TREATMENT OF FISHERY EFFLUENT BY USING GAS STRIPPING REACTOR

R.Naveenraj[1] ,M.Manonmani[2], T.Sathya[3]

[1]PG Scholar, [2,] Assistant Professor, [3,] Professor, Department of Environmental Engineering
M.A.M. College Of Engineering, Tiruchirappalli—621105, Tamilnadu, India

ABSTRACT: The main environmental problem of fish industries are high water consumption and high organic matter, oil, and grease, ammonia, nitrogen, and salt contents in the waste water. Aeration helps in the oxidation of these minerals. This project consequently focuses on how the various constituents of waste water vary with aeration. In this paper, gas stripping is used to treat the waste water and the setup is constructed in a circular tank. Aeration is done at various flow rates and at a constant time period. The flow rate of aeration would increase the percentage removal of various constituents. And the optimum removal of these constituents such as biological oxygen demand, chemical oxygen demand, Ammoniacal nitrogen and Kjeldahl nitrogen and some other parameters are found out using this technique. Also, aeration has no effects on salts and lipids. It could be concluded that ammonia content, waste water salinity, oil and grease plays a decisive role in the efficiency of fish processing wastewater treatment.

Key words. Organic loading rate, fat, oil and grease, free ammonia, nitrogen.

1.INTRODUCTION

Fishes play a significant role in the economic and social well being of nations. Fisheries and its resources constitute a wide source of food and feed a large part of the world's population besides being a huge employment sector. The fish industries consume a large amount of water in operations such as cleaning, washing, cooling, thawing, ice removal etc. Consequently, this sector also generates large quantities of wastewater in which the treatment is particularly difficult due to the high content of organic matter and salts and to the significant amount of oil and grease they present. These factors together with the fact that these effluents present significant variations depending on the production process and on raw material processed makes difficult to meet the emission limit values for industrial wastewater and to deal with this problem in a suitable manner. A wide variety of inhibitory substances are the primary cause of failure since they are present in substantial concentrations in wastes. These effluents are often subjected to a pretreatment before discharge to the sewage system for further treatment at an urban waste treatment. The common processes in fish processing plants are filtering, freezing, drying, fermenting, canning and smoking. Regarding the organic matter degradation, the wastewaters are conventionally subjected to biological treatments. It yields desired results only when carried out in optimum conditions under proper observation. This paper presents a critical review of the inhibitors that affect the wastewater in fish processing industries.

1.1 FISH PROCESSING INDUSTRY: The fish processing industry produce wastewater containing a substantial amount of contaminants in soluble, colloidal and particulate forms. The degree of Contamination depends on the process. It may be small (washing operations), mild (fish filleting), or heavy (boat storage tanks unloading, blood water from facilities storage tanks, "stick water" from fishmeal processing. Wastewater from fishery operations can be very high in dissolved and suspended organic materials. This results in high biological oxygen demand (BOD) and chemical oxygen demand (COD). Fats, oil and grease are also present in high amounts. Often suspended solids and nutrients such as nitrogen and phosphate can be high. Unpleasant odor and high temperature are also issues. Fishery wastewater was noted to sometimes contain a high concentration of sodium chloride from boat unloading, processing water and brine solutions. The major types of waste found in fishery wastewater are blood, offal products, viscera, fins, fish heads, shells, sinks and meat "fines". The major process operations include product receiving, boat unloading, sorting and weighing, preparation (butchering, scaling, filleting, skinning, evisceration), inspection and trimming, product processing such as pickling brining etc, further processing (canning, bottling), packaging and dispatch. Organic materials in the wastewater are produced in the majority of these processes. However, most of it originates from the butchering process, which generally produces organic materials such as blood and gut materials. Fishery wastewater generally can be divided into two categories: High volume – low strength wastes consists of the water used for unloading, fluming, transporting, and handling the fish plus the wash down water. The boat bilge water, fish preparation water and "stick water" from fish meal processing are examples of low volume – high strength water. The degree of pollution of wastewater depends on several parameters. The type of operation involved and type and amount of fishery processes are the most important factors involved. Good manufacturing practices, including water savings and segregation of high strength wastes also influence the strength and volume of Wastewater produced. Tuna canning plants commonly produce light, easy to treat wastewater, with low BODs and CODs (700and 1600 mg/l average was reported), low TSS (up to 500 mg/l) and moderate FOGs (up to 500 mg/l). Fishmeal plants were reported to produce some of the most contaminated and challenging to treat wastewater with BODs and CODs as high as 30,000 and 50,000 mg/l, TSS 30,000 mg/l and FO's over 10,000 mg/l. all herring processing also produces heavy load wastewater. Salmon, cod, mahi- mahi, and pacific whiting processing produce moderately contaminated wastewaters with BODs and CODs up to 60,000 and 15,000 mg/l, TSS up to 12,000 mg/l and FOGs up to 2,000 mg/l. Crab and shrimp processing also produce moderately contaminated wastewater. Fats, oil and grease are among the most objectionable components from the fishery wastewater. The presence of FOG in an effluent is mainly due to processing operations such as canning. Fish oil, unless removed in a fishmeal plant, often ends up in the processing wastewater. The FOG should be removed from wastewater for numerous reasons: it usually floats on top of water's surface and affects the oxygen transfer to the water; it is objectionable from an aesthetic point of view, and its decomposition generates unpleasant odors. FOGs also cling to tanks as well as pumps, ducts and pipes reducing their capacity in the long term. The FOGs of fishery wastewater varies from 10 to 20,000 mg/l, depending on the fishery operation and process being carried out. Suspended solids (TSS) present similar problems. Heavy solids also sediment and over time can clog pumps, pipes, tanks or accumulate at waterways floors. Solids and FOGs should be removed as soon asPossible in the wastewater treatment process with as low shear – mixing energy as possible. Time and shear energy often dissolve solid and colloidal components. Dissolved organic materials are much more expensive to remove.

