

ENVIRONMENTAL ISSUES OF SUGAR INDUSTRY

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Shakarganj Limited

Environmental Pollution

The contamination of the physical and biological components of the earth/atmosphere system to such an extent that normal environmental processes are adversely affected.

Types

- **Air Pollution**
- **Water Pollution**
- **Land Pollution**
- **Noise Pollution**
- **Radiation Pollution**
- **Thermal Pollution** etc.

Pakistan's Environmental Challenges

- Environmental issues in Pakistan include **deforestation, air pollution, water pollution, noise pollution, climate change, pesticide misuse, soil erosion, natural disasters and desertification.**
- Pakistan has been declared among *top ten countries* most affected by climate change.
- Pakistan has laws to protect the environment, but the government and citizens lack the will to implement and follow those laws completely.

Sugar & Ethanol Industry In Pakistan

- Sugar industry seasonal in nature usually 100 – 130 days operation and producing almost 6 MMT
- Ethanol industry produce more than 2,500 MT / day

- Ethanol export figure of year 2018 was almost 653,000 MT

List of distilleries in Pakistan

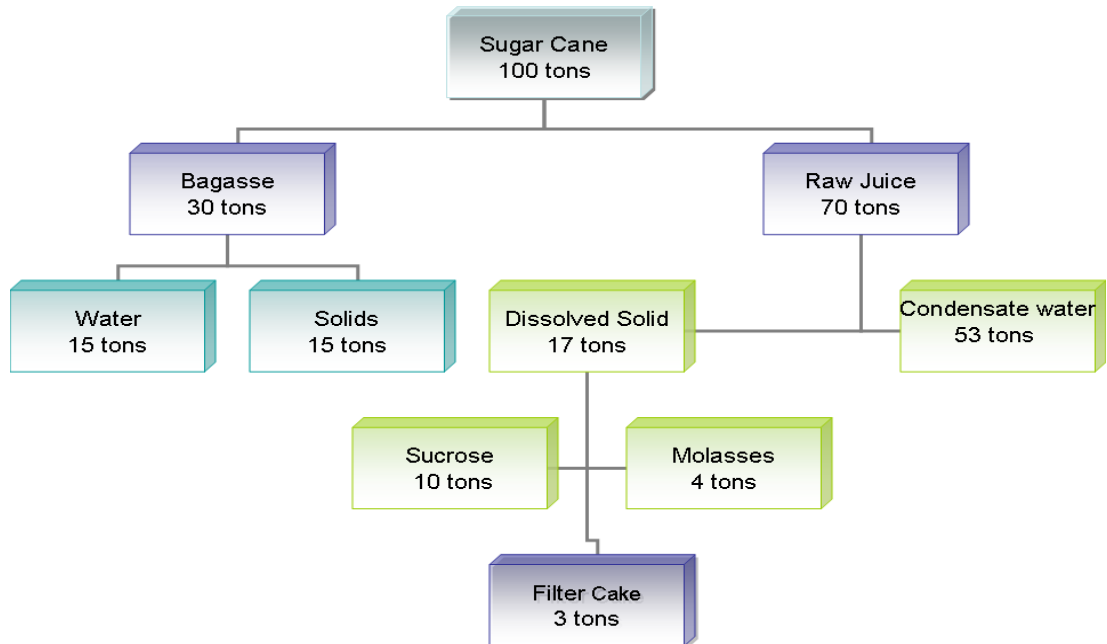
S. No	Description	Installed Capacity Liters per day	Spent wash produced (M3) / day
1	Al- Abbas Sugar Mills and Distillery Ltd, Mirwah, Mirpur khas	165,000	2,063
2	Ansari Sugar Mills and Distillery Ltd, Maatli, Badin	100,000	1,250
3	Chashma Sugar Mills & Distillery Dera Ismail Khan	100,000	1,250
4	Colony Sugar Mills and Distillery Ltd, Phalia	125,000	1,563
5	Crystalline Chemical Industries Ltd. Sargodha	100,000	1,250
6	Dewan Sugar Mills Ltd, Thatta	125,000	1,563
7	Frontier Sugar Mills and Distillery Ltd, Takht- Bhai	25,000	313
8	Habib Sugar Mills and Distillery Ltd, Nawabshah	150,000	1,875
9	Haseeb Waqas Sugar Mills and Distillery Ltd, Nankana Sahib	125,000	1,563
10	Hunza Sugar Mills & Distillery Shah Kot Faisalabad	125,000	1,563
11	Khanzana Sugar Mills and Distillery Ltd, Peshawar	25,000	313
12	Matyari Sugar Mills and Distillery, Heyderabad	100,000	1,250
13	Noon Sugar Mills and Distillery Ltd, Bhalwal	80,000	1,000
14	Premier Sugar Mills and Distillery Ltd, Mardan	46,000	575
15	Premier Chemical Industries, Sheikhpura	425,000	5,313
16	Shakarganj Mills Ltd, Jhang	350,000	4,375
17	Shahmurad Sugar Mills and Distillery Ltd, T.M. Khan	125,000	1,563
18	Saleem Sugar Mills and Distillery Ltd, Charsadda	40,000	500
19	Tandlianwala Sugar Mills and Distillery, Kanjwani	125,000	1,563
20	Unicol Pvt. Ltd. Mirpur Khas	100,000	1,250
21	United Distillery Ltd, Sadiqabad	120,000	1,500
22	Rehman Hajra Muzaffargarh	125,000	1,563
23	Madina Distillery Faisalabad	375,000	4,688
24	Ramzan Distillery Faisalabad (Under erection)	125,000	1,563
Total		3,301,000	41,263

