iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** VI **Month of publication:** June 2018

DOI: http://doi.org/10.22214/ijraset.2018.6037

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue VI, June 2018- Available at www.ijraset.com

A Review on Emerging Contaminants in Sludge Waste Treatment and its Methodology

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Abstract: The wastewater discussed IS predominantly of domestic origin. Varying amounts of industrial and laboratory wastewaters can be collected and treated with the sanitary sewage. The primary purpose of the treatment of sewage is to prevent the pollution of the receiving waters. Many techniques have been devised to accomplish this aim for both small and large quantities of sewage. Biological Wastewater Treatment System integrates biological reactors with Degremont clarifiers and sludge thickeners to treat effluent from a physical/chemical wastewater treatment system for the removal of nitrates, heavy metals, ammonia, and biochemically oxidizable organics measured as the Biochemical Oxygen Demand (BOD).

Key words: domestic origin, industrial wastewaters, laboratory wastewaters, pollution, biological reactors, Degremont, , heavy metals, Biochemical Oxygen Demand (BOD).

I. INTRODUCTION

Industrial sludge treatment chemicals are extensively used in order to purify water before it can be reused or released into the atmosphere. Industrial sludge contains a combination of compounds of agricultural value (nitrogen, organic matter, phosphorous etc) and pollutants (metals, pathogens, organic pollutants). The market for these chemicals is expected to grow significantly over the next few years due to the expected growth in volume of sludge owing to the growing level of industrialization. Industries such as food and beverage, personal care, automotive and paper and pulp are the key consumers for these chemicals due to the large production of sludge in these units. Industrial sludge treatment chemicals are categorized based on the function they perform into dewatering and drying chemicals, conditioning and stabilizing chemicals, thickening chemicals and digestion chemicals among others. Conditioning and stabilizing chemicals are the highest used chemicals globally. The market for these chemicals is expected to witness significant growth over the new few years owing to the increases industrial activities and the growing regulatory requirements for industrial sludge treatment. The product category for these chemicals consists of coagulants and flocculants, corrosion inhibitors, de-foamers, disinfetants and biocides among others. Flocculants are used in order to support the functioning of coagulants in dewatering and thickening process. These chemicals are cost effective as compared to other methods of sludge treatment and are increasingly being preferred in major emerging economies. However, the growing demand supply gap coupled with the high cost of production and raw material for these chemicals is expected to curtail the growth of the market over the next couple of years.

II. LITERATURE SURVEY

The Auckland region has two sewage treatment plants: one in Albany and one in Mangere. The process described below is that used by the Mangere treatment plant, which was built in 1960 and currently serves Auckland, Manukau and Waitakere Cities and the Papakura District. It is the largest such treatment plant in New Zealand, but its methods are similar to those used throughout the country.Pepples and Mancl (1998) did document diluting raw wastewater to obtain wastewater with residential strength charact eristics, but develop of HSW is more complicated than adding water and nitrogen.. Dog food was the major contributor to TSS in the synthetic mixture. The sludge was the There is only one published paper available documenting the creation of synthetic HSW (Matejcek et al., 2000). The authors generated synthetic HSW starting with tap water that was allowed to dechloriante over 4 days. Then SPAM ®, Crisco® Vegetable Oil, Purina® Brand Dog Food and dextrose were added along with sludge from a wastewater treatment plant. SPAM® was the primary source for BOD5 and O&G with dextrose added for minor adjustment to the BOD5source for natural bacteria. Batches were mixed from low strength to high strength as described previously.