1.2 COMPOSITION OF WASTEWATER:

1.2.1 pH:pH serves as one of the important parameters because it may reveal contamination of a wastewater or indicate the need for pH from fishery processing plants is usually close to neutral. For example, a study found that the average pH of effluents from blue crab processing industries was 7.63, with a standard deviation of 0.54; for non- Alaska bottom fish, it was about 6.89 with a standard deviation of 0.69. The pH levels generally reflect the decomposition of proteinaceous matter and emission of ammonia compounds.

1.2.2 SOLIDS CONTENT: Solids content in a wastewater can be divided into dissolved solids and suspended solids. However, suspended solids are the primary concern since they are objectionable on several grounds. Settle able solids may cause reduction of the wastewater duct capacity; when the solids settle in the receiving water body, they may affect the bottom dwelling flora and the food chain. When they float, they may affect the aquatic life by reducing the amount of light that enters the water. Soluble solids are generally not inspected even though they are significant in effluents with a low degree of contamination. They depend not only on the degree of contamination but also on the quality of the supply water used for the treatment. In one analysis of fish filleting wastewater, it was found that 65% of the solids present in the effluent were already in the supply water.

1.2.3 ODOR: In fish processing industry, odor is caused by the decomposition of the organic matter, which emits volatile amines, diamine, and sometimes ammonia. In Wastewater that has become septic, the characteristic odor of hydrogen sulfide may also develop. Odor is very important issue in relation to public perception and acceptance of any wastewater treatment plant. Although relatively harmless, it may affect general public life by inducing stress and sickness.

1.2.4 TEMPERATURE: The major types of wastes found in fishery wastewaters are blood, offal products, viscera, fins, fish heads, shells, sinks, and meat "fines". These wastes contribute significantly to the suspended solids concentration of the waste stream. However, most of the solids can be removed from the wastewater and collected for animal food applications. A summary of the raw wastewater characteristics for the canned and preserve fishery industry. Wastewaters from the production of fish meal, soluble, and oil from herring, menhaden, and alewives can be divided into two categories: high volume – low strength wastes and low volume – high strength wastes. High volume – low strength wastes consists of the water used for unloading, fluming, transporting, and handling the fish plus the wash down water. In one study, the fluming flow was estimated to be 834 L/ ton of fish with suspended solids loading of 5000 mg/L. the solids consisted of blood, flesh, oil and fat. The above figures vary widely. Other estimates listed herring pump water flows of 16L/sec with total solids concentrations of 30,000 mg/L and oil concentrations of 4000 mg/L. The boats bilge water was estimated to be 1669 L/ton of fish with a suspended solids level of 10,000 mg/L. Stick waters comprise the strongest wastewater flows. The average BODs value for stick water has been listed as ranging from 56,000 to 112,000 mg/L, with average solids concentrations, mainly proteinaceous, ranging up to 6%. The fish processing industry has found the recovery of fish soluble from stick water to be at least marginally profitable. In most instances, stick water is now evaporated to produce condensed fish soluble. Volumes have been estimated to be about 500 L/ton of fish processe

