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OVERVIEW OF EFFLUENT TREATMENT PLANT USED FOR TEXTILE INDSTRY

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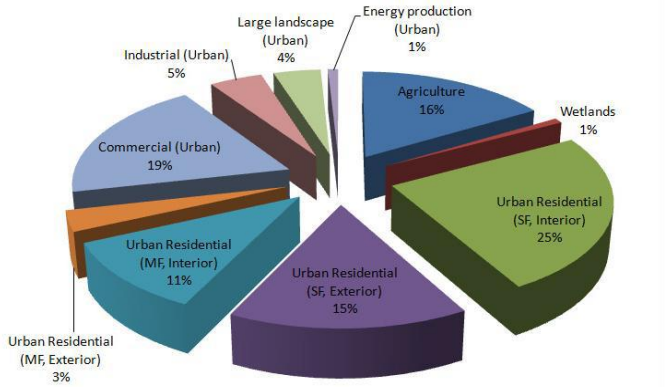
Abstract - *India is undergoing in rapid increase of industrial sector and it is concerning by many environmental factors as waste from these industries is directly dumped in water bodies and it can create serious impact to aquatic life and ecology. So, this effluent needs to be treated well before being dumped. Effluent from various types of industries such as textile, pharma, pigment, dairy contains exaggerated amount of toxic chemicals and other chemical factors. Certain processes such as reactive dyeing in textile industries require large quantities of alkali but pre-treatments and some washes can be acidic. It is therefore necessary to adjust the pH in the treatment process to make the wastewater neutral. Speaking of the textile industries, it needs enormous amount of water and variety of chemicals for different operations such as washing, dying, etc. the spillage of these chemicals, cause significant hazard to environment. On the other hand, dairy industry's wastewater generally contains fats, lactose, proteins, nutrients which increase the Biological Oxygen Demand (BOD) of water. It may also contain detergents and sanitizing agents which are obtained by cleansing process and it leads to increase in Chemical Oxygen Demand (COD). This paper gives an overview of effluent treatment plant used in textile industrial sector. This paper also provides a statistical data about ETP's and factors affecting it.*

Key Words: Chemical Oxygen Demand, Biological Oxygen Demand, Textile Industry.

1.INTRODUCTION

Effluent treatment plants are installed at various industrial clusters all over India. These plants serve to reduce effluent treatment cost and also try for better collective treatment with reduction in land cost for small scale industries [5]. In textile industries it is found that there is low efficiency of chemical operations with spillage of chemical which cause a significant threat of pollution to environment and make process of treating water a complex problem. Talking more about textile industries and its production of wastewater also known as effluent contains certain amount of pollutants [10]. Huge quantity of alkali is required for process like reactive dying but certain pre-treatment can be acidic. So, pH is needed to be adjusted as per treatment process to make wastewater neutral. Wastewater obtained from textile industries is a complex problem for several reasons such as:

1) *High TDS value.*
2) *Presence of heavy metals which are toxic in nature like Cr, As, Cu, Zn, Pb, etc.*
3) *Nature of organic dye stuff is non-biodegradable [10]*



Ref: Wastewater Treatment by Effluent Treatment Plants. International Journal of Civil Engineering. 3. 19-24. 10.14445/23488352/IJCE-V3I12P105. [5]

Presence of free- chlorine and dissolved silica Several parameters are set by government bodies which must be followed by industries when treated wastewater is being discharged into natural water bodies. Certain kind of industries are required to install ETP's by law. Artificial Neural Network (ANN) are used for prediction of variables in waste water treatment plants [3.] Operators find it helpful for taking corrective actions and manage particular process as per norms [1]. Due to shortage of river basins caused by rapid increase of industrialization and agriculture growth with urbanization has led to alarming increase in effluent. But treatment of effluent by small scale industries is not complying with standard

parameters because of which it is not suitable for household use and agriculture use too [5].

Why ETP? *Recycling of industry effluent and to reduce use of potable water [5]. Expenditure made on water procurement also can be saved. Government has set up standards for discharged waste which should be followed by each and every industry to avoid heavy penalties [7]. By recycling wastewater and reduction in use of potable water industry contributes in sustainable development. Sludge obtained after treating effluent from textile industries can be used for making of bricks known as sludge bricks which is a whole new idea of waste management [6]. Various stages are present in textile industry among which most of pollution is caused by dying plant which incorporate 1. Pretreatments 2. Dying 3. Finishing [7,10]. Waste obtained from textile dying usually contains partially or unused organic compounds which have high BOD and COD [8.]*
Due to increase in environment responsiveness in most of the developing and industrialized countries, eco-labelling is enquired with determination [8]. This all has led to forcefully reduction of environmental impact throughout world.

Literature review*:*

Treatment levels:

For treatment of effluent there are certain levels of treatment to follow which are as follows:

1. *Preliminary*
2. *Primary*
3. *Secondary*
4. *Tertiary [Advanced]*

Preliminary level*:*

At this level big sized obstructions like plastics and wood blogs are physically separated [5]. Some of the commonly used methods/units are screening which means it has uniform sized openings generally of 10mm is used [3]. Second unit is sedimentation which uses gravity to exclude suspended solids from water. Next unit is clarification in which solid is separated from fluids and nothing else is done.

Parameter	Standard limit
BOD (mg/L)	50
COD (mg/L)	200
TSS (mg/L)	150
TDS (mg/L)	2100
TS (mg/L)	2250
Turbidity (NTU)	-
pH	6
Na (mg/L)	-
K (mg/L)	-
Ca (mg/L)	0.5
Mg (mg/L)	5
Fe (mg/L)	2
Cu (mg/L)	0.5
Cr (mg/L)	0.5
Pb (mg/L)	0.1
Mn (mg/L)	5
As (mg/L)	0.2
Cd (mg/L)	0.05
Ni (mg/L)	1
Hg (mg/L)	0.01

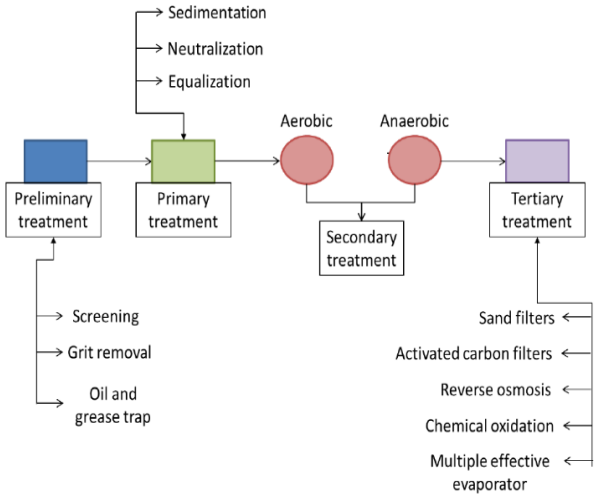
Source: Efficiency of Effluent Treatment Plants and Threat to Human Health and Aquatic Environment in Bangladesh. Asian Journal of Chemistry. [13].

Primary level:
Sole purpose of this method is to remove floating and settling particles such as organic particles. Mostly both chemical and physical methods are used for this process. In chemical process, which are always used by physical operations can also be used as biological treatment process [2]. Chemicals are added to effluent to bring changes in quality. Certain parameters such as pH, oxidation, precipitation, and coagulation. When wastes are acidic (low pH): NaOH, Na_2Co_3, $CaCO_3$ and $Ca(OH)_2$ and if waste is alkali (high pH): H_2SO_4, HCL [10].
After pH control chemical coagulation and flocculation process starts, in which collection of minute particles is done. Coagulants such as $Al_2(SO_4)_3$ also known as alum is added to effluent. By this step, small particles get attracted towards each other and form particles called flocs. For flocculation process a polyelectrolyte speeds up the process and settles more quickly.

Secondary level:
Secondary level basically includes two types of process which are Biological and Chemical. In biological process main focus is on to reduce or remove organic and inorganic compounds. Biological unit process comprises of two types of process which are Aerobic and Anerobic [5].

Tertiary level:
It is final level of process, of cleaning wastewater after which it is discharged into environment or recycled [2]. Nitrogen and phosphorus among inorganic with the help of alum and Bacteria, parasites among organic compounds with help of chlorine are mainly focused in

this process [5]. $NaHSO_3$ is used to remove excess amount of chlorine before water being discharged.



Effluent Treatment Plants: Overview, Technologies and Case Examples [2]

Procedure:

Here we will discuss function of each part in detail. 1) Process starts with removing of solids to avoid abrasions of mechanical equipment and clogging of hydraulic systems is done by help of screen chamber 2) Collection tank collects the effluent and transfers it to equalization tank. 3) In equalization tank effluent is stored for approximately 10 hrs. for proper homogenous mixing, this process is done because concentration and pH vary most of the time. As continuous mixing is done suspended solids are not able to be settled at bottom [5]. at this step few additives are added to effluent: 1. Lime (800-900ppm) [5] is added to make pH of effluent between 8-9. 2. Alum: (200-300ppm) is added to remove color of effluent. 3. Poly-electrolyte as we discussed before is added to settle suspended solids and reduce suspended solids and TSS. If above mentioned additives are added with proper portion and continuous rapid mixing is done then it facilitates homogenous mixture of flocculates to produce microflocs. 5) Once the effluent comes to clarriflocculator in which water is stirred continuously. Excess of water is moved to aeration tank, once again solid particles are settled down which are afterwards collected separately and dried. Macro flocs are formed by slow mixing in flocculation process. 6) As discussed in previous step excess water is transferred to Aeration tank in which dosing of urea and DAP is done. After adding these additives contact of water with air is increased. BOD and COD values are reduced by approximately 90% in this process of aeration. 7) Sludge is collected in clarifier with excess amount of water and is disposed out. The water being discharged is checked with standards made by Government [7]. 8) At next step inlet water is separated in terms of solids and liquids by centrifugal action in sludge thickener. Water percentage is reduced by noticeable percentage of about 45%. Sludge is then reprocessed and sludge is collected at bottom. 9) This will be the last step of the process in which drying of two different types of sludge is done.

Managing and monitoring:

This plant contains many mechanical parts which needs monitoring time to time especially rotating instruments like blowers, pumps and centrifugal pumps which are used for mixing. Malfunction of instrument can be understood by sound while plant is in function [2]. Operator of plant must be aware of sound when system is working fine and when there is default. Rotating equipment needs regular greasing and oil check for working properly so operator must check it regularly [8]. If problems are not noticed and one of plant's equipment stops to function so operator must be ready with spare parts. This will save industry from unwanted shutdown. While pH dosage use of acid is seen so it is advisable to operator to change plastic parts with stainless steel as it will not undergo corrosion if acid comes in contact with it [7].

Conclusion:

Rapid industrialization has created numerous threats to nature by different kinds of pollution, one of which is water pollution. ETP's are required in every industry where effluent is obtained. Process of ETP is different for different kind of industries. In this review paper we have discussed ETP for textile industry. We have discussed its steps and levels, standards mentioned by government authorities and maintenance requirements. ETP's are not only used for industrial effluent, it can be also used for municipal liquid waste. ETP's can save a large amount of potable water from being used in industry as recycled water can be used instead. Standards of treated wastewater should be same as that of govt. standards, if they are not then as discussed it can harm other businesses like agriculture.

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