SUGAR INDUSTRIES's EFFLUENT

AND

TREATMENT METHODOLOGIES

By

BASANT

Introduction to sugar Industry

Sugar is one of the most vital sources for human diet and it is a crucial product of the human life. Sugar cane and sugar beet are valuable crops for sugar production, which has very high demand in the marketplace. Also, bagasse is the by-product of sugarcane industry, which provides energy in the form of fuel for the generation of electricity and steam.

Sugar is produced approximately in 115 countries in the world. Out of these, 67 countries produce sugar from sugarcane, 39 from sugar beets and 9 countries from sugar cane as well as sugar beets.

It is estimated that sugarcane represents 70% of global sugar production, while 30 % generated from sugar beet and cassava Sugar manufacturing produces a lot of waste water, with high level of organic pollution in both aquatic and terrestrial ecosystems, when allowed to discharge without treatment.

Sugar mill effluent contains a high amount of pollution load, particularly in terms of suspended solids, organic matter, press mud, bagasse and air pollutants. Though sugar mill effluent has a relatively clear appearance. However, after stagnating for some time it turns black and starts emitting foul odors and deplete dissolved oxygen content of water bodies, rendering them unhealthy for both aquatic life and human uses.

It has been reported that on an average 30,000 - 40,000 liters of effluent is generated per tons of processed sugar.

Source of Effluent Generation in Sugar Industries

- Cleaning and washing of Milling house floor , Various division of boiling House like evaporators, Clarifiers, Vacuum pans , Centrifugation, etc generate huge amount of wastewater.

- Routine Cleaning of Heat Exchangers and other equipments with chemical.
- Leakage from equipments ,system drain.
- Boiler Blowdown, Spray pond overflow and condenser cooling water which is discharge as waste water when it gets contaminated with cane juice.
- Sewage of the Plant

Typical composition of Effluent of Sugar Industry

S.N.	Parameter	Average Value
1	pH	6 – 11
2	Chemical Oxygen Demand (COD)	3000 – 6000 ppm
3	Biological Oxygen Demand (BOD)	1500 – 3000 ppm
4	Total solid (TS)	3000- 5500 ppm
5	Total dissolve Solid (TDS)	2500 – 5000 ppm
6	Total Suspended Solid (TSS)	600- 1000 ppm
7	Oil and Grease	10- 18 ppm

Effluent characteristics

- The Sugar Industries wastewater is characterized by its brown colour, Low pH , High Temperature, High BOD & COD, Odour Problem , Total Solid and high percentage of dissolved organic and inorganic matter.
- Wastewater from sugar industries generally contains carbohydrates, nutrients, Oil and grease, chlorides, sulphates and Heavy Metal

TREATMENT MEHODOLOGIES

- Treatment of Sugar Industry wastewater required a process that combines physical , chemical and biological treatment.
- To start the treatment process, first we need to pass the effluent through Screen to separate big particles that may damage the down the line equipment .
- After screening we need to consider to remove oil and grease from the system by passing the effluent through Oil and grease trap chamber.
- Once the effluent is free from Big size particles and Free oil and grease. We need to consider a Balancing / Equalization zone, where different process stream get mixed

and get self utilization take place. It is a important aspect where we can save the down the line process cost.

- We need to keep this chamber in agitation , by way of mixers / air /way of hydraulic design so that suspended particle remains in suspension and mixing take place properly.
- If pH of the Equalized effluent is not maintained then we need to add suitable chemicals.
- This neutralized effluent then need to pas through the primary treatment where we can remove suspended solids by way of sedimentation . Different technologies are available for this and selection is made on the basis of available area and effluent characteristics after balancing.
- Now after this stage our effluent is ready for the further available treatment, the options available are as per following :
- Biological treatment – Highly recommended
- Physiochemical treatment – Not recommended
- Mechanical / Membrane based treatment – High cost but can be used if Factory situation allowed, however space is major constraints.