EFFLUENT QUANTITIES

Volume

- A Cane sugar factory generally produces effluent @ 0.2-0.3 m³/ ton of cane crushed
- With 1 liter Ethanol production, 12.5 – 14.0 liters of stillage produced
- Standard says that effluent quantity should be less than 0.2 m³/ ton of cane crushed

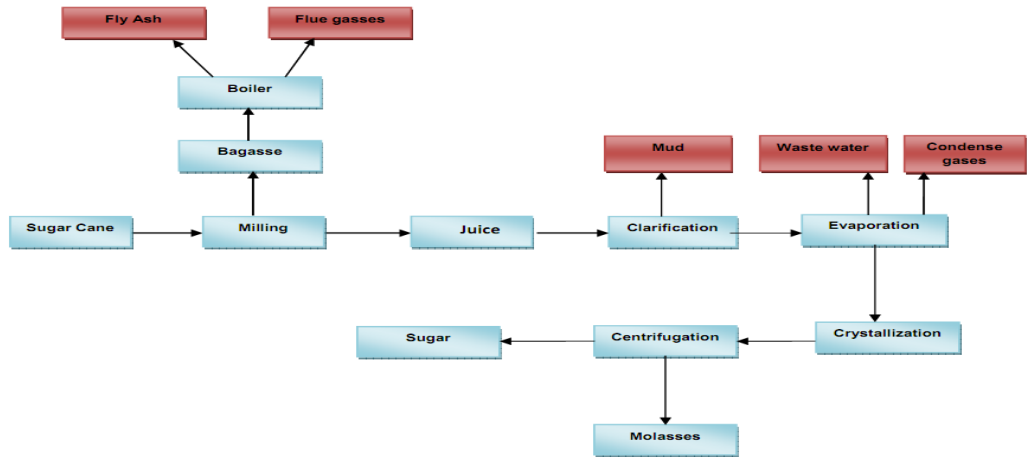
Mass Balance of Sugarcane



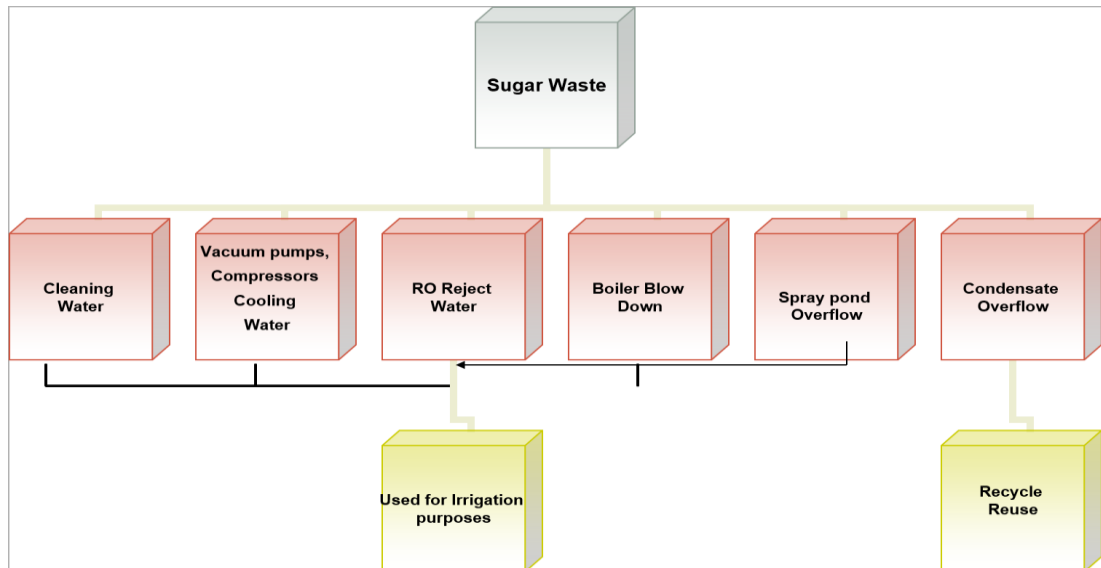
Possible Pollutants from Sugar & Ethanol Production

- **Liquid**
 1. Oil & greases
 2. Acidic and basic cleaning waters
 3. Ferment wash
 4. Stillage
