OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE & ENGINEERING

REUSE OF WASTEWATER TREATED BY USING SEQUENTIAL BATCH REACTOR (SBR) PROCESS FOR AGRICULTURE / IRRIGATION PURPOSE

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Abstract: Water in India is primarily a state subject. Water is important factor in our life. It is fact that if water is used there will be waste. India as a developing country also faces water crisis. Sequencing batch reactors (SBRs), due to its operational flexibility and excellent process control possibilities, are being extensively used for the treatment of wastewater which nowadays is fast becoming contaminated with newer and more complex pollutants. It is also possible to include different expanding array of configurations and various operational modifications to meet the effluent limits which are also continuously getting upgraded. This article provides basic description of SBR process along with its functional and physical variants that lead to improve the removal of nutrients and emerging contaminants. The significance of selectors and various recent advancements in the application of SBR has been discussed along with the possibilities held by SBR process in the treatment of wastewater of different origins and composition to produce effluent of reusable quality.

Keywords: *Sequential Batch Reactor (SBR), Water Reuse, Nutrients.*

I INTRODUCTION

The Water reuse is increasing all over the world. The water reuse is gaining popularity throughout the world as an option for supplying a reliable alternative supply of water for that do not require high-quality water, freeing up limited potable water resources, while reducing effluent discharges into receiving waters. Sewage treatment or the treatment of wastewater is necessary to remove contaminants from wastewater which are hazardous to Environment. Before disposed of it in river streams or on land, In Present Day's There are two system's are running in treatment of wastewater one is Activated Sludge Process (ASP) or Conventional Process And the other is Sequential Batch Reactor (SBR) Technology. The objective of this Project is to study the parameters of treated wastewater come from both the units and to examine or study reuse of the wastewater treated by using the SBR technology for Agriculture purpose. As it is now a Days necessary due to shortage of natural sources of water. And need to find the best alternative option for agriculture purposes. It is therefore essential to reduce surface and ground water use in all sectors of consumption, to substitute fresh water with alternative water resources and optimize water efficiency through reuse option. The alternative resources include rainwater and grey water. One alternative source of water is wastewater recycling. The Technique to recycle water through the reuse of wastewater by economical way. Waste water is non-industrial Wastewater generated from domestic processes such as toilet, Kitchen, Sink and bathing. Dish, Shower, Sink, due to rapid industrialization and development, there is an increased opportunity for waste water reuse in developing countries in india.

There are different wastewaters treatment units and processes available, the choice of the process for treatment i.e chemical or biological, depends on wastewater characteristics, environmental and economic condition.

1.1 Concept Of Sequential batch reactor (SBR):

• SBRs are used all over the world since 1920s. With their growing popularity in Europe and china as well as the United States, They are being used successfully to treat both municipal and industrial wastewater, in areas characterized by low or varying flow patterns.

• It is more viable choice over the conventional activated-sludge process because of its improvement in equipment's and technology especially in aeration devices and computer control system.

1.2 Reason To Choose SBR:

• It can be provided in the areas where there is limited space is available.

• Treatments takes place in a single basin instead of multiple basins as ASP.

• Older wastewater treatment facilities can be retrofitted to an SBR because the basin is already present.

• High efficiency of removal BOD, COD content, low pH value in treated wastewater.

II LITERATURE REVIEW

Lin et al. (2004), investigates the municipal sewage wastewater treatment be chemical coagulation and sequencing batch reactor (SBR) methods with an aim to elevating water quantity to meet the standards required for agriculture irrigation. Both the conventional and modified SBR methods are considered. The conventional SBR technology is a batch process based on a single activated sludge treatment reactor. Chemical coagulation alone was able to lower the wastewater COD and color by up to 75 to 80%, (COD and NTU to below 20 and 2mg/l). the water quality was consistently excellent and was deemed suitable for agriculture irrigation.

Sirianuntapiboon et al. (2005), gave a study based on Sequential Batch Reactor used in dairy wastewater treatment, in dairy waste treatment most of time we are use membrane coupled sequencing batch reactor (MSBR). After treatment our wastewater effluent concentration effectively decrease. Its efficiency COD, BOD5, total nitrogen (TKN), and oil and grease removal efficiencies of 89.3, 83.0, 59.4 and 82.4%, respectively, when treatment was done at high organic loading rate (OLR) of 1.34 kg BOD/m3d.

