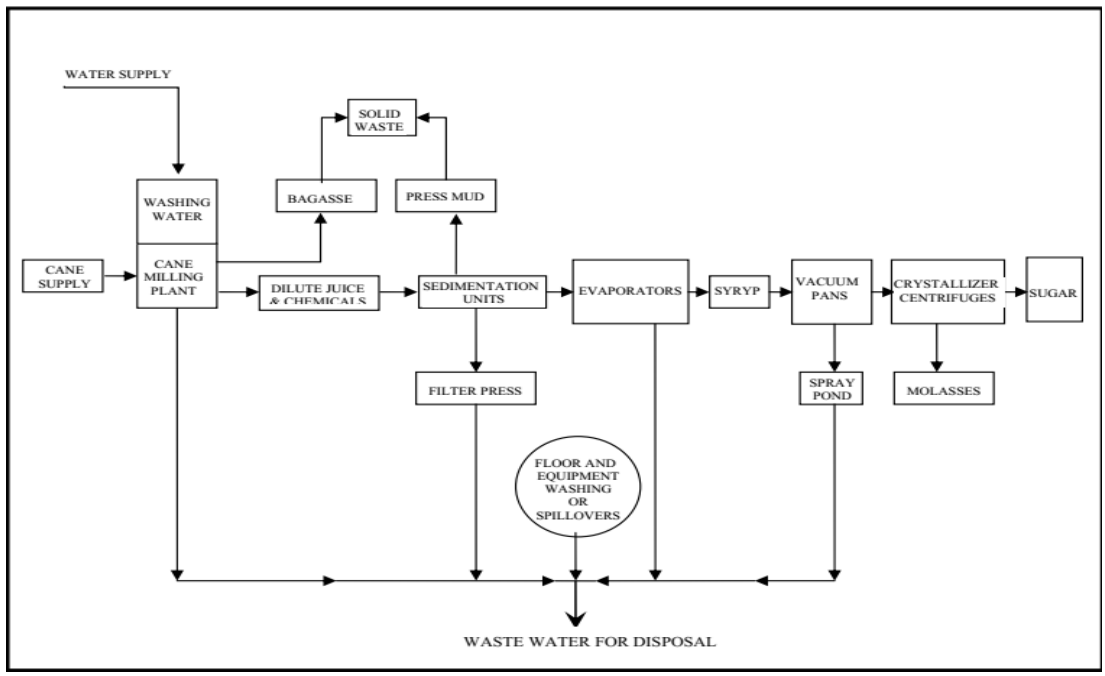
By

USMAN

Sugar Waste Water

- Wastewater with varying levels of pollution load is generated at nearly all stages of sugar production. Cane washing becomes necessary when the cane is harvested mechanically, generating waste water that has a high concentration of suspended solids and may have a significant sugar concentration due to damage incurred by the cane during mechanical harvesting.
- Relatively mild effluents from the mill house, containing oil, grease, and some sugar content, are generated from the lubricating and cooling systems, floor washings, the large quantity of water used for juice extraction, and some leakage and spillover.

Typical Waste Water Generation Points



Sugar WASTE WATER

- High load of chemical oxygen demand (COD), BOD in comparison to other food industry.
- Effects of Sugar Waste Water
    - Environmental effect
    - Effects on water
    - Effects on soil

