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"Study The Different Parameters of Sewage Treatment With UASB & SBR Technologies"

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Abstract: *Every community produces both liquid and solid wastes and air emissions. The liquid waste-wastewater-is essentially the water supply of the community after it has been used in a variety of applications. From the standpoint of sources of generation, wastewater may be defined as a combination of the liquid or water-carried wastes removed from residences, institutions, commercial and industrial establishments, together with such groundwater, surfacewater and stromwater as may be present. This waste water through sewer comes to the sewage treatment plant so that parameters are reduced and treated wastewater be disposed into water or land. For treating the sewage UASB(UP FLOW ANAEROBIC SLUDGE BLANKET) and SBR(SEQUENCING BATCH REACTOR) technologies are mostly used.*
All the parameters of these samples were analyzed using standard methods prescribed in "Standard methods for examination of water and wastewater". It was observed that pH & temperature values at outlet by both the processes are almost same. Reading were taking on two consecutive days and value of Biochemical Oxygen Demand by UASB process was 32, 32mg/l and by SBR process was 11, 16mg/l. Chemical oxygen Demand by UASB process was 112, 96mg/l and by SBR process was 32, 34mg/l. Total Suspended Solids by UASB process was 58, 44mg/l and by SBR process was 10, 12mg/l. Both the processes were used for treating the wastewater and the SBR process showed better results as comparative to UASB.

Objective oF Study:
To study the degree of correction occurring on the sewage after treating with UASB and SBR technologies at STP, Village Balloke, LUDHIANA
In this study attempt has been made to study the difference between two technologies after treatment process is done. Process followed is as under
(1)Collection of the sample
(2)Determination of the physical & chemical characteristics.

I. Introduction

In early days waste products of the society including human excreta are been collected, carried & disposed of manually by the human beings and this system called dry conservancy system. This system leads to bad smell and health hazard. Now a day with the march of civilization & development proper disposal of waste done by a new system called sewage system that had replaced the old dry conservancy system. In the sewage system, the waste mixed with water called sewage. Sewage carried through close pipes or lines called sewers to the place away from the residential area under the force of gravity to sewage treatment plant (STP). Here sewage treated before disposing in environment. As sewage includes dissolved and suspended organic solids, number of living microorganism, which lead into bad condition, odor and appearance. Microorganism may contain disease-producing (pathogenic) bacteria and viruses that can be readily transferred by sewage from sick individuals to well ones. So by removing it properly environment can maintain in an acceptable and safe condition.

Characteristics Of Sewage

Knowing of the sewage is essential for the proper treatment and management both effectively and economically. Characteristics helps us in the choosing treatment method, extent of treatment, assessing beneficial uses of waste and utilization of purification capacity of natural body of water in planned and controlled manner. The characteristics are as follows:

- Physical
- Chemical
- Bacteriological

Physical Characteristics:

These include those that detected using the physical senses i.e. by physical examination. They are temperature, color, odor, turbidity and solids.

PHYSICAL CHARACTERISTICS

CHARACTERISTIC	CLASSIFICATION OF SEWAGE
Turbidity	Normally turbid; stronger the sewage, higher the turbidity
Color	• Normal fresh sewage containing DO is grey. • Black or dark color indicates stale or septic sewage accompanied by septic odour due to the discharge of chemical or industrial effluent.
Odour	Fresh sewage have musty odor or odorless. After 3-4 hour it become stale and start omitting foul/ offensive smell, that of hydrogen sulphide.
Temperature	• Generally, temperature of sewage is slightly higher than the normal water temperature. • In India, average temperature is 20^0C. • It is an important factor as it affects biological activity of microorganism, solubility of gases & viscosity of sewage.
Solids	• Sewage have very small of solids than water. • Forms of solids are suspended, dissolved, colloidal, settable solids- organic & inorganic solids. • Solids burn at high temperature 500°C to 600°C to form carbon dioxide, water etc, called as volatile solids. These are from living sources. • Those that donot burn at500°C to 600°C, but remain as a residue called fixed solids. It may be composed of grit, clay, salts, and metals. These are from nonliving sources.

CHEMICAL CHARACTERISTICS:

The chemical characteristics of wastewater of special concern to the utilities man are pH, DO, nutrients and toxic substances.