Sunil .S. Mane, & Dr. G.R. M. et.al (2012) in "SBR-An Application Wastewater" this paper describes SBR is One of the Potential option to treat the Industrial wastewater. As it consist a wide variety of both inorganic and organic pollutant. Which can be successfully Removed by use of this Technology.

Abubkar sule , ab aziz abdul atiff, I.M.Lanwal, In Treatment of kitchen effluent using SBR and reuse of it for irrigation purpose. This paper describes the applicability of SBR on Aerobic treatment to overcome the lack of deficiencies remain in previous treatments.

III METHDOLOGY

3.1 Processes for SBR:

The operation of an SBR is based on a fill-and-draw principle, which consists of five steps.

Steps (1) Fill (2) React (3) Settle (4) Decant (5) Idle

(1) FILL: In this process, the influent wastewater is entered in the basin. It brings the Food for Microbes in the activated sludge which creates the environment for biochemical reaction.

Fill process consists following Three Phases.

a) Static Fill: In this type there is no mixing or aeration while the influent wastewater is entering in the tank. It is used during startup phase it is energy saving components.

b) Mixed Fill: In this type mechanical mixers are active but the aerators remain off so mixing produces uniform blend of influent wastewater and biomass due to aerators remains off anoxic condition is present which promotes denitrification.

c) Aerated Fill: In this type both the aerators and the mechanical mixing unit are activated. The contents are aerated to convert the anoxic or anaerobic zone over to aerobic zone.

(2) REACT: This phase allows for further reduction or polishing of waste water parameters. During this phase, no waste water enters in the basin and both the mechanical and aeration units are on. The rate of organic removal is high in this phase and most of the carbonaceous BOD removal occurs.

(3) SETTLE: In this phase, activate sludge is allowed to settle under quiescent conditions. No flows enter in the basin and aeration and mixing remains closed. This sludge tends to settle as a flocculent mass forming a distinctive interface with the clear supernatant. It is critical part of this cycle.

(4) DECANT: In this phase, a decanter is used to remove clear supernatant effluent, after the settle phase is completed. There are two Types of Decanters –

a) Floating Decanter: It maintains the inlet orifice slightly below the water surface. It offers flexibility to the operator.

b) Fixed Arm: These are less expensive designed to allow the operator to lower or raise the level of the decanter. It is optimal that the decanted volume is same as the volume that enters in the basin during the fill phase.

(5) IDLE: This step occurs between Decant and Fill phase. The time varies based on the influent flow rate and the operating strategy. During this phase, a small amount of activated sludge at the bottom of the SBR basin is pumped out. This process is known as wasting.

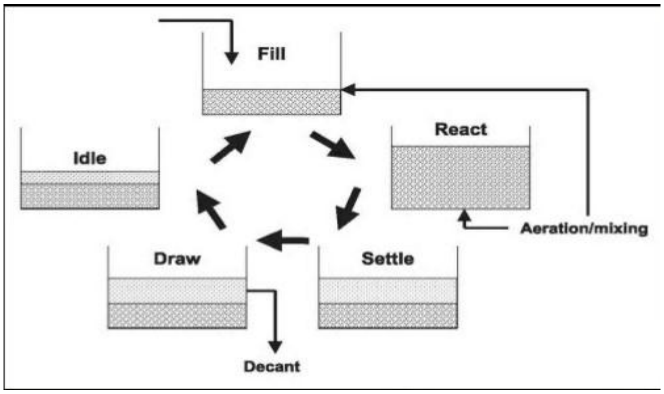


Fig.1 Show The Various Phases in SBR

3.2 Three Stages of Wastewater Treatment:

(1) Primary Wastewater Treatment:

A Primary treatment of wastewater involves sedimentation of solid waste within the water. This is done after filtering out larger contaminants within the water. Wastewater is passed through several tanks and filters that separate water from contaminants. The resulting "sludge" is then into a digester, in which further processing takes place. The primary batch sludge contains nearly 50% of suspended solids within wastewater.

(2) Secondary wastewater treatment:

Secondary treatment of wastewater makes use of oxidation to further purify wastewater. This can be done in one Two Three Way.