India is developing country with 16 per cent of the world population and two percent of the total land area. The exponential increase in industrialization is not only consuming large areas of agricultural land but simultaneously causing serious environmental degradation. Industrialization and urbanization have resulted on discharge of large wastes is rich in organic matter as well as in nutrients. There are enormous quantities of industrial solid organic wastes available outside the farm from different sources and they are yet to be used judiciously in crop production. If, these wastes are properly disposed so that it do not contribute to the problem of pollution (Sundari and Mathew, 2010). Waste is defined as discarded material which has no value in normal use or for ordinary use. Solid wastes are those undesirable, useless and unwanted materials and substances that comes from human and animal activities (http://www.recycling-waste.blogspot.in/2009). In some cases what one person discards may be re-used by somebody else (http://www.harenvironment.gov.in) Methodology Waste, or rubbish, trash, junk, garbage, depending on the type of material or the regional terminology, is an unwanted or undesired material or substance. It may consist of the unwanted materials left over from a manufacturing process (industrial, commercial, mining or agricultural operations) or from community and household activities (www.fullcycle.co.za, 2009). Waste is generated in all sorts of ways. Its composition and volume largely depend on consumption patterns and the industrial and economic structures in place. Air quality, water and soil contamination, space consumption and odors all affect our quality of life (www.grida.no, 2013) Wastes are materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of one's own purposes of production, transformation or consumption, and of which one wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded (The United Nations Statistics Division (UNSD), 2013) "Waste" is everything that no longer has a use or purpose and needs to be disposed. The right term certainly applies to discarded material, but there are specific definitions for waste that affect how waste is regulated and must be handled (www.avma.org, 2013). Pollution and diseases, human-induced climate change is increasingly recognized as a crucial threat and natural variability. Climate change is altering migratory species patterns, causing coral bleaching, etc. (Subramani, 2012). Ecosystems maintain global environmental balance. Anything that alters the function of ecosystems creates an imbalance that affects all life on Earth (www.ehow.com, 2013). On account of the increasing industrialization and rapid growth of population, the solid wastes generation has not only increased but its nature has also been changed. In this context proper solid waste management is highly required to save public health and to protect environment. Environmental pollution needs diverse innovative technologies and managerial plans for better remedies. We should also encourage hooprivate and community effort to reuse discarded material(http://www.huntington-study-group.org /Portals/BecomingASiteGreenGlobe.jpg)

III. METHODOLOGY

The contaminants in wastewater are removed by physical, chemical, and biological means.

A. Physical Operations

Among the first treatment methods used were physical unit operations, in which physical forces are applied to remove contaminants. They still form the basis of most process flow systems for wastewater treatment. Some of the basic physical operations are given below: Screening, Comminuting, Flow equalization, Sedimentation etc.

B. Chemical Operations

Treatment methods in which the removal or conversion of contaminants is brought about by the additions of chemicals or by other chemical reactions are known as chemical unit processes. Precipitation and adsorption are the most common examples used in wastewater treatment. In Chemical precipitation, treatment is accomplished by producing a chemical precipitate that will settle.

C. Biological Operations

Treatment methods in which the removal of contaminants is brought about by biological activity are known as biological unit processes. Biological treatment is used primarily to remove the biodegradable organic substances (colloidal or dissolved) in wastewater. Basically, these substances are converted into gases that can escape to the atmosphere and into biological cell tissue that can be removed by settling. Biological treatment is also used to remove nutrients (nitrogen and phosphorus) in wastewater.

In sewage treatment we are using different process.

Neutralization process is heart of our project. Here we are using 4 tanks, 8 solenoid switches and 7 level switches which will help to control the flow of treated and untreated water. For Neutralization process we are using one acid and base tank whose flow will be control with the help of fine valve.-Sewage treatment is a continuous process based on PLC. It includes four process which are given below in brief:-

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D. Screening

As per diagram, reservoir tank is the source of sewage. So with the help of pump, sewage fluid is pumped into tank 1. Tank1 is provided with Level High & Level Low switches. As soon as high level is reached, Level High is switched off through controller. After some delay, Solenoid Valve is opened through which the sewage water from tank 1 is allowed to flow in tank2. Here we are using iron net which is use to eliminate small solid particles, plastics, covers etc. from sewage water. In this process water is allow to stay for some time.

