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TRANSFORMATION OF SEWAGE WATER TO POTABLE WATER

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ABSTRACT

Sewage treatment uses Primary, Secondary, Tertiary treatments for treating predominantly domestic sewage. Primary treatment includes screening and skimming operations. Variety of screens such as bar screens, fine screens, comminutors etc and different types of skimmers such as roto skimmer, spiral skimmer are used for this purpose. The disposals from these operations are also beneficial. Secondary treatment includes decomposition of organic matter by addition of microorganisms. Tertiary treatment includes disinfection of water by advanced techniques as R.O, U.V etc. The water reclaimed by this treatment can be used for different domestic and industrial purposes.

Keywords: Screening, Comminutors, Skimming, Microbial decaying, UV radiation.

INTRODUCTION

Sewage contains suspended and floating matters in it. The suspended matters are of large size such as tree leaves, paper, gravel; timber-pieces etc. as well as of small size such as sand, silt etc. The large size suspended and floating matters can be removed by passing sewage through screens



MATERIALS AND METHODS

SCREENING

The process of removing large matters from sewage by passing it through screens is called screening¹.

SKIMMING

The floating matters such as oils, grease, etc., are removed from the sewage by skimming tanks and this process of removing is called skimming.

PURPOSE OF SCREENING

This is the first treatment or operation which is carried out at the treatment plants. Following are the main purposes of the screening:

1. To remove the floating solids - this may clog the pumps at the treatment plants and outfall.
2. To remove the solids from the sewage which will form ugly sludge banks at the site of sewage disposal, when the sewage is given only primary treatment.
3. To remove the solids which will clog the trickling filters² and will also interfere with the aeration in the activated sludge treatment units.

TYPES OF SCREENS

A screen is a device with openings generally of uniform size for removing bigger suspended or floating matter in sewage. The screening element may consist of parallel bars, rods, gratings or wire meshes or perforated plates and the openings may be of any shape. Screens can be classified as:

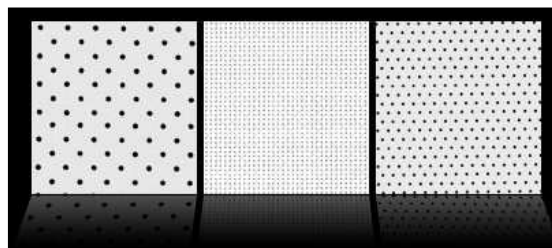
- (i) Racks or bar-screens.
- (ii) Perforated or fine screens.
- (iii) Comminuters or cutting screens.

The classifications can also be done as:

- (a) Coarse, medium or fine screen (on their opening size).
- (b) Disc, band, drum, wings or cage etc. (on their shapes).
- (c) Hand or mechanical cleaned screens.
- (d) Fixed, moving or moveable screens.

FINE SCREENS

Fine screens are used over a wide range of applications. Applications that typically use fine screens are pre-treatment in conjunction with a coarse bar screen, primary treatment in lieu of primary clarifiers, and pre-treatment at combined sewer overflows. When clogging of trickling filters presents the potential for a problem, it is common to use fine screens upstream of the trickling filters to remove solids from the primary effluent. Fine screens that are used for pre-treatment applications include, band screens, static screens, rotary drum screens, and step screens. These screens are usually classified as fine screens by the space opening which is typically between 2 to 6 mm.



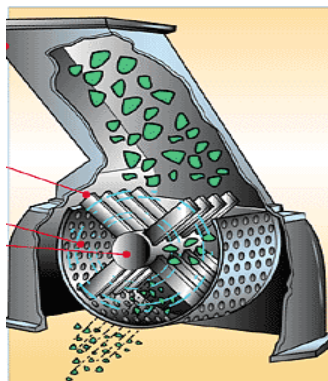
BAR SCREENS

These are typically at the head works (entrance) of a wastewater treatment plant (WWTP)³, bar screens are used to remove large objects such as rags, plastics bottles, bricks, solids, and toy action figures from the waste stream entering the treatment plant. Bar Screens are vital to the successful operation of a plant, they reduce the damage of valves, pumps, and other appurtenances. Floatables are also removed at the entrance to a treatment plant, these are objects that "float" on the surface of the water and if aren't removed end up in the primaries or aeration tanks. Typically bar screens fall under two classifications, mechanical and manual bar screens (trash racks can either be manually cleaned or mechanically cleaned). Both manual and mechanical screens contain equally spaced vertical or inclined bars that span the width of a channel. Some WWTPs plants still use manually cleaned bar screens, but because they are so labor intensive, the trend is to move toward mechanical bar screens. Mechanically bar screens are the more routinely used type because of their ability to operate automatically⁴.



COMMINUTERS

These are cutting screens which are used to reduce the particle size of waste water solids⁵.