1. Bio filtration: this method of secondary treatment of wastewater employs in sand filter, or contact filters, or trickling filters to ensure that additional sediment is removed from wastewater. Of the three filters, trickling filters are typically the most effective for small-batch wastewater treatment.

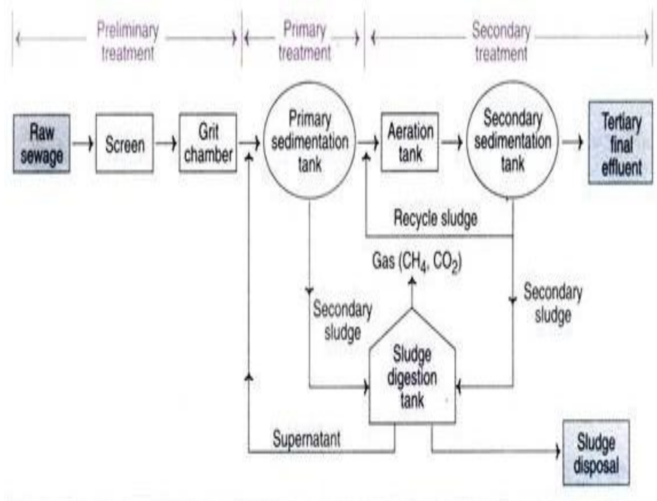
2. Aeration: Aeration is a long, but effective process that entails mixing wastewater with a solution of microorganisms. The resulting mixture is then aerated for up to 30 hours at a time to ensure results.

3. Oxidation Ponds: Oxidation ponds are typically used in warmer places. In addition of this method utilizes natural bodies of water like lagoons. Wastewater is allowed to pass through this body for a period of time and is then retained for two to three weeks.

(3) Tertiary wastewater treatment:

The third and last step in the basic wastewater management system is mostly comprised of removing phosphates and nitrates from the water supply. Substance like activates carbon and sand are among the most commonly used materials that assists in this process.

Fig.2 Shows The Conventional Flow Diagram Of Sewage Treatment Plant.



3.3 Benefits of water reuse in Agriculture:

The most important is benefit of water reuse in agriculture of following points are below.

1. Cost Effective: Water recycling can be less financially straining in the long term. Agroundwater is depleted, the costs and energy associated with pumping increases as well, as it requires more energy to drive the pumps. Recycling water can help save money the over time.

2. Energy saving: Water and energy are intricately linked. The water is used to create energy, and energy is required to collect, clean, and distribute water. In addition, different end uses require different levels of water quality. A reusing water and treating it for its intended use saves the energy.

3. Eco-Conscious: Reusing water saves resources, and reduces pollution to sensitive water bodies, and it help create riparian areas. In Idaho 92% of their 6.5 billion gallons of recycled water is now used to irrigate crops, which keeps 2000 tons of nitrogen and 500 tons of phosphorous out of rivers and streams.

4. Safe: state and federal regulations establish stringent standards of water quality and public health purposes. Forty-three states have regulations on processing reclaimed water for irrigating crops specific to whether the products will be consumed by humans. The regulations include rigorous microbiological and chemical testing.

IV RESULTS AND ANALYSIS

4.1

Table 4.1. Typical concentration of Untreated domestic wastewater.

Constituents	Unit	*Typical Concentration*		
		Low	**Medium**	**High**
BOD(biochemical oxygen demand)	*Mg/ L*	110	190	350
COD (chemical oxygen demand)	*Mg/ L*	250	430	800
TOC(total organic carbon)	*Mg/ L*	80	140	260

Table 4.2. Typically SBR operation are divided in five phases summary in design operation.

Cycle	*Filling*	*Aeration time (min)*	*Settling time (min)*	*Withdrawer time (min)*	*HRT (min)*
1	*10*	*18*	*60*	*55*	*143*
2	*10*	*36*	*60*	*55*	*161*
3	*10*	*54*	*60*	*55*	*179*
4	*10*	*72*	*60*	*55*	*197*
5	*10*	*90*	*60*	*55*	*215*
6	*10*	*108*	*60*	*55*	*233*

