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A Suitable and Effective Method for the Treatment of Effluents Discharged from Sugar Plant

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ABSTRACT: Due to rapid industrialization, urbanization and intensive cultivation disposal of industrial effluents and domestic wastages become a hurdle for the existence of creatures. The purification and management of these effluents became a major task for the researchers. Hence various methods were introduced and developed for the purification and management of waste water. Water sources are getting polluted and contaminated due to the discharge of industrial wastages and domestic wastages as well as different inorganic and organic and biological pollutants among them pesticides are very common which were discharged due to agriculture activities creating serious environmental problem. Various methods of water treatment have been introduced such as chemical oxidation, photocatalysis, electrochemical, coagulation, activated carbon adsorption, biological treatment. However compared to the above present work is low cost and suitable for the removal of pollutants at high concentrations.

KEYWORDS: Effluents from sugar plant, waste water, Effluent treatment process, physical and chemical treatment

I. INTRODUCTION

Environmental pollution is a most dangerous problem that man is facing today. The fast growth of population fulfilled by scientific and technology development in health and cultivation has led to a huge increment in the environmental pollution. From the industries a variety of effluents polluting water sources which are expensive and difficult to treat. Water pollution is any biological, physical or chemical change in water quality that has an adverse effect on living organisms and makes water unsuitable for use [1]. The rejections, pollutants, toxic heterogeneous composition generated from various industries became a source of water pollution. It is a real degradation of environment and shows enormous harmful effect on human health. The water pollution constituted is an integral part of the development strategies conceived and implemented in each country at the national level as a sector level.

To deal with effluents, the solutions coming out of the production plant have gradually been substituted for an increased decentralized approach to treat the selected wastewater streams in the most effective and economical way [2]. Further, additional goals like reducing the overall effluent emissions by recycling the treated wastewater towards zero-discharge strategies or minimizing waste generation and disposal costs have gradually been incorporated to both water and wastewater management approach. The future of industrial wastewater treatment has two main targets:

I. Monitoring and abatement of trace pollutants.

II. Further development of the existing and new wastewater treatment technologies in order to minimize the costs and optimize resource consumption.

The most frequently used methods of dairy industrial waste water treatment have been the method of dilution in a natural receiver of waste water, irrigation of the abandoned land, treatment of septic tanks, biological filtering in the filter filled with slag, gravel or sand, or chemical deposition using chemical coagulants [3-7], and treatment in constructed wetlands and intermittent sand filters [8]. Waste water characteristics and levels of pollutants vary

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significantly from industry to industry. The growth of industrialization leads to the rise of wastewater from various industries and so the pollution load on the environment is increases. The high cost for the treatment and disposal of industrial wastewater is now become a challenging problem for developing countries. The sample used in this research was waste water from sugar factories, candy factories . Various methods of water treatment has introduced such as chemical oxidation, photo catalysis, electro chemical, coagulation, activated carbon adsorption, biological treatment(Table 3). However compared to the above present work is low cost and suitable for the removal of pollutants at high concentrations.

II. PARAMETERS OF NATURAL WATER AND WASTEWATER

Natural water can be divided into two categories: surface water, such as rivers and streams (Moorland surface drainage) torrents, natural lakes, reservoirs, ponds (lowland surface drainage) and subterranean water such as springs and ground water. The composition of natural water is determined by a sequence of physical chemical and bio-chemical processes which occur during different stages in hydrologic cycle. Atmospheric agents play an active role in these processes. For this reason the quality of natural water is greatly influenced by atmospheric conditions and seasonal variations in temperature, as for example the water in basins with a low replenishment rate. Here we are presenting some standards parameters for water characterization as shown in Table 1.

Table 1: Standard parameters of water characterization

| S. No. | Parameters | IS: 10500(1991) | |
|--------|-------------------------------------|-------------------------------|--|
| | | Requirement (desirable limit) | Permissible limit in the absence of alternate source |
| 1 | Colour | 5 HU | 25 HU |
| 2 | Odour | UO | UO |
| 3 | pH | 6.5-8.5 | No relaxation |
| 4 | Turbidity | 5 | 10 |
| 5 | Total Hardness As CaCO ₃ | 300 | 600 |
| 6 | Total solids | 500 | 2000 |
| 7 | Total alkalinity | 200 | 600 |
| 8 | Chloride | 250 | 1000 |
| 9 | Sulphate | 200 | 400 |
| 10 | Calcium as CaCO ₃ | 200 | 400 |
| 11 | Magnesium | 30 | 100 |