E. Sedimentation

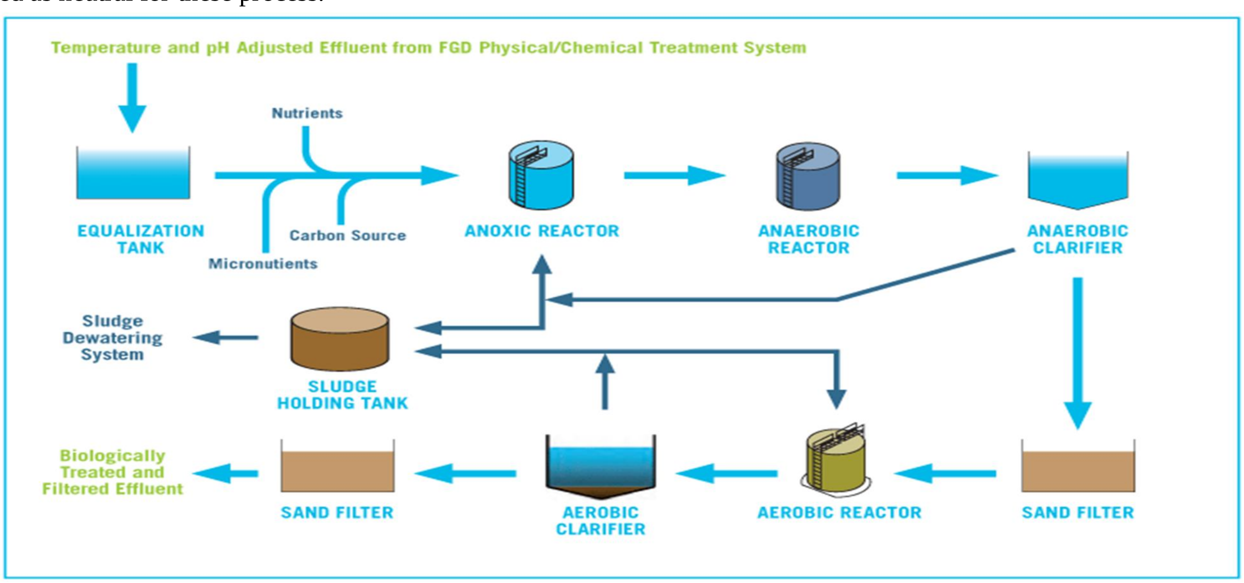
As soon as sufficient water from tank 1 is taken in the tank 2 i.e. up to Level High Solenoid Valve2 will close. Here we are using stirrer which is operating on motor. This stirrer is moving very slowly at the top of the water in order to collect all the floating solids which is not removed in screening process. Here it slows down and the suspended solids gradually sink to the bottom. This mass of solids is called primary sludge. Various methods have been devised to remove primary sludge from the tanks. As water remains in the tank for some time sludge get settle down at the bottom of the tank. After some time Solenoid Valve 4 get open and settled sludge is taken to the drain. After a certain delay Solenoid Valve3 get open and Water goes into Tank3.

F. Chlorination

Water from tank comes into tank 3 through Solenoid Valve2 . In tank 3, we treat this water by alum and chlorine water. As we can see in the diagram there are two small tanks above the tank3 which contain alum and chlorine, get controlled by Solenoid Valve 3 and Solenoid Valve 4. As water enters into tank 4 according to the value of the pH of the water, particular amount of alum and chlorine get added into tank. Alum helps to settle the sludge at bottom so water gets clean and chlorine is used as purifying agent which kills the bacteria in the water. As soon as alum and chlorine starts adding stirrer in tank starts rotating. Stirrer is used in order to mix the mixture properly. Stirrer rotates till Solenoid Valve 4 is close. Once the Solenoid Valve 4 get open Stirrer stops rotating. After certain amount of delay Solenoid Valve 5 gets opened and water from tank 3 is transfer into tank 4. As water moves sludge into tank 3 is removed by the manually operated tank. Tank 3 is also provided with limit switches which controls the limit of the tank.

G. Neutralization

Separate tank (tank 4) is used to carry out neutralization which is also provided with LH4 & LL4 switches to carry necessary conditions .This is very important process for sewage water . First of all pH of the sewage water is measured with the help of signal conditioning of pH meter and then transmitted to PLC controller so that it can give further control to adjust the pH of sewage water by addition of acid (through Solenoid Valve 6) or base (through Solenoid Valve7) to the water coming from tank 2 .While addition of acid or base the stirrer provided in this tank is continuously operated with duty cycle of 5sec .Here as soon as acid or base starts adding in the tank stirrer starts rotating. As level reaches at Level Low 4 stirrer stops rotating. Tolerance Band of 6 to 8 pH is considered as neutral for these process.



H. Gas chromatography - mass spectroscopy (GC-MS)

This technique is used to separate out a mixture of compounds collectively known as 'volatile organic compounds'. There are many compounds in this group, including such substances as benzene, carbon tetrachloride, toluene and 1,1,1-trichloroethane.

The gaseous mixture is extracted from solution by sparging with an inert gas. The organics thus driven off are adsorbed onto a 'sorbent trap' - a tube packed with beads of silica gel and a 2,6-diphenylene oxide polymer and beads coated with methyl silicone. This trap is then heated and a backflow of inert gas desorbs the gases and carries them into a GC column. They progress through the column as described above, but this time each fraction coming out of the column is sent to a mass spectrometer. In the mass spectrometer molecules of the compound are ionised and some of the positively charged ions dissociate into smaller fragments. The spectrometer separates the ions, gives their mass to charge ratio, and the relative amount of each ion. Compounds have distinct mass spectra. This gives two parameters by which each compound can be identified - the time of elution from the column and its mass spectrum. As before, the read-out from the GC column itself also gives the amount of that compound was present.