- **pH** is used to describe the acid or base properties of water solutions. pH of sewage is generally greater than seven.
- **Chloride** is inorganic substance that enters sewage urine of living organisms. Contribution is 8 gm per person per day.
- **Nitrogen** in sewage indicates organic matter. It formed in different form according to decomposition of organic waste. It can be in the form of albuminoidal nitrogen (before decomposition), free ammonia (first stage of decomposition), nitrite (partially decomposed) and nitrates (fully decomposed).
- **Nutrients (oil, fats, carbohydrates & grease)** found in the sewage due to the discharge from the animal and vegetable matter, garages, kitchens etc.
- **Dissolved oxygen** not found in sewage.DO decreases with increase in temperature.
- **Chemical oxygen demand (COD)** measure of oxygen required for chemical oxidation. It helps in differentiating biologically oxdisable & non-oxdisable material, which interfere in the BOD.
- **Biological oxygen demand (BOD)** measure of oxygen required for biological decomposition of biodegradable organic matter under aerobic condition. BOD is test carried out for a period of 5 days 20^oC.

Disposal Of Sewage

Disposal of the sewage done in two main ways:

1. Disposal on land.
2. Disposal in water.

Disposal On Land:

When untreated sewage disposed on land then part of water percolating through soil to ground water and other part evaporates. Suspended solids in the leaching water clog the void present in the soil. This leads to the change in the condition of the soil; can also results in poundings of sewage over the land where mosquitoes breed. Therefore, sewage treated before disposing off. Treated sewage used on land for cultivation this called as the effluent irrigation, broad irrigation or sewage farming.

DISPOSAL IN WATER:

Untreated sewage discharged into the water bodies that lead to deposition of the solids and other floating matters to settle at the shores. Organic waste present in water body use up the dissolved oxygen of water body and takes anaerobic condition that leads to killing of fishes and phytoplankton. Pathogenic bacteria lead to cause water borne diseases like cholera, typhoid, dysentery etc.

II. Treatment Methodology

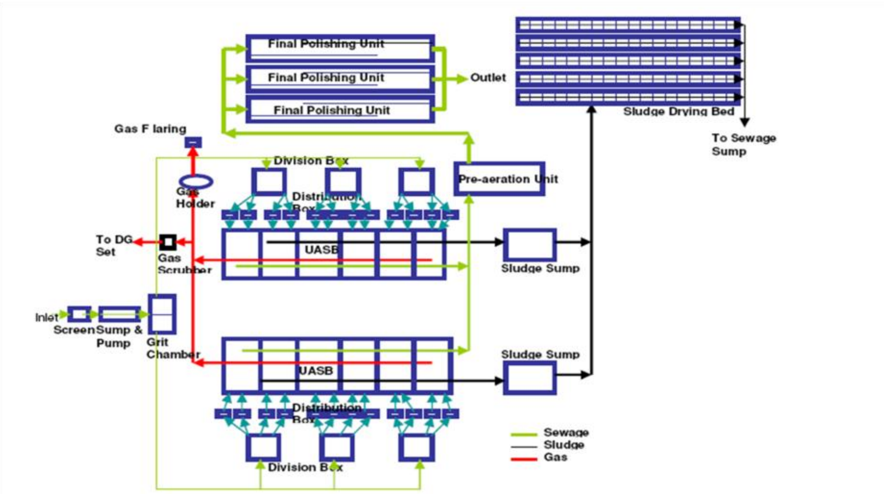
152 MLD UASB Based STP at BALLOKE Ldh. UP FLOW ANAEROBIC SLUDGE BLANKET