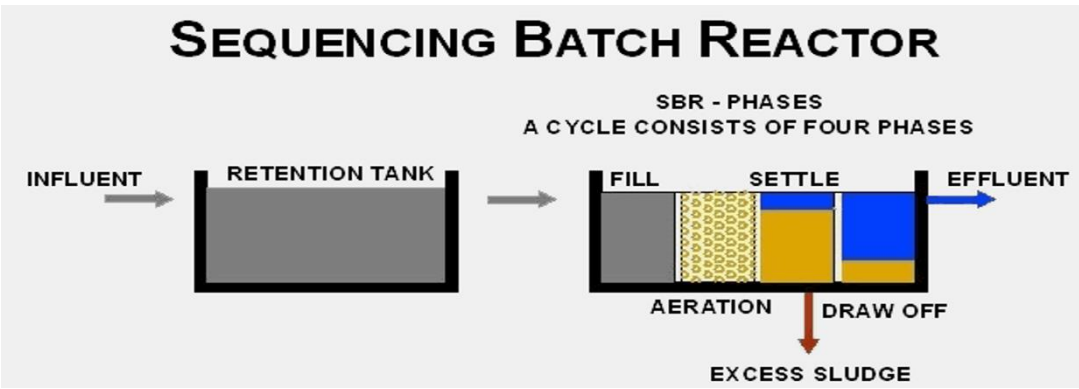
Sequential Batch Reactor

- In a conventional activated sludge system, unit processes would be accomplished by using separate tanks.
- Sequential batch reactor is a modification of activated sludge process which has been successfully used to treat municipal and industrial wastewater.
- The difference between the two technologies is that the SBR performs equalization, biological treatment, and secondary clarification in a single tank using a timed control sequence.

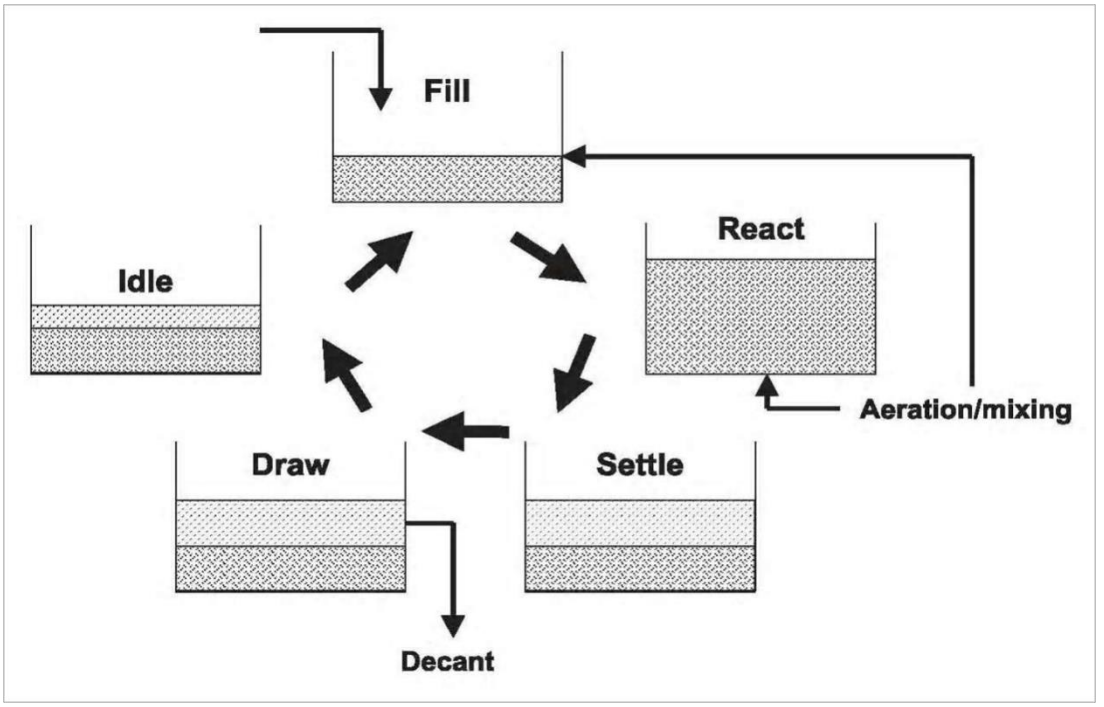
SBR Working Principles

- SBR technology is a method of wastewater treatment in which all phases of the treatment process occur sequentially within the same tank.
- The sequencing batch reactor is a fill and draw activated sludge system. In this system, wastewater is added to a single "batch" reactor, treated to remove undesirable components, and then discharged.