1.2.5 BIOCHEMICAL OXYGEN DEMAND: Biochemical oxygen demand (BOD) estimates the degree of contamination by measuring the oxygen required for oxidation of organic matter by aerobic metabolism of the micro flora. In the fishery wastewater, this oxygen demand originates mainly from two sources. One is the carbonaceous compounds that are used as substrate by the aerobic microorganisms; the other source is the nitrogen- containing compounds that are normally present in fishery wastewater, such as protein, peptides, and volatile amines. Standard BOD tests are conducted at 5- day incubation for determination of BOD concentrations. Fishery wastewater is very high in BOD. Literature data for fishery operations show a BOD production of one to 72.5 kg of BOD per ton of product. White fish filleting processes typically produce 12.5 – 37.5 kg BOD for every ton of product. The BOD is generated primarily from the butchering process and from general cleaning, while nitrogen originates predominantly from blood in the wastewater stream.

1.2.6 CHEMICAL OXYGEN DEMAND: Another alternative for measuring the organic content of wastewater is the chemical oxygen demand (COD), an important pollutant parameter for the fishery industry. This method is more convenient that BOD since it needs only about 3 hours for determination compared with 5 days for BOD determination. The COD analysis, by the dichromate method, is more commonly used to control and continuously monitor wastewater treatment systems. Because the number of compounds that can be chemically oxidized is greater than those that can be degraded biologically, the COD of an effluent is usually higher than the BOD. Hence it is common practice to correlate BOD vs. COD and then use the analysis of COD as a rapid means of estimating the BOD of a wastewater. Depending on the types of fishery wastewater, the COD can range from 150 to 42,000 mg/L. one study examine a tuna- canning and by product rendering plant for five days and observed that the average daily COD ranged from 1300 – 3250 mg/L.

1.2.7 TOTAL ORGANIC CARBON: Another alternative for estimating the organic content is the total organic carbon (TOC) method, which is based on the combustion of organic matter to carbon dioxide and water in a TOC analyzer. After separation of water, the combustion gases are passed through an infrared analyzer and the response is recorded. The TOC analyzer is gaining acceptance in specific applications as the test can be completed within a few minutes, provided that a correlation with the BOD or COD contents has been established. An added advantage of TOC test is that the analyzer can be mounted in the plant for online process control. Owing to the relatively high cost of the apparatus, this method is not widely used.

1.2.8 NITROGEN AND PHOSPHOROUS: Nitrogen and phosphorous are nutrients that are of environmental concern. They may cause proliferation of algae and affect the aquatic life in a water body if they are present in excess. However, their concentration in the sea-food processing wastewater is minimal in most cases. It is recommended that a ratio of N to P of 5:1 be achieved for proper growth of the biomass in the biological treatment. Sometimes the concentration of nitrogen may also be high in sea-food processing wastewaters. One study shows that high nitrogen levels are likely due to the high protein content (15-20% of wet weight) of fish and marine invertebrates. Phosphorous also partly originates from the seafood, but can also be introduced with processing and cleaning agents.

1.2.9 FATS, OIL AND GREASE: Fatty organic materials from animals, vegetables, and petroleum also are not quickly broken down by bacteria and can cause pollution in receiving environments. When large amounts of oils and greases are discharged to receiving waters from community systems, they increase BOD and they may float to the surface and harden, causing aesthetically unpleasing conditionsFats, oil and grease is another important parameters of fishery waste water. The presence of FOG in an effluent is mainly due to the processing operations such as canning, and the fish being process. The FOG should be removed from waste water because it usually floats on the water surface and affects the oxygen transfer to the water; it is also objectionable from an aesthetic point of view. The FOG may also cling to the waste water ducts and reduce their capacity in the long term. The FOG of fishery waste water varies from o to 17000 mg/lit, depending on the fish being processed and the operation being carried out.

1.2.10 INORGANICS: Inorganic minerals, metals and compounds, such as sodium, potassium, calcium, magnesium, cadmium, lead, copper, nickel and zinc are common in waste water from both residential and non residential sources. They can originate from a variety of sources in the community including industrial and commercial sources, storm water, and inflow and infiltration from cracked pipes and leaky manhole covers. Some are toxic to animals and human and may accumulate in the environment. For this reason, extra treatment steps are often required to remove inorganic material from industrial wastewater sources. Heavy metals, for eg., which are discharged with many types of industrial wastewater, are difficult to remove by conventional treatment methods. Although acute poisoning from heavy metals in drinking water are rare in the U.S, potential long term heath effects of ingesting small amounts of some inorganic substances overran extended period obtain are possible.