IS 10500 (1991), Indian standards for drinking water.1-9

Table 2 Characteristics of Waste water from a Typical Sugar Plant

| S. No. | parameter | concentration |
|--------|------------------------|---------------|
| 1 | BOD | 1250 mg/L |
| 2 | COD | 2250 mg/L |
| 3 | pH | 5-7 |
| 4 | Temperature | 25-35°C |
| 5 | Total Suspended solids | 600 mg/L |
| 6 | Total Dissolved solids | 2000 mg/L |
| 7 | Total volatile solids | 1300 mg/L |
| 8 | Oil and Grease | 60 mg/L |
| 9 | Sulphates | 500 mg/L |

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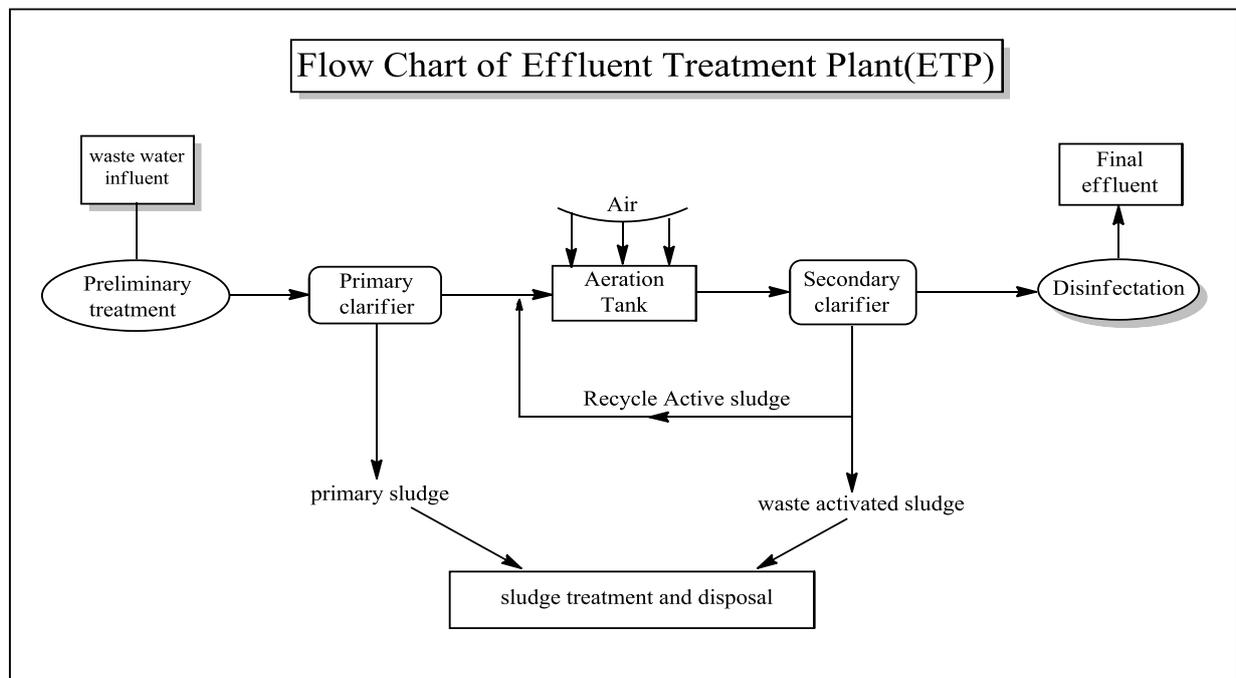
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| | | |
|----|------------|----------|
| 10 | Nitrogen | 10 mg/L |
| 11 | Phosphorus | 60 mg/L |
| 12 | Chloride | 60 mg/L |
| 13 | Calcium | 180 mg/L |
| 14 | Magnesium | 80 mg/L |

III. EFFLUENT TREATMENT PROCESS



3.1. Stages of Treatment of Effluents in ETP:

3.1.1. Initial Treatment stage: Separation of big size impurities such as plastic materials, polythene covers, wood logs, papers, cloth etc are removed by using a screen with openings of uniform size. Generally maximum 10mm is used. The suspended solids are removed by the physical water treatment process using gravity is known as sedimentation.

3.1.2. Primary Treatment stage: In this stage floating and settled materials like suspended solids and organic substances are removed by chemical operations. Adding of suitable chemicals changes the quality of waste water such as coagulation, pH control, chemical precipitation and oxidation.

pH controlling: pH of the wastewater has controlled by neutralisation of acidic wastage by the addition of NaOH, Na_2CO_3 , CaCO_3 or Ca(OH)_2 and alkali wastage by H_2SO_4 , HCl.

Chemical coagulation: According to Herdy-Schulz rule Coagulating power of an electrolyte is directly proportional to the valency of the active ions. Coagulation refers to collecting the minute solid particles dispersed in a liquid into a larger mass. Chemical coagulants like $\text{Al}_2(\text{SO}_4)_3$ or $\text{Fe}_2(\text{SO}_4)_3$ (Alum) are added to wastewater to improve the attraction among fine particles so that they come together and form larger particles called flocs.