Biological Treatment

A. Anaerobic treatment – Technology with low energy consumption and get methane rich biogas,

1. Anaerobic Sequential Batch Reactor – ASBR , No after treatment is needed , Good quality outlet water . Not used much due to high cost of decanting
2. Up- Flow Anaerobic Sludge Blanket – UASB , Being commonly used and getting advantage of low energy requirement and benefit of biogas. Big area is needed
3. Low Rate Digester - LRD , Being commonly used and getting advantage of low energy requirement and benefit of biogas. Big area is needed
4. Anaerobic Hybrid Reactor – AHR – Very Low Foot print, Being commonly used and getting advantage of low energy requirement and benefit of biogas. Big area is needed

B. Aerobic treatment

1. Activated Sludge Process – ASP , Big area is needed with high energy requirement.

2. Sequential batch Reactor- SBR , Lower foot print is needed and good quality out let water we get.

3. Combination of trickling filter and ASP – Low Energy and comparatively low are s needed

4. Moving Bed Bio Reactor – MBBR – Low area but high energy requirement.

5. Integrated Film Activated Sludge – IFAS – Low area and comparatively low energy then MBBR

6. Membrane Bio- Reactor – MBR – Very Low area , Very good quality outlet water ,Outlet water simply use directly to Revere osmosis for recycle.

Physiochemical Treatment

1. Coagulation , flocculation and then sedimentation and filtration. – Chemical cost are very high and not get good result also chemical sludge is harder to dispose off.
2. Electro oxidation- Low foot print but cost is very high, operating cost is also high.
3. Electro coagulation - Low foot print but cost is very high, operating cost is also high.

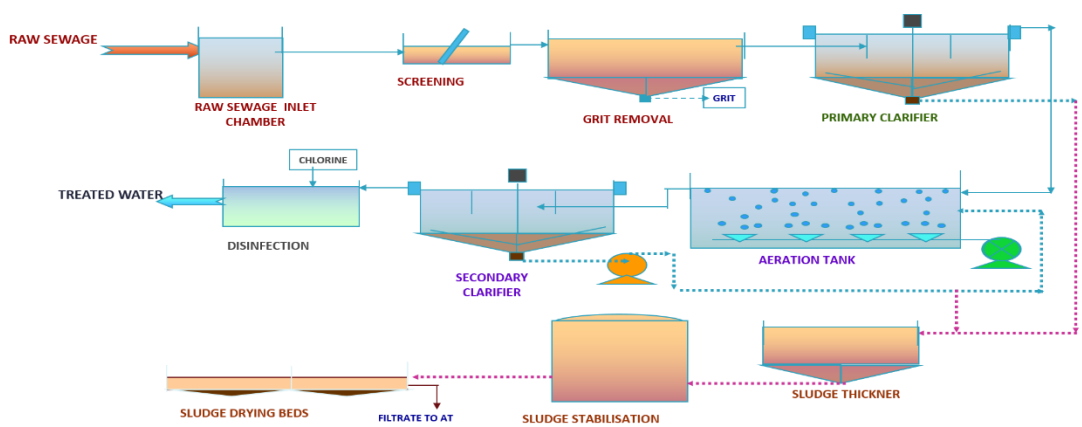
Mechanical and Membrane based Treatment

- Evaporator – Very High Energy requirement, concentrate becomes an issue .
- Mechanical Vapour Recompression – MVR.

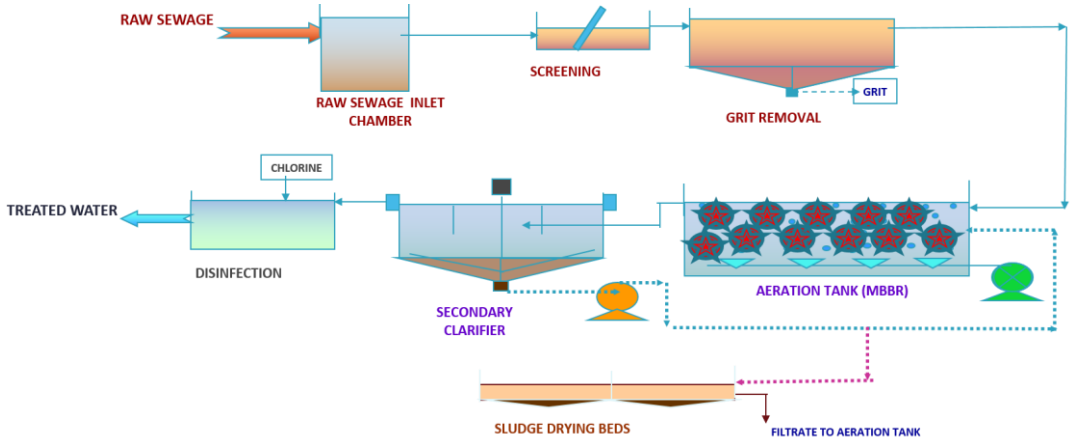
  New technology , low Energy and space requirement, High cost and again concentrate become a issue
- Ultra Disk Reverse Osmosis – UDRO