Diagram showing SBR operating principles

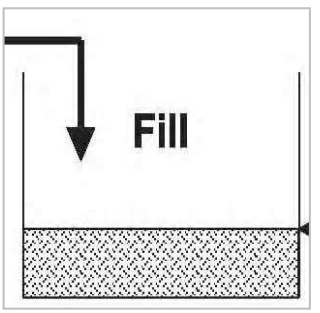


Various Phases In a Typical SBR Process



Fill Phase

- During the fill phase, the basin receives influent wastewater. The influent brings food to the microbes in the activated sludge, creating an environment for biochemical reactions to take place.

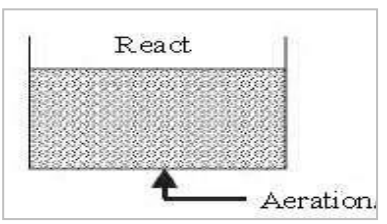


Types Of Fill Phase

- Static fill
- Mixed fill
- Aerated fill

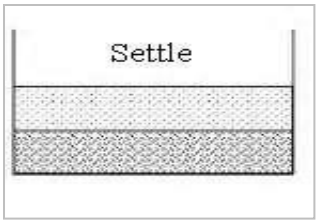
React Phase

- During this phase, no wastewater enters the basin and the mechanical mixing and aeration units are on.
- This phase allows for further reduction of wastewater parameters



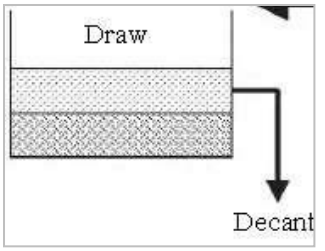
Settle Phase

- During this phase, activated sludge is allowed to settle under quiescent condition. The activated sludge tends to settle as a flocculent mass.



Decant Phase

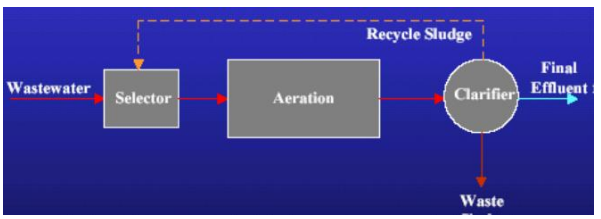
- Clarified treated effluent (supernatant) is removed from the tank.
- No surface foam or scum is decanted.



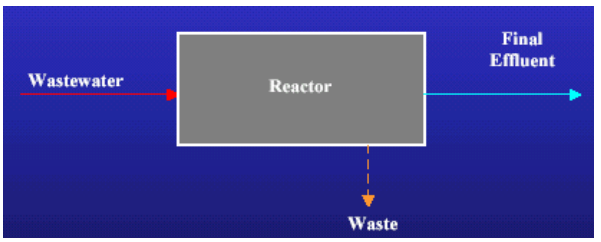
Idle Phase

- This step occurs between the decant and the fill phases.
- The idle period is used when the system is waiting for enough effluent to process.

Differences Between ASP & SBR



- Continuous Process
- Removes BOD
- Nitrification



- Batch Process
  - Continuous with multiple reactors
- Removes BOD
- Nitrification and Denitrification

Operational Parameters (ASP)

Design Parameters For Activated Sludge Systems					
Sr.no	**Parameters**	**Units**	**Conventional**	**Complete mix**	**Extended**
1	Flow Regime		Plug Flow	Complete Mix	Complete Mix
2	F/M ratio	1/d	0.3 – 0.4	0.3 – 0.5	0.1 – 0.18
3	Sludge age	D	5 – 8	5 – 8	10 – 25
4	MLSS	mg/l	1500 – 3000	3000 – 4000	3000 – 5000
5	MLVSS/MLSS	Ratio	0.8	0.8	0.6
6	HRT	Hrs	4 – 6	4 – 5	12 – 24
7	BOD Removal	%	85 – 92	85 – 92	95 – 98