- **Solid**
 1. Bagasse
 2. Fly ash
 3. Mud
- **Gas**
 1. Stack gases / Flue gases
 2. Bio gas / H₂S

POSSIBLE POLLUTANTS from Sugar Production



LIQUID WASTE FROM SUGAR PROCESSING

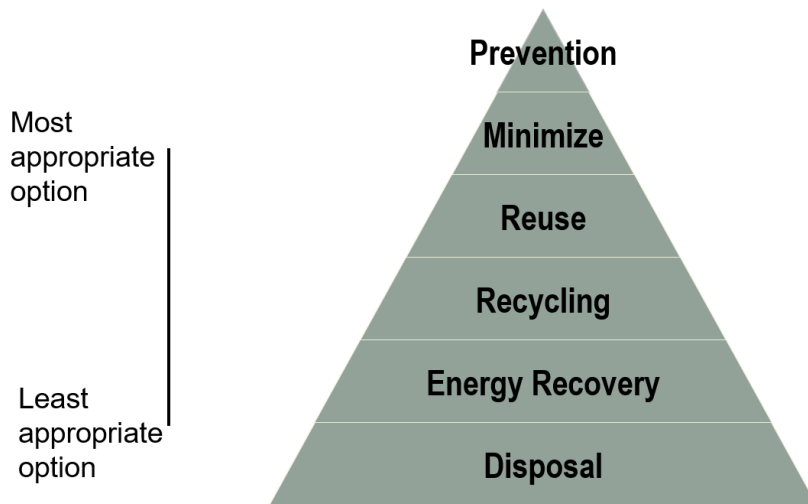


Effluent Quantity @ 8,000 Tcd

Sr.No	Waste generating Sections @ 8,000 tons/day crushing	M ³ /hr
1	Mill Bearing Cooling, Mill Washing and Floor washing	6
2	Cooling Tower Bleed off	2
3	Boiler Blow down	4
4	Turbo Feed Pump	4
5	Evaporator /Pans/Heaters Cleaning,	15
6	Vacuum pumps, Coprocessors cooling water	8