Upflow Anaerobic Sludge Blanket (UASB) reactor for Sewage Treatment

Since 1982, in several parts of the world experiments have been undertaken to assess the applicability of the UASB system - the Upflow Anaerobic Sludge Blanket system,described in detail by several authors **(Lettinga et al., 1980, Lettinga and HulshoffPol, 1984)** for the direct treatment of sewage in warm climates. Experiences in Brazil**(Souza, 1986)**, Indonesia **(National Institute for Public Health et al. 1988)**, India**(Siddigi, 1990)**andColombia**(Schellinkhout et al., 1985)** showed that a BOD reduction of 75% is feasible under tropical conditions and somewhat lower in colder areas **(Vieira and Souza, 1986)**. It is also indicated that considerable cost reductions could be achieved in comparison to other treatment systems. In 1990, thus far largest sewage treatment plant based on UASB technology was built in the Colombian city of Bucaramanga (600 000 in hab, 900 m + sea level). Smaller plants are being operated in Kanpur, India (5 000 m3/day), Colombia (20,000 population equivalent (PE).Successful use of anaerobic reactors (especially up-flow anaerobic sludge blanket reactors, (UASB) for the treatment of raw domestic sewage in tropical and subtropical regions opened the opportunity to substitute the aerobic processes with the anaerobic technology for the removal of organic matter from the influent wastewater. Despite the success, effluent from the anaerobic reactors, treating domestic sewage, requires post-treatment in order to achieve the discharge standards prevailing in most countries. The use of UASB technology for sewage treatment has been explored as a feasible option in many developing countries like Colombia, Indonesia, Brazil, China, and India. Capital costs for the UASB process are lower than those for other anaerobic processes since the separation of gas, liquid and solids takes place entirely in the reactor and no support medium for bacterial attachment is required. An USAB reactor has four major components: (1) sludge bed; (2) sludge blanket; (3) gas-solids separator (GSS); and (4) settling zone. The key feature of the UASB process that allows the use volumetric COD loadings compared to other anaerobic processes is the development of a dense granulated sludge. Because of the granulated sludge floc formation ,the solids concentration can range from 50 to100mg/l at the bottom of the reactor. and 5to 40mg/l in a more diffuse zone at the top of the UASB sludge blanket the granulated sludge particles have a size range of 1.0 to 3.0mm and result in excellent sludge-thickening properties with SVI values less than 20mL/g may be required to develop the granulated sludge and seed is often supplied from other facilities to accelerate the system startup. Variations in morphology were observed for anaerobic granulated sludge developed at 30 and 20C,but both exhibited similar floc size and settling properties(Soto et al.,1997).The development of granulated sludge solids is affected by the waste water characteristics. Granulation is very successful with high carbohydrate or sugar wastewaters,but less so with wastewaters high in protein resuling in a more fluffy floc instead.other factors affecting developing of granulated solids are pH , upflow, velocity and nutrients addition .The pH should be maintained near 7.0,and a recommended COD:N:P ratio during the startup is300:5:1,while a lower ratio can be used during steady –state operation at 600:5:1.Control of the up flow velocity is recommended during startup by having it high enough to wash out nonflocculent sludge.

The presence of other suspended soilds in the sludge blanket can also inhibited the density and formation of granulated sludge.An explanation of the fundamental metabolic conditions associated with granular sludge formation is provided by Speece(1996)based on work by Palns et al .(1987,1990)The formation of dense granulated sludge floc particles is favored under conditions of near neutral pH,a plug-flow hydraulic regime, a zone of high hydrogen partial pressure,a nonlimting supply of NH4-N,and a limited amount of the amino acid cysteine With a high hydrogen concentration and sufficient NH4-N,the bacteria responsible for granulation may produce other amino acids ,but there synthesis is limited by the cysteine supply. Some of the excess amino acids that are produced are thought to be secreted to form extracelluar polypeptides which ,in turn,will bind organisms together to form the dense pellets or floc granules.