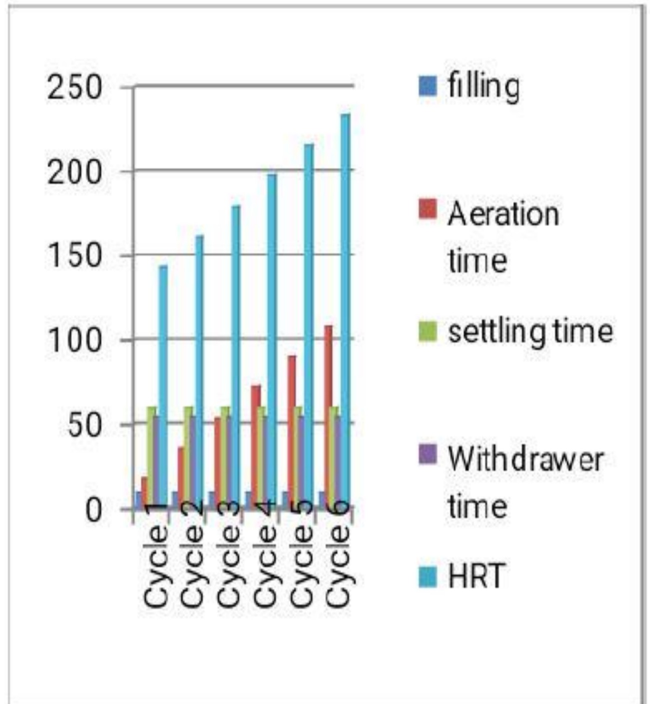
Table4.3EffectofTemperature on oxygen saturation at 1 atmospheric pressure.

Temperature		*Concentration (mg/L) of DO at Saturation*
°C	*°F*	
0	*32*	*14.6*
5	*41*	*13.1*
10	*50*	*11.3*
15	*59*	*10.1*
20	*68*	*9.1*
25	*77*	*8.8*

Table4.4Three Sample are used for this example

Sample 1:	*COD=3,474mg/L* *BOD=1,800mg/L* *COD/BOD= {3,474/1,800}= 1.93*
Sample 2:	*COD=2,670mg/L* *BOD=1,500mg/L* *COD/BOD = {2,670/1,500}= 1.78*
Sample 3:	*COD=2,451mg/L* *BOD=1450mg/L* *COD/BOD = {2,451/1450}= 1.69* *(1.93+1.78+1.69)/3=1.8* ***COD:BOD Ratio = 1.8:1***

4.2 Analysis of COD and BOD.



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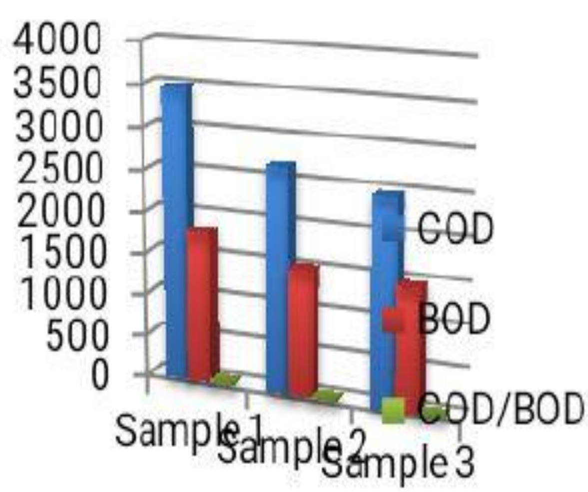

V CONCLUSION

1. According to our conclusion, The waste water have high BOD, Turbidity and total dissolved solids. Our aim is to make this water will safe for disposal in natural environment or to use it for other purposes.

2. The DO content of waste water recorded is found to be low value due to the presences of higher organic matter and an increased BOD and COD.

3. Higher quantity of inorganic nutrients like nitrogen and phosphorous was found present in the waste water.

4. It can be Recycled/ Reused as a source water for a multitude of water-demanding activities such as Agriculture, Irrigation, aquifier recharge, and aquaculture.

VI OUTCOME

1. The most comman reasons for a establishing a wastewater reuse program is to identify new water sources for increased water demand and to find economical ways to meet increasingly more stringent discharge standards.

2. Provision of nutrient- rich wastewater can reuse increase agricultural production in water-poor areas.

3. It may reduce the need for large wastewater treatment systems, if significant portions of the waste stream are reused and recycled.

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