Flocculation: chemical flocculent is a polyelectrolyte which enhances the flocculation process by bringing particles together to form larger flocs, which settle out more quickly.

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3.1.3. Secondary Treatment stage: In this stage biological and chemical processes are involved. Biological unit process is to reduce or remove the concentration of organic and inorganic compounds. All the biological treatments are based on microorganisms, mainly bacteria. **Aerobic Processes:** Aerobic treatment processes take place in the presence of air (i.e. oxygen). Utilizes those microorganisms (aerobes), which use molecular/free oxygen to assimilate organic impurities i.e. convert them in to carbon dioxide, water and biomass.

Anaerobic Processes: the anaerobic treatment processes take place in the absence of air (i.e. oxygen). Utilizes microorganisms (i.e. anaerobes) which do not require air to assimilate organic impurities. The final products are methane and biomass.

3.1.4. Final Treatment Purpose: Final cleaning process improves the quality of wastewater before it is reused, recycled or discharged to the environment.

Mechanism: Removes remaining inorganic compounds, and substances, such as the nitrogen and phosphorus. Bacteria, viruses and parasites, which are harmful to public health, are also removed at this stage.

Methods: Alum used to remove additional phosphorus particles and group the remaining solids together for easy removal in the filters. Chlorine contact tank disinfects the finally treated wastewater by removing microorganisms including bacteria, viruses and parasites. The remaining chlorine in water is removed by adding sodium bisulphate before it's discharged.

3.2. Advantages of Effluent Treatment Process

- To cut expenditure on water procurement.
- To reduce the usage of fresh/potable water in Industries.
- To clean industry effluent and recycle it for further use.
- To safeguard environment against pollution and contribute in sustainable development.
- To meet the Standards for emission or discharge of environmental pollutants from various Industries set by the Government and avoid hefty penalties.

IV. CONCLUSIONS

Extensive research activity in this field has led to significant improvement and diversification in the processes and methods used for waste-water treatment and sludge management. It is generally recognized that the main economic burden associated with water pollution is the effect of pollution on health alternative methods can be used to further treat or distribute the treated effluent. Due to continuous increase in its demands, rapid increase in population and expanding economy of the country we need some advanced well equipped and low cost and easily generable techniques. Compared to the conventional treatment systems, ETP need lesser material and energy, are easily operated and can be maintained by untrained personnel. Further these systems have lower construction, maintenance Above technique is useful for all wastewater and natural water to remove pollutants and impurities from bulk water and reuse this wastewater to reduce stress of economy on country and it also affect the environment and indirectly helpful to reduce water pollution. The parameters of resulting water shown in Table 3 are almost near to the standard parameters of a good water .

Table 3 Parameters of wastewater after Treatment

| S. No. | parameter | concentration |
|--------|------------------------|---------------|
| 1 | BOD | 150 mg/L |
| 2 | COD | 250 mg/L |
| 3 | pH | 7-8 |
| 5 | Total Suspended solids | 20 mg/L |
| 6 | Total Dissolved solids | 25 mg/L |

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| | | |
|----|-----------------------|----------|
| 7 | Total volatile solids | 2 mg/L |
| 8 | Oil and Grease | 1 mg/L |
| 9 | Sulphates | 150 mg/L |
| 10 | Nitrogen | 2mg/L |
| 11 | Phosphorus | 4 mg/L |
| 12 | Chloride | 300 mg/L |
| 13 | Calcium | 180 mg/L |
| 14 | Magnesium | 35 mg/L |