Operational Parameters (SBR)

Design Parameters For SBR Systems				
Sr.no	**Parameters**	**Units**	**Continuous & Intermittent**	**Decant Intermittent**
1	F/M ratio	1/d	0.05 – 0.08	0.05 – 0.3
2	Sludge age	D	15-20	4 – 20
3	MLSS	mg/l	3000 – 4000	3500 – 4500
4	Cycle Time	H	04 – 08	2.5 – 6
5	Settling Time	H	>0.5	>0.5
6	Decant Depth	M	1.5	2.5
7	Process oxygen BOD Kg O2/kg	BOD	1.1	1.1

Efficiency of Removal

The Average Performance Data Values		
Parameters	**SBR**	**ASP**
BOD/COD	85-98%	75-80%
TSS	85-97%	85-90%
Total Nitrogen Removal	>75%	No treatment
Phosphorus removal	57-69%	No treatment
Total Coliforms	99%	90-96%

Advantages of SBR

- Equalization, primary clarification, biological treatment and secondary clarification can be achieved in a single reactor vessel.
- SBR requires small space.
- SBR has controllable react time and quiescent settling.
- Minimal footprint.
- High nutrient removal capabilities.
- The BOD removal efficiency is generally 85 to 98%
- Filamentous growth elimination

Expected Outcomes

- The pollutant removal efficiency of SBR system is higher for nitrogen and phosphate.
- SBRs combine all of the treatment steps and processes it will result in low land area requirement.
- High BOD removal efficiency is expected.
- It can also remove heavy metal such as Zn, Cu, Pb.

Benefits to Society

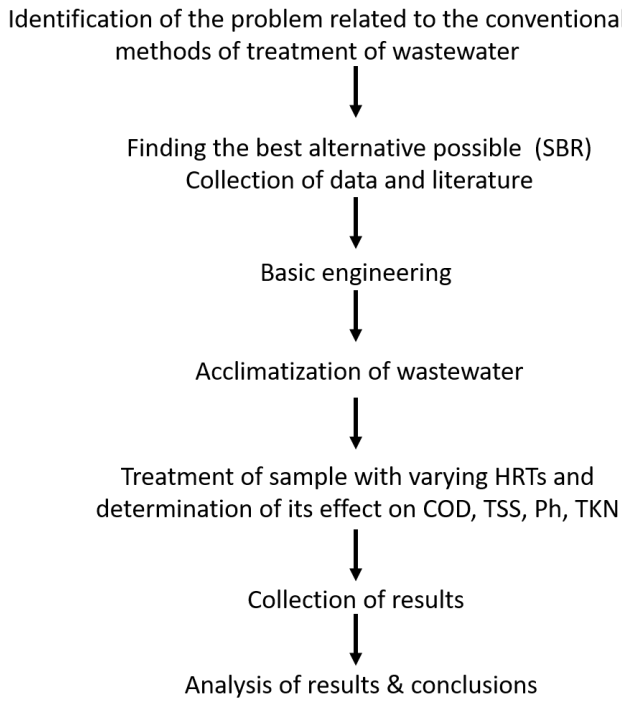
- Highly efficient and economic technology in comparison to present methods of treatment (ASP)
- As nitrogen removal is also possible, it will help against Blue baby syndrome.
- As Nutrient removal is possible (N&P), it will help against Algal bloom maintaining quality of water body in which its effluent is being disposed.