IV. CONCLUSION

If the process possess significant environmental potential as they are expected to, these shall be useful in the industrial treatment of sludge waste, sewage waste and all the industrial waste released. This study is expected to lead the development of innovative method in treating waste water.

The outcome of the proposed work will enlighten the role of treating the sewage water from industries environmentally beneficial . Final result of this work is expected to be very useful to the social relevance. The possible output of this project will be published in highly reputed International journals with good impact factor. This study contributes much new information to the field of Environmental chemistry, Biochemistry chemistry and Civil Engineering .

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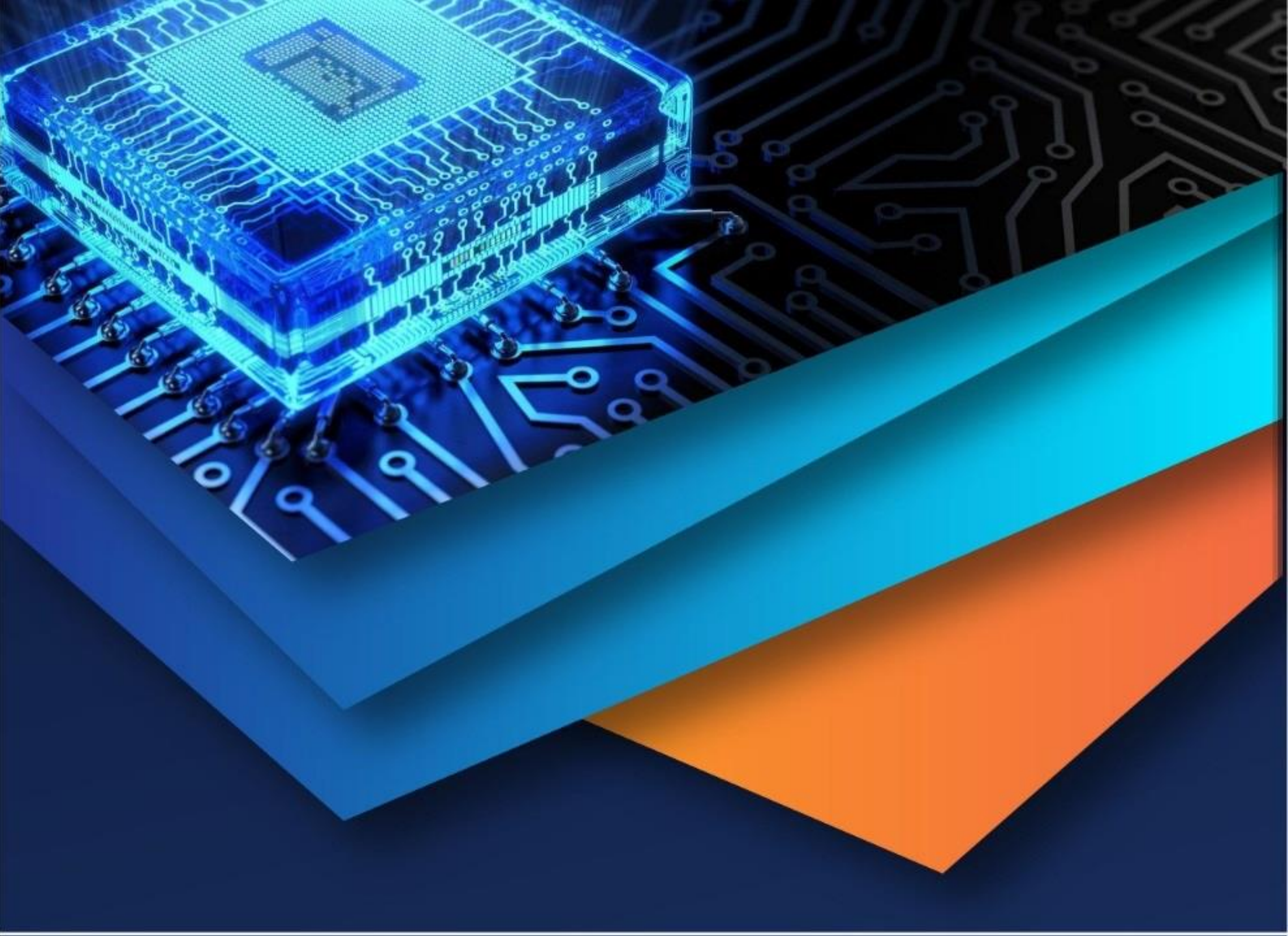

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