REFERENCES

- MISHRA, FALGUNI KP. *Characterization of sewage and design of sewage treatment plant. Diss. National Institute of Technology, Rourkela*,2012.
- E. Abadulla, T. Tzanov, S. Costa, K.H. Robra, P.A. Cavaco, et al. *Decolorization and detoxification of textile dyes with a laccase from *Trametes hirsuta*. Appl Environ Microbiol*, 2000, 66, 3357-3362.
- T.J. Britz, C.van Schalkwyk, Y.-T. Hung,) *Handbook of Industrial and Hazardous Wastes Treatment*, L.K. Wang, Y.-T. Hung, H.H. Lo, C. Yapijakis, Ed., *CRC Press, Boca Raton, FL*,2004, pp. 661-691
- M.G. Healy, M. Rodgers, J. Mulqueen, *Bioresour. Technol.* 2007, 98, 2268–2281.
- E. Neczaj, M. Kacprzak, T. Kamizela, J. Lach, E. Okoniewska, *Desalination*,2008, 222,404–409
- Vourch, B. Balanec, B. Chaufer, G. Dorange, *Desalination*, 2008, 219, 190–202.
- J.P. Kushwaha, V.C. Srivastava, I.D. Mall, *Crit. Rev. Food Sci. Nutr.* 2011, 51, 442–452
- Selambakkannu, Sarala, et al. "Effect of gamma and electron beam irradiation on textile waste water." *J Sains Nukl Malays*,2011, 23 , 67-73.
- J. Bandara , C. Morrison, J.Kiwi, C.Pulgarin, P. Peringer, Degradation/decoloration of concentrated solutions of Orange II. Kinetics and quantum yield for sunlight induced reactions via Fenton type reagents. *J Photochem Photobio A: Chem.*1996, 99, 57.
- G.L. Baughman, E.J. Weber, Transformation of dyes and related compounds in anoxic sediment: kinetic and products. *Environ Sci Technol* ,1994, 28, 267-276.
- M.I. Beydilli, S.G. Pavlostathis, W.C. Tincher, Decolorization and toxicity screening of selected reactive azo dyes under methanogenic conditions. *Water Sci Technol* ,1998, 38, 225-232.
- S.Blumel , A.Stolz Cloning and characterization of the gene coding for the aerobic azoreductase from *Pigmentiphaga kullae* k24. *Appl Microbiol Biotechnol.*2003, 62, 186-190.
- U.Bohmer , C.Kirsten , T.Bley , M.Noack White-rot fungi combined with lignite granules and lignitic xylite to decolorize textile industry wastewater. *Eng Life Sci.*2010, 10, 26-34
- J.L. Bragger , A.W.Lloyd , S.H.Soozandehfar , S.F.Bloomfield , C.Marriott , et al. Investigations into the azo reducing activity of a common colonic microorganism. *Int J Pharm* ,1997, 157, 61-71.
- K.C.A.Bromley-Challenor , J.S.Knapp , Z.Zhang , N.C.C.Gray , M.J.Hetheridge , et al. Decolorization of an azo dye by unacclimated activated sludge under anaerobic conditions. *Water Res.*2000, 34, 4410-4418.
- J.P.Brown Reduction of polymeric azo and nitro dyes by intestinal bacteria. *Appl Environ Microbiol*,1981, 41, 1283-1286.
- R.Carita , M.A.Marin-Morales Induction of chromosome aberrations in the *Allium cepa* test system caused by the exposure of seeds to industrial effluents contaminated with azo dyes. *Chemosphere*, 2008, 72, 722-725.
- L.Casieri , G.C.Varese , A.Anastasi ,V. Prigione , K.Svobodova , et al. Decoloration and detoxification of reactive industrial dyes by immobilized fung *Trametes pubescens* and *Pleurotus ostreatus*. *Folia Microbiol*,2008, 53, 44-52.
- F.J.Cervantes Quinones as Electron Acceptors and Redox Mediators for the Anaerobic Biotransformation of Priority Pollutants. *Agrotechnology and Food Sciences*, Sub-department of Environmental Technology, Wageningen University, Wageningen, The Netherlands2002, pp: 166.
- D.Charumathi , D. Nilanjana Bioaccumulation of synthetic dyes by *Candida tropicalis* growing in sugarcane bagasse extract medium. *Adv Biol Res* ,2010, 4, 233-240.
- B.Y. Chen , C.H.Hsueh ,W.M. Chen , W.D.Li Exploring de colorization and halotolerance characteristics by indigenous acclimatized bacteria: chemical structure of azo dyes and dose-response assessment. *J Taiwan Inst Chem Eng*, 2011,42, 816-825.
- G.Chen Electrochemical technologies in wastewater treatment. *Separation and Purification Technology* , 2004, 38, 11.
- H.Chen , R.F.Wang , C.E.Cerniglia Molecular cloning, overexpression, purification, and characterization of an aerobic FMN-dependent azoreductase from *Enterococcus faecalis*. *Protein Express Purif* , 2004, 34, 302-310.
- M.Chivukula , V.Renganathan, Phenolic azo dye oxidation by laccase from *Pyricularia oryzae*. *Appl Environ Microbiol*, 2004, 61, 4374-4377.
- K.T.Chung , S.E.J.Stevens . Degradation of azo dyes by environmental microorganisms and helminths. *Environ Toxicol Chem*,1993, 12: 2121-2132.
- K.T.Chung, S.E.J.Stevens , C.E.Cerniglia . The reduction of azo dyes by the intestinal microflora. *Crit Rev Microbiol*, 1992,18, 175-197.
- H.Claus , G.Faber , H.Koenig Redox-mediated de colorization of synthetic dyes by fungal laccases. *Appl Microbiol Biotechnol* ,2002,59, 672-678.