Work Plan

S. No.	Activity	Sub activities	Time (Months)	Schedule
1.	Detailed study of wastewater	Detailed study of the existing systems, sugar industry wastewater & its characteristics, Effects of sugar effluents, etc	01	Jan 2016 Feb 2016
2.	Draw a soft project	Basic engineering package & detail engineering package	03	April 2016 June 2018

3.	Execution and commissioning	Deliverable e.g Glass fused steel tanks, blowers, piping, pumps, E&I package, aeration system etc. Installation and commissioning including all test and trails	05	July 2016 Dec 2016
4.	Results	Final results submissions	N/A	Mar 2017

Proposed Methodology

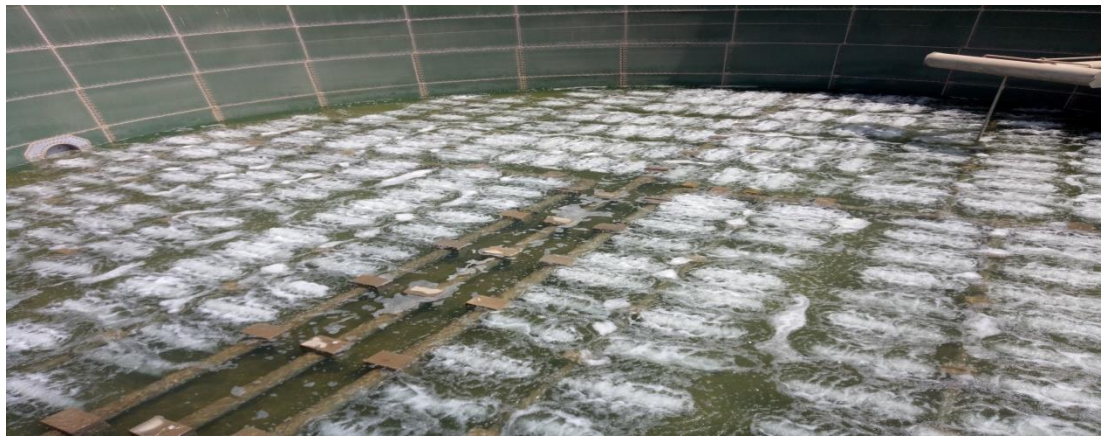


SBR Installations at Mehran Sugar Pakistan SBR Treatment System

Aerial View

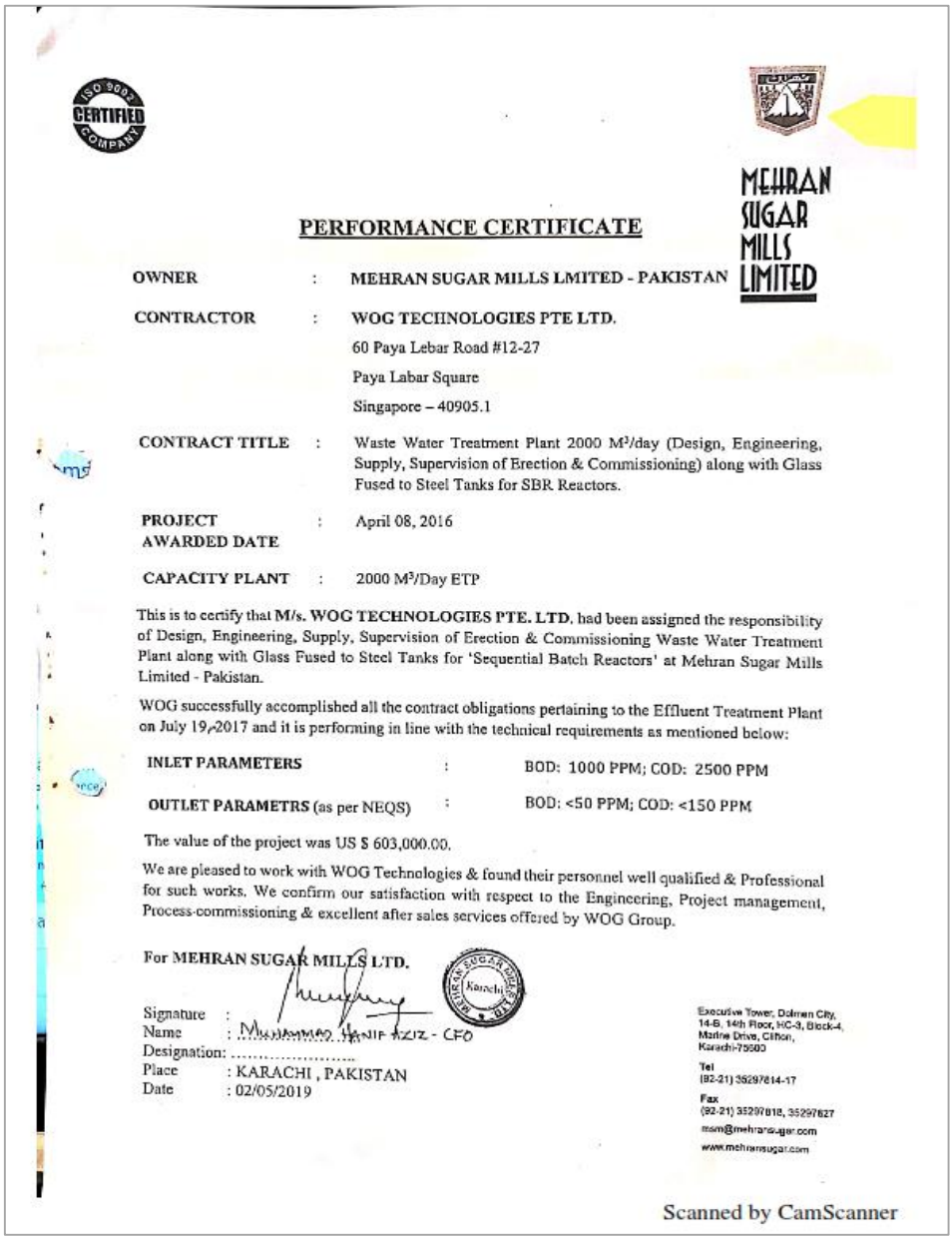
SBR Decanter

SBR Under Air Distribution Testing



SBR Under Testing for Proper Mixing

Local Reference



MEHRAN SUGAR MILLS LIMITED

PERFORMANCE CERTIFICATE

OWNER	:	**MEHRAN SUGAR MILLS LMITED - PAKISTAN**
CONTRACTOR	:	**WOG TECHNOLOGIES PTE LTD.** 60 Paya Lebar Road #12-27 Paya Labar Square Singapore – 40905.1
CONTRACT TITLE	:	Waste Water Treatment Plant 2000 M^3/day (Design, Engineering, Supply, Supervision of Erection & Commissioning) along with Glass Fused to Steel Tanks for SBR Reactors.