FLOW diagram of UASB



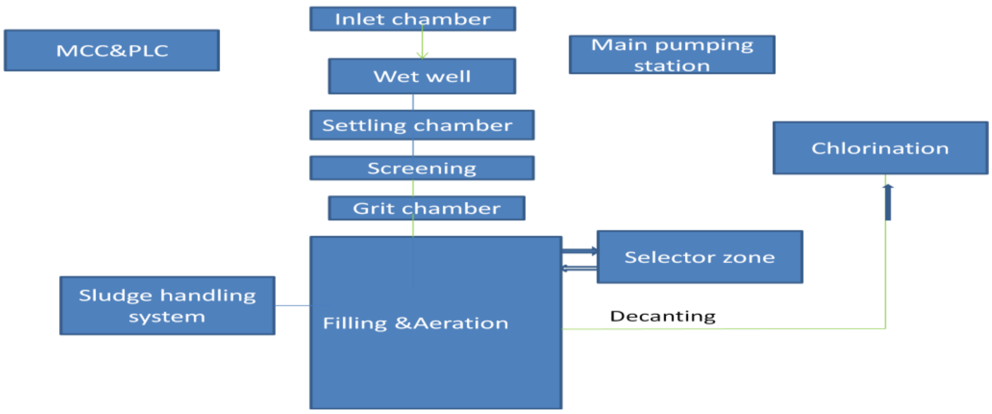
105 MLD SBR based STP at VILL. BALLOKE, Ldh SEQUENCING BATCH REACTOR

The sequencing batch reactor(SBR) process utilizes a fill and draw reactor with complete mixing during the batch reaction step(after filling)and where the subsequent steps of aeration and clarification occurred in the same tank.All SBR systems have five steps in common,which are carried out in sequence as follows (1)Fill,(2)React (aeration),(3)Settle(sedimentation),(4)Draw(decant)and(5)Idle.For continuous flow applications ,atleast two SBR tanks must be provided so that one tank receives flow while the other completes is treatment cycle .Several process modifications have been made in the times associated with each step to achieve nitrogen and phosphorus removal .

Sludge wasting is another important step in SBR operation that greatly effects performance.Wasting is not included as one of the five wasting.The amount and the frequency of sludge wasting is determined by performance requirements,as with a conventional continous flow system .In an SBR operation sludge wasting usually occurs during the react phase so that a uniform discharge of soilds (including fine material and large floc particles) occurs .A unique feature of the SBR system is that there is no need for a return activated sludge (RAS)system.Because both aeration and settling occur in the same chamber ,no sludge is lost in the react step and known has to be returned to maintain the soilds content in the aeration chamber.The SBR process can also be modified to operate in a continuous flow mode.

During the fill operation ,volume and substrate (raw waste water or primary effluent)are added to the reactor .The Fill process typically allows the liquid level in the reactor to rise from 75% of capacity(at the end of the idle period) to 100%.When two tanks are used,the fill process may last about 50%of the full cycle time .During fill ,the reactor may be mixed only or mixed and aerated to promote biological reactions with the influent wastewater.During the react period ,the biomass consumes the substrate under controlled environmental conditions.

FLOW DIAGRAM OF SBR



III. Results

PARAMETER	UASB TECHNOLGY				SBR TECHNOLGY				UNITS	Standarad Values
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	mg/l	
pH	7.2	7.1	7.2	7.1	7.2	7.3	7.2	7.2		With in range of 6.0 to 9.0
Temperature	28	26	28	28	26	27	27	27	○C	
COD	384	112	452	96	464	32	432	34	mg/l	<100mg/l
BOD5	204	32	210	32	160	11	200	16	mg/l	<30mg/l
TSS	410	58	554	44	500	10	525	12	mg/l	<30mg/l
TDS	722	666	726	600	800	560	790	540	mg/l	
TS	1132	724	1280	644	1175	510	1220	490	mg/l	

IV. Conclusion

From this study the observed values of parameters like pH and temperature at the outlet were almost same. Reading were taking on two consecutive days and value of Biochemical Oxygen Demand by UASB process was 32, 32mg/l and by SBR process was 11, 16mg/l. Chemical oxygen Demand by UASB process was 112, 96mg/l and by SBR process was 32, 34mg/l.Total Suspended Solids by UASB process was 58, 44mg/l and by SBR process was 10, 12mg/l. .Total Disolved Solids by UASB process was 666, 600mg/l and by SBR process was 560, 540mg/l.Total Solids by UASB process was 724, 644mg/l and by SBR process was 510, 490mg/l.

So for the treated wastewater, SBR showed lesser values as compared to UASB technology. So by analyzing the values we can conclude that SBR is better technology as compared to UASB.

But for using SBR technology, energy in terms of electricity is required whereas no power consumption is required in case of UASB technology.

Also land required for installing SBR is less as compared to UASB.

So depending upon the availability of land and power and on requirement of efficiency of results , any one of the above technology can be used.

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