  New technology , low Energy and space requirement, High cost and again concentrate become a issue

Option 1:ASP - Flow Diagram

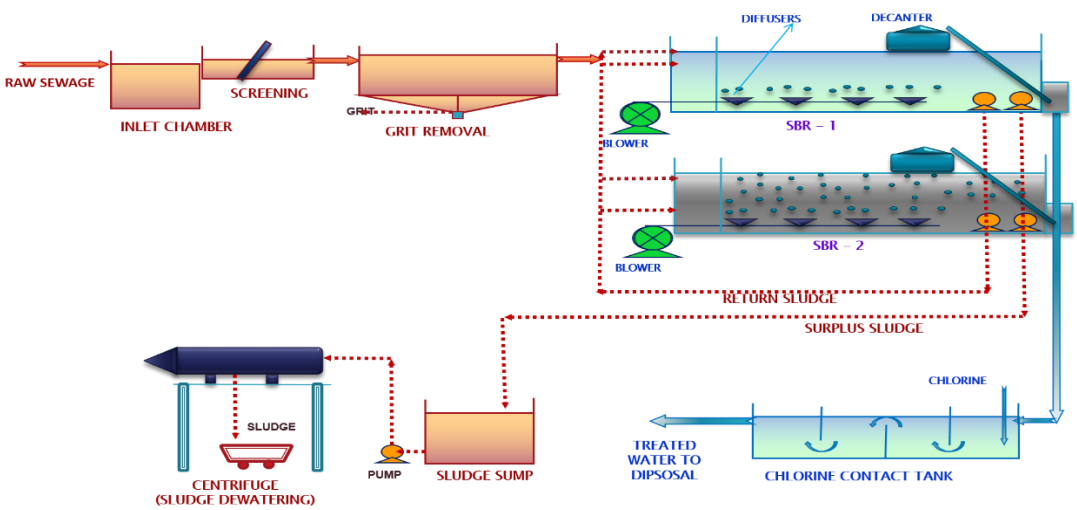


MBBR - Flow Diagram

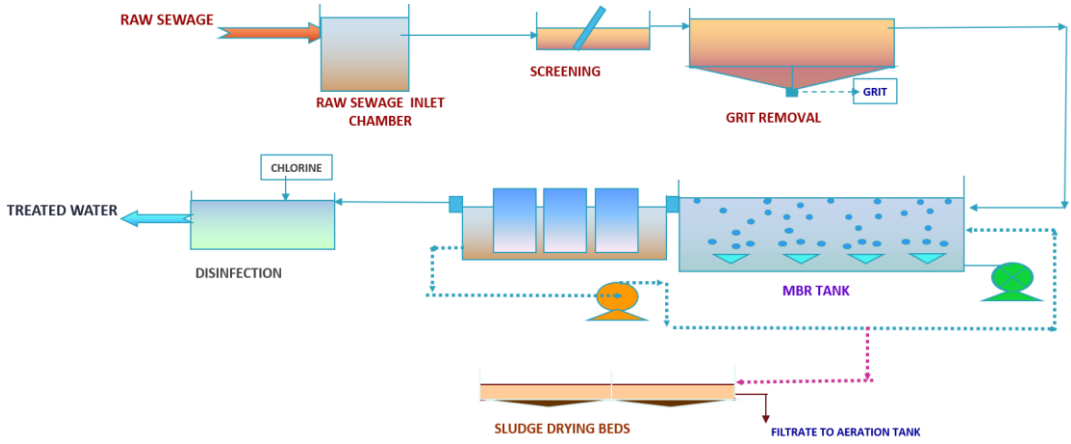


MBBR

SBR - Flow Diagram



MBR- Flow Diagram



TRICKLING FILTER - Flow Diagram