PROJECT AWARDED DATE	:	April 08, 2016
CAPACITY PLANT	:	2000 M^3/Day ETP

This is to certify that **M/s. WOG TECHNOLOGIES PTE. LTD.** had been assigned the responsibility of Design, Engineering, Supply, Supervision of Erection & Commissioning Waste Water Treatment Plant along with Glass Fused to Steel Tanks for 'Sequential Batch Reactors' at Mehran Sugar Mills Limited - Pakistan.

WOG successfully accomplished all the contract obligations pertaining to the Effluent Treatment Plant on July 19,2017 and it is performing in line with the technical requirements as mentioned below:

INLET PARAMETERS	:	BOD: 1000 PPM; COD: 2500 PPM
OUTLET PARAMETRS (as per NEQS)	:	BOD: <50 PPM; COD: <150 PPM

The value of the project was US $ 603,000.00.

We are pleased to work with WOG Technologies & found their personnel well qualified & Professional for such works. We confirm our satisfaction with respect to the Engineering, Project management, Process-commissioning & excellent after sales services offered by WOG Group.

For MEHRAN SUGAR MILLS LTD.

Signature :
Name : MUHAMMAD HANIF AZIZ - CFO
Designation: .....
Place : KARACHI , PAKISTAN
Date : 02/05/2019

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