7	Gland Cooling of Pumps	2
8	Sugar dust catching system	1
9	Condensate water overflow	40
10	Spray Pond Overflow	15
11	Leakages & Washing	3
	Total effluent generation	100

APPROACHES TO ENVIRONMENT PROTECTION



In-house Improvement Options

Best Practice in waste management

Triple “R” Approach

- a) Reduce Water Consumption
- b) Recycle Surplus Condensate
- c) Re-use Cooling Water
 - Use of Sugar Mill waste water for irrigation purpose
 - Biocomposting of filter cake & stillage / Sugar Mills waste water

پائیدار ترقی کیلئے پانی کی بچت

پانی کے بہتر استعمال کیلئے اسکی پیمائش پہلی شرط ہے۔



واٹر فلومیٹر لگانے سے

- پانی کی صحیح اور مناسب مقدار کی پیمائش ہو سکتی ہے۔
- کیمیکلز کے استعمال میں کمی لائی جاسکتی ہے۔
- آلودہ پانی کے استعمال میں کمی ہو سکتی ہے۔
- توانائی کے خرچ میں کمی ہو سکتی ہے۔
- پانی صاف کرنے کے خرچ میں کمی ہو سکتی ہے۔
- 10 سے 20 فیصد پانی کی بچت ممکن ہے۔

Effluent Measurement Method

1) Area Velocity Method

The simplest method of measuring flow in an open channel is to measure the depth of flow and calculate the cross sectional area and then to estimate the velocity by throwing a stick or other floating object into the flow stream and measuring the time it takes to travel a set distance!

Flow = Area × Velocity

Area (A) = Width × Depth

Velocity (B) = distance ÷ Time × Factor (.66)

Flow = (width × Depth) × (distance/time) × .66 OR Flow = A × B × 0.66

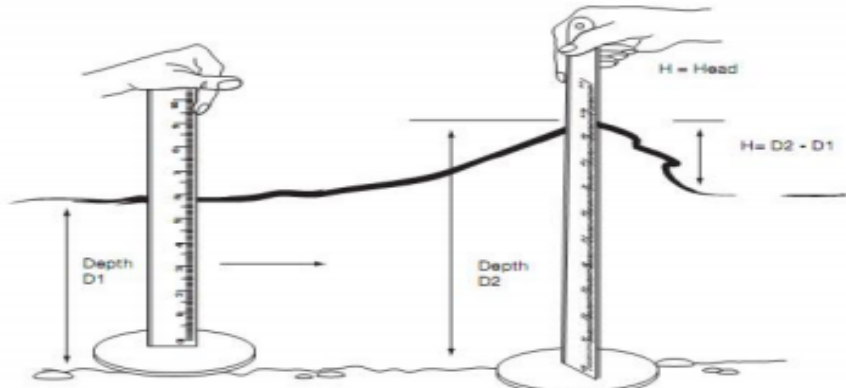


Figure 2. Using a velocity Rod. (Waterwatch, 2002).

Effluent Measurement Method

2) Weir Plate Method

A flow measuring weir is simply a structure over which water flows in such a way that volumetric flow rate can be calculated.



$$q = \frac{2}{3} c_d b (2g)^{1/2} h^{3/2}$$

Where

q = flow rate (m^3/s)

h = elevation head on the weir (m)

b = width of the weir (m)