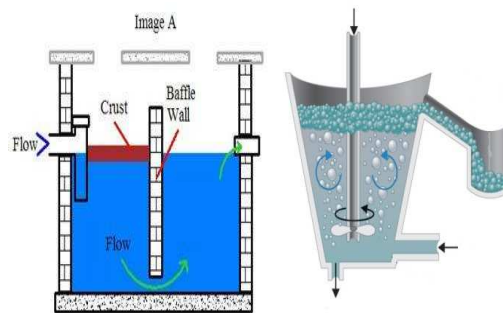
Screening Disposal

Screenings have a moisture content of about 85 to 95 percent and an organic content of 50 to 80 percent. A sanitary means of disposal is required due to the high organic content. Therefore, these materials are usually buried. Sometimes they are incinerated or ground by shredders into small particles. Burial after draining is the most common means of screenings disposal. The solids are placed in a hole or trench and covered with at least 6 inches of dirt. Sometimes lime and odor-masking chemical techniques⁶ are used to prevent nuisance problems such as odor development and insect breeding. Incineration⁷ is possible in a separate unit, in a skimming incinerator, a refuse

incinerator, or a dewatered sludge incinerator. The screenings moisture content before incineration should be reduced to about 60 to 65 percent by drainage, pressing and dewatering ⁸.

SKIMMING TANKS

These tanks are used for removing oil, grease and fats from sewage. The tanks are used to settle sludge while grease and oils rise to the surface and are skimmed off. This tank has one vertical baffle wall and divided into two compartments and this does not touch down. As air is circulated lighter particles come up. The sewage enters the tank from inlet, all the oily matter is collected through and this removal rate can be increased by 300-400 percent by passing chlorine gas of 1.5 mg/litre of sewage is applied along with compressed air and there by subjection to vacuum for 10-15 minutes, the grease can also be removed from sewage. There is comprehensive range of oil skimming equipment for both rectangular and circular tank configurations and to suit all conditions of skimming in both manual and automatic operating units ⁹.



Types of skimmers

Roto-Skim

This is the simplest and most economical skimming equipment and is widely used in municipal and industrial wastewater installations. It consists of a slotted steel pipe installed with the edge of the slot slightly above the liquid surface, so that when the edge is rotated below the surface, floating material and some liquid flows into the pipe openings and are flushed out of the tank for disposal. The Roto-Skim is available in four basic types: lever, rack & pinion, worm gear and motor operated.

Spiral-Skimmer

These are primarily used for light frothy scums. The power operated, revolving spiral shaped blade, mounted ahead of a scum trough, skims the floating materials from the tank surface and deposit it into the scum trough for further disposal.

Circular-Skimmer

These are used where small volumes of skimmings are anticipated. Common applications include primary clarifiers in sewage or industrial wastewater treatment plants where only small amounts of oils must be skimmed.

Roll-Skimmer

This skimmer finds wide application in the refining, petro-chemical, automotive, steel mill, machine shop and similar industries for free mineral oil removal from liquid surfaces. The skimming unit comprising of a pipe roll revolves down into an oil film on the water surfaces and preferentially picks up an oil film on the roll surface. The adhering oil film is doctored off into a trough for further removal. These can be provided either as wall mounted fixed units varying liquid levels.

Belt-Skimmer

These units are similar in application and operation to the roll skimmers except that a belt is used instead of a roll. An important advantage of the belt skimmer is that it combines oil skimming and lifting of the skimmed oil to a higher point in one operation.

DISPOSAL OF SKIMMINGS

The disposal of skimming obtained from the skimming tanks can be done for the manufacture of soaps, lubricants, wax, pitch and other non-edible products .if mineral oils are present in small quantity, organic and vegetable oils – then they can be used for production of fuel gas¹⁰.

SECONDARY TREATMENT

Secondary treatment is designed to substantially degrade the biological content of the sewage which is derived from human waste, food waste, soaps and detergent .This removes dissolved and suspended biological matter. Secondary treatment is typically performed by indigenous water-borne micro-organisms in a managed habitat¹¹.

TERTIARY TREATMENT

This is next waste water treatment process after secondary treatment. This step removes stubborn contaminants that secondary treatment was not able to clean up. Advanced treatments like Chlorination, Desalination & RO process^{12 13}, UV treatment¹⁴ are used in this process.



By employing these operations sewage water can be used for domestic and industrial applications. NEWater is the brand name given to reclaimed water produced by Singapore's Public Utilities Board, which treats wastewater (sewage) that is purified using dual membrane (via microfiltration and reverse osmosis) and ultraviolet technologies, in addition to conventional water treatment processes¹⁵.

CONCLUSION

Present amount of water does not suffice the requirements of scores of people of India. Removal of contaminants is made possible by engineering these techniques and thus shall be adequate to all practical purposes.

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