1.2.11 NUTRIENTS: Wastewater often contain large amounts of nutrients, nitrogen and phosphorous in the form of nitrate and phosphate, which promotes plant growth. Organisms only require small amount of nutrients in biological treatments, so their normally is an excess available in treated wastewater. In severe cases, excessive nutrients in receiving waters cause algae and other plant to grow quickly depleting oxygen in the water. Deprived of oxygen, fish and aquatic life die, emitting foul odors. Nutrients from wastewater have also been linked to ocean "red tides" that poison fish and cause illness in humans. Nitrogen in drinking may contribute to miscarriages and is the cause of serious illness infants called methemoglobinemia or "blue baby syndrome".

1.2.12VOLITALE ORGANIC COMPOUNDS: Volatile organic compounds such as benzene, toluene, xylene, trichloroethylene, dichloromethane, and trichloroethylene are common soil pollutants in industrialized and commercialized areas. One of the more common sources of these contaminants is leaking underground storage tanks. Improperly discarded solvents and landfills, built before the introduction of current stringent regulations, are also significant sources of soil VOCs. Many of organic substances are classified as priority pollutants such as polychlorinated biphenyls (PCBs), polycyclic aromatic, acetaldehyde, formaldehyde, 1,3-butadiene,1,2-dichloroethane,dichloromethane, hexachlorobenzene (HCB), etc.,

1.2.13 HEAVY METALS: Several industries discharge heavy metals, it can be seen that of all of the heavy metals, chromium is the most widely used and discharged to the environment from different source and many of the pollutants entering aquatic ecosystems (e.g., mercury lead, pesticides, and herbicides) are very toxic to living organisms. They can lower reproductive success, prevent proper growth and development, and even cause death. However, chromium, lead and mercury. These have a tremendous affinity for sulphur and disrupt enzyme function by forming bonds with sulphur groups in enzymes. Protein carboxylic acid ($-CO_2H$) and amino ($-NH_2$) groups are also chemically bound by heavy metals. Cadmium, copper, lead and mercury ions bind to cell membranes, hindering transport processes through the cell wall. Heavy metals may also precipitate phosphate bio-compounds or catalyze their decomposition. The pollutant cadmium in water may arise from industrial discharges and mining wastes. Cadmium is widely used in metal plating. Chemically, cadmium is very similar to zinc, and these two metals frequently undergo geochemical processes together. Both metals are found in water in the +2 oxidation state. The effects of acute cadmium poisoning in humans are very serious. Among them are high blood pressure, kidney damage, destruction of testicular tissue, and destruction of red blood cells. Cadmium may replace zinc in some enzymes, thereby altering the stereo-structure of the enzyme and impairing its catalytic activity. Cadmium and zinc are common water and sediment pollutants in harbors surrounded by industrial facilities. Inorganic lead arising from a number of industrial and mining sources occurs in water in the +2 oxidation state. Lead from leaded gasoline used to be a major source of atmospheric and terrestrial lead, much of which eventually enters natural water systems.

Cyanide: Cyanide ion, CN^-, is probably the most important of the various inorganic species in wastewater. Cyanide, a deadly poisonous substance, exists in water as HCN which is a weak acid. The cyanide ion has a strong affinity for many metal ions, forming relatively less toxic ferrocyanide, Fe (CN)6 4□□,with iron(II), for example. Volatile HCN is very toxic and has been used in gas chamber executions in the United States. Cyanide is widely used in industry, especially for metal cleaning and electroplating. It is also one of the main gas and coke scrubber effluent pollutants from gas works and coke ovens. Cyanide is widely used in certain mineral processing operations.

Ammonia: Ammonia is the initial product of the decay of nitrogenous organic wastes, and its presence frequently indicates the presence of such wastes. It is a normal constituent of some sources of groundwater and is sometimes added to drinking water to remove the taste and odor of free chlorine. Since the pKa (The negative log of the acid ionization constant) of the ammonium ion. NH_4 is 9.26 most ammonia in water is present as NH_4 rather than NH_3.

SOLIDS: Solid materials in wastewater can consist of organic and/or inorganic materials and organisms. The solids must be significantly reduced by treatment or they can increase BOD when discharged to receiving waters and provide places for micro organisms to escape disinfection. They also can clog soil absorption fields in onsite systems.

Settle able solids: Certain substances, such as sand, grit, and heavier organic and inorganic materials settle out from the rest of the wastewater stream during the preliminary stages of treatment. On the bottom of settling tanks and ponds, organic material makes up a biologically active layer of sludge that aids in treatment.

Suspended solids: Materials that resist settling may remain suspended in waste-water. Suspended solids in wastewater must be treated , or they will clog soil absorption systems or reduce the effectiveness of disinfection systems.

Dissolved solids- Small particles of certain wastewater materials can dissolve like salt in water. Some dissolved materials are consumed by micro organisms in waste water, but others, such as heavy metals, are difficult to remove by conventional treatment. Excessive amounts of dissolved solids in waste water can have adverse effects on the environment.

Gases: Certain gases in waste water can cause odors, affect treatment, or are potentially dangerous. Methane gas, for example, is a byproduct of anaerobic biological treatment and is highly combustible. Special precautions need to be taken near septic tanks, manholes, treatment plants, and other areas where wastewater gases can collect. The gases hydrogen sulphide and ammonia can be toxic and pose asphyxiation hazards. Ammonia as a dissolved gas in waste water also is dangerous to fish. Both gases emit odors, which can be serious nuisance. Unless effectively contained or minimized by design and location, waste water doors can affect the mental well- bring and quality of life of residents. In some cases, odors can ever lower property values and affect the local economy. In addition to the many substances found in waste water, there are other characteristics system designers and operators use to evaluate waste water. For example, the color, odors', and turbidity of waste water gives clues about the amount and type of pollutants present and treatment necessary. The following are some other important waste water characteristics that can affect public health and the environment, as well as the design, cost, and effectiveness of treatment.

General Service effluents: These effluents may include waste water (canteens, etc) water used for heating (boiler blow down, spent resin regenerates) etc.

Intermittent effluents: These must not be forgotten, they may occur from accidental leaks of products during handling or storage, from floor wash water and from polluted water, of which storm water may also give rise to a hydraulic overload. For the correct design of an industrial effluent treatment plant, the following parameters must be carefully established (I.W.T, 1999)

- Types of production, capacities and cycles, raw materials used.
- Composition of the make-up water used by the industrial plant.
- Possibility of separating effluents and/or recycling them.
- Daily volume of effluents per type.
- Average and maximum hourly flows (duration and frequency by, type).
- Maximum pollution flow (frequency and duration) per type of waste and for the specific type of pollution coming from the industry under consideration.

Since it can seriously, disturb the working of certain parts of the treatment facilities (glues, tars, fibers', oils, sands, etc.). When a new factory is being designed, these parameters will be ascertained after analysis of the manufacturing processes and compared with data from existing factories. The amount and degree of pollution depend on the methods of manufacturing.

1.3 EFFECTS OF INDUSTRIAL EFFLUENTS

Chemical compounds present in the polluted water as well as biological pollutants such as pathogenic viruses, bacteria, protozoa and helminths that may be present in the raw municipal waste water has led to the contamination of the water body. Based on the studies done, of the major reasons for the diminishing water quality is due to industrial effluents released to the water bodies which in return cause significant effect to the marine vertebrates and invertebrates as well as to the human health. Focusing on the waste water generated by manufacturing industries and agricultural activities, these sources of waste water produces pollutants that are biologically and chemically harmful with high potential to cause disease and detrimental environmental effects. Municipal waste water comprises of relatively small concentration of suspended and dissolved organic as well as inorganic solids. Industrial processed generates natural and synthetic organic chemicals while sewage discharge contains organic substances such as carbohydrates, lignin, fats, soap, synthetic detergents and proteins. The presence of inorganic substances including a number of potentially toxic elements such as arsenic, cadmium, chromium, copper, lead, mercury, zinc, and others resulting from domestic and industrial sources may also contribute to the unfavorable defect towards the quality of the water.

Thus, the presence of these contaminants may lead to the unfortunate consequent which is the pollution of the water bodies. Water pollution is caused by point and non-point sources. Point sources include sewage treatment plants, manufacturing and agro-based industries and animal farms. Non-point sources are defined as diffused sources such as agricultural activities and surface runoffs (Environmental Quality Report, 2006). Based on the Environmental Quality Report, 2006, the cause of the river water pollution is due to untreated or partially treated sewage and discharges from agro-based and manufacturing industries. Studies show that the rivers and the man-made waterways are polluted by domestic garbage, livestock and farm waste, raw sewage, limestone quarry sludge, untreated chemical and organic wastes from oil, rubber and wood based industries. The industries that have contributed to the pollution of the vast volume of water bodies include textile industries, food industries, metallurgical industries, pulp and paper industries, paint industries, agricultural activities and many more. High concentration of metallic effluents such as Mercury, cadmium, Zinc, Iron, Manganese and other generating from the untreated effluents accumulated in the food chain and hence affect the human health when the food is consumed. This contaminant then interfaces with the enzyme activity and the formation of red blood cells that may cause harmful effect in humans.

1.4TESTING AND MEASUREMENT OF WASTEWATER

System operators, designers, and regulatory agencies use tests to evaluate the strength of waste water and the amount of treatment required, the quality of effluent at different stages of treatment, and the quality of receiving waters at the point of discharge. Tests also determine whether treatment is in compliance with state, local, and federal regulations. In small communities, operators and health officials often are trained to collect samples and perform some or all waste water tests themselves. An option that sometimes is more economical for small systems is to send samples away to a lab for testing. The following are a few important tests are Biochemical Oxygen Demand, Total Suspended Solids, Total Coliforms And Fecal Colifor.

1.5 OBJECTIVES

The main objective of treating water intended for public water supplies is to produce a supply of water that is chemically and bacteriologically safe for human consumption. The treatment process includes pre-treatment, aeration, coagulation, flocculation, sedimentation, filtration, fluoridation, conditioning, and disinfection. In our project we undergo supply of air using gas stripping. Aeration brings water and air in close contact in order to remove dissolved gases (such as carbon dioxide). It oxidizes dissolved metals such as iron, hydrogen sulphide, and volatile organic chemicals(VOCs). Aeration is often the first major process at that treatment plant. During aeration, constituents are removed or modified before they can interfere with the treatment processes. All aerators are designed to create a greater amount of contact between air and water to enhance the transfer of gases and increase oxidation. This makes the impure source of water in greater rate of purity approximately 60 to 70%. The aeration processes is carried out through various types of aerators.

- Waste water treatment is generally to allow wastewater and effluent to be disposed of without danger to human health and unacceptable to the natural environment.
- To calculate the parameter level in the waste water using the bubble aeration process.
- To evaluate the characteristics of domestic waste water.

2.LITERATURE REVIEW

Ju-Chang Huang and Chii Shang Henry's law constant is a primary indicator of a compound potential for removal by gas stripping. This method therefore offers significant advantages in efficiency and overall cost when used for the removal of volatile organic compounds from portable or wastewater streams.

Mark H Mobley (1997) The line diffusers are installed from the surface and can be retrieved if necessary for maintenance without the use of divers. Reservoir aeration diffusers can be supplied with either air from compressors or oxygen from liquid oxygen storage tank or pressure swing adsorption facility. The process spent a total of about $600000 to $900000 in annual oxygen costs to operate these six systems.

Diego rosso, and Michael k Stenstrom(2006) Fine pore diffusers have become the most common aeration technology in wastewater treatment in developed countries. They have higher efficiencies per unit energy consumed and are usually installed in full floor configurations which enhance their operating efficiency. Fine bubble diffusers have greater mass transfer depression than coarse bubble or surface aerators. Describe the variability measured at small scale due to uncontrolled energy density.

Claude E. boyd and Douglas j. Martinson (1984) Small aerators are widely used in fisheries to improve dissolved oxygen concentrations and to affect water circulations in fish holding tanks and in ponds. Manufactures usually provide data on the oxygen transfer rates of their aerators. However, each manufacturer can develop standard tests which will yield the most favorable results for that particular type of aerators. For example, because of the longer contact time between air bubbles and water, diffused – air aeration systems can be shown to operate much more efficiently in deep water than in shallow water. Hence, standardized tests for diffused air systems are often conducted in deep basins.

Marius- Daniel Roman (2015) The two most common types of aeration systems are diffused aerators and surface aerators. While each is highly effective each has certain advantages and disadvantages that make them the appropriate choice based on their characteristics. The main functions of the aeration systems are summarized. In essence it is to provide sufficient oxygen in order to satisfy the respiratory demand of the microbial biomass and to maintain this biomass in suspension. Aeration and mixing in the aeration tank is normally achieved by causing either mechanical aeration that is using surface