$g = 9.81 (m/s^2)$ - gravity

C_d = discharge constant for the weir - must be determined

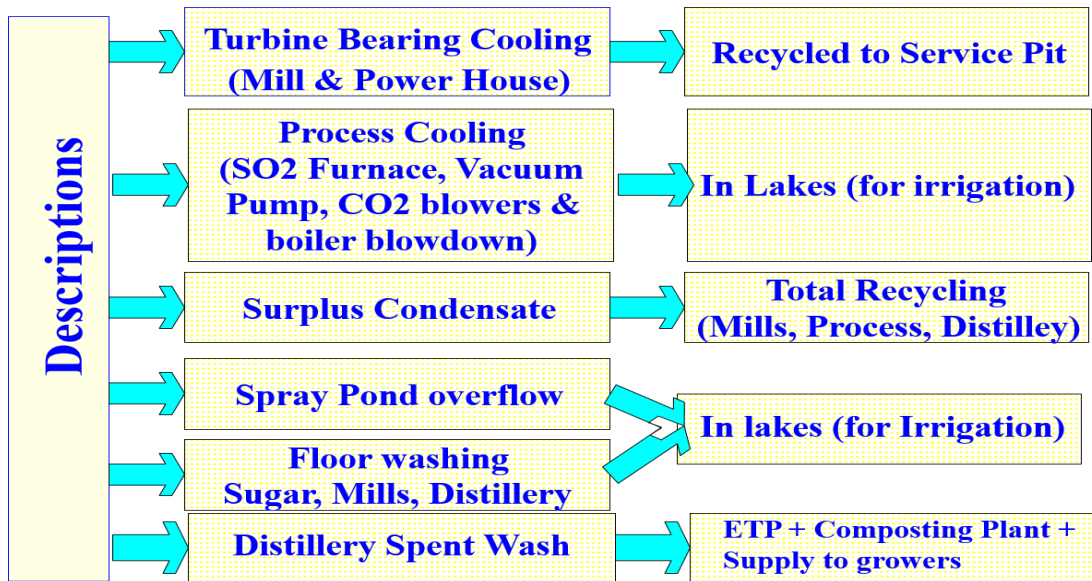
Steps for wastewater Minimization

- ❖ Flow measurement through flow meter and monitoring is essential at inlet and out let of each consumer unit at the mill for better water management practices.
- ❖ Routine inspection of units, particularly pumps, pipes and other vessels.
- ❖ use of pressurized general washing
- ❖ substitute, when possible fresh water with hot condensate.
- ❖ collection for re-use of fresh water and pipe washing
- ❖ Hydraulic & pollution load reduction (leakages through pumps and pipes should be controlled.
- ❖ Drying washing in sugar units should be encouraged.
- ❖ Raw water is used to clean the tubes of heat exchangers ,evaporators and vacuum pans during mechanical cleaning (brushing), after use effluent is drained as waste water. Collect this effluent and reuse it.
- ❖ Use close circuit cooling of bearings in which cooling water circulate inside jackets.

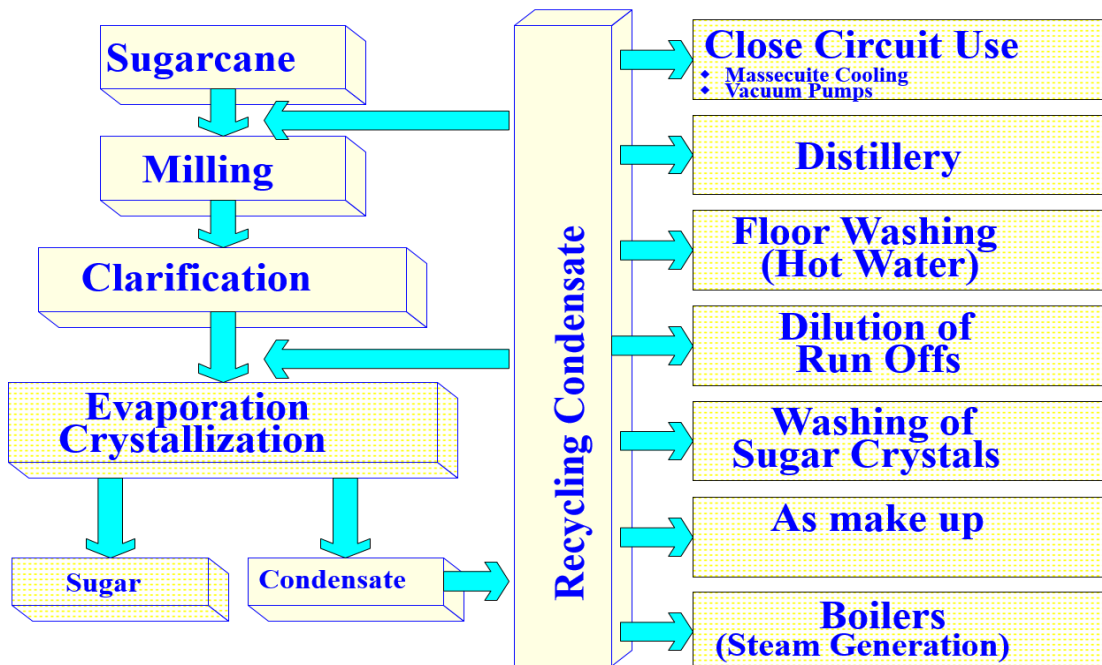
- ❖ Monitor and follow up the quality and quantity of pollution sources to prevent additional polluting effluent.

Liquid Waste Management

Current Practices Adopted by Shakarganj:



Condensate Water Management at Shakarganj



LAKES AT SHAKARGANJ

Sr.No	Descriptions	Total Storage Capacity (M ³)
1	Aabpara Lake	8,350
2	New Car Stand Lake,	3,150
3	Management lake	6,722
4	Imbibitions Pond (for Hot water use)	1,066
5	Hot Water lake	1,200
6	Lake Behind Environment Office -1	41,450
7	Lake Behind Environment Office -2	35,880
8	Lake Behind Environment Office -3	15,850
9	Bio Power Lake -1(Treated Water)	11,200
10	Bio Power Lake -2(Treated Water)	11,200
11	Haq Land Lake -1(Treated Water)	11,200
12	Haq Land Lake -2(Treated Water)	11,200
	Total	158,468

186 acre land is also acquired outside mills premises for water storage

AAbpara Lake



MANAGEMENT HOUSE LAKE 1



MANAGEMENT HOUSE LAKE 2



CONDENSATE WATER STORAGE LAKE



THE ENVIRONMENTAL PROBLEMS

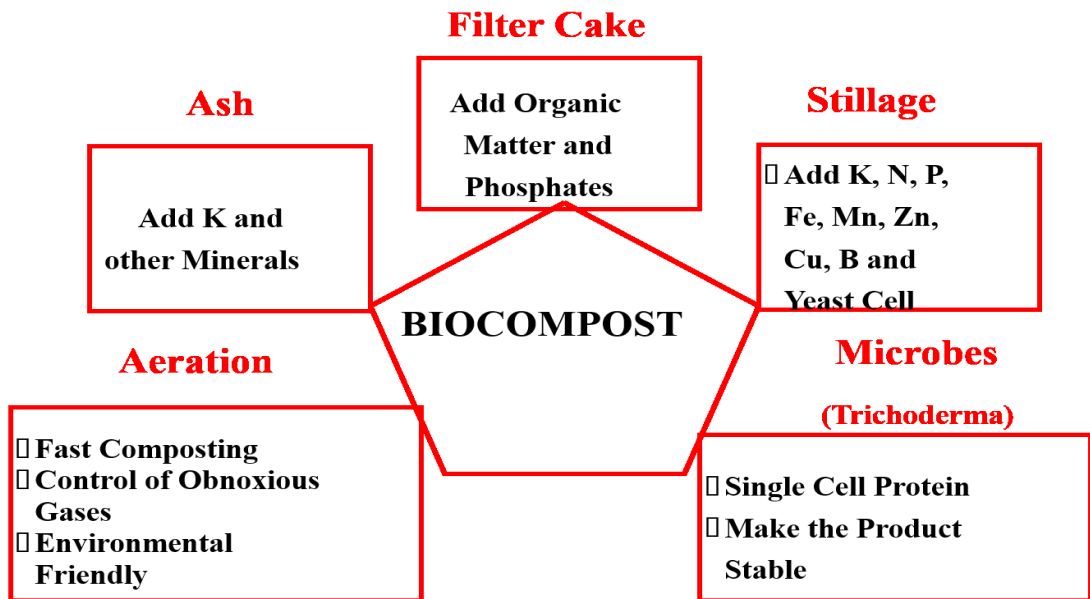
Current Practices for Controlling Air Emissions:

- Some sugar mills have wet scrubbing system in boiler stacks for scrubbing CO₂ gas, which is used in the carbonation process.
- Simultaneously, the spray of water captures most of the fly ash and reduces its emission into the atmosphere.
- The fly ash absorbed in water is removed from the bottom of the stacks as solid waste.
- Boilers of some sugar mills are also equipped with cyclone, which also help to reduce the particulate matter emissions
- Emissions from the boilers, which are not equipped with scrubbing systems or cyclones, are very high and create environmental problems around the mill area.

Bio composting

It is a process to treat effluents making an environment friendly stable product which could increase the productivity of Soils and Plants

Bio Composting At Shakarganj



BIO COMPOSTING



SHAKARGANJ TIGER COMPOST

(Organic Fertilizer)

Shakarganj Tiger compost (fertilizer) which is a value added nutritional material, rich source of organic matter and essential macro & micro nutrients taken from press mud and

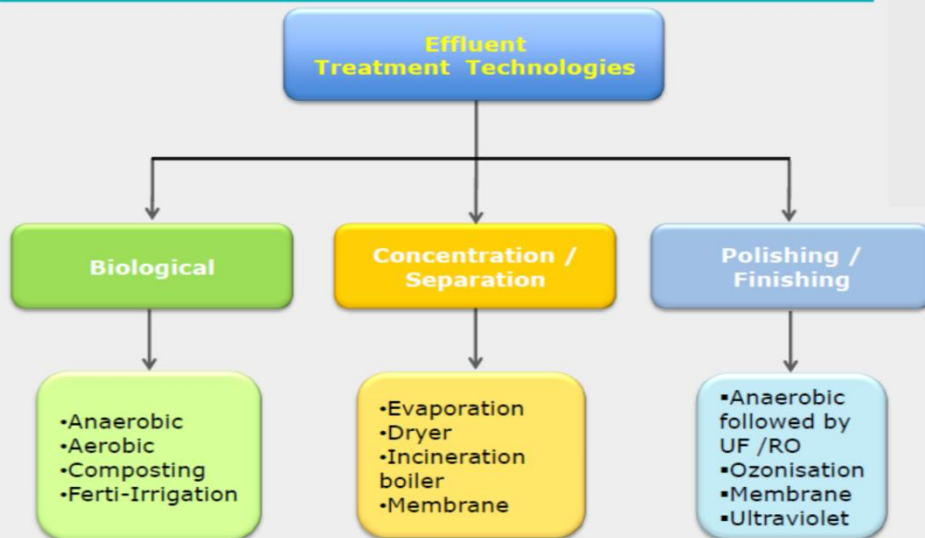
stillage . It is helpful for economically successful raising of vigorous sugarcane crop. Shakarganj Tiger compost is provided to growers on cheapest cost.

"Effluent is a problem, if not used at appropriate place with appropriate technology"



"Effluent is useful resource, if used at appropriate place with appropriate technology"

Spent Wash Treatment Technologies



Combinations of treatment methods can be used in accordance with local norms and economics

EFFLUENT TREATMENT PLANT



Degradation of organic matter by anaerobic bacteria in absence of O_2 , yielding valuable biogas .

NEQs In Pakistan

Sr. #	Parameters	Unit	NEQs
1	pH	-	6 - 9
2	Biochemical Oxygen Demand (BOD ₅)	mg/L	80
3	Chemical Oxygen Demand (COD)	mg/L	150
4	Total Suspended Solids (TSS)	mg/L	200
5	Chloride (Cl)	mg/L	1,000
6	Sulphate (SO ₄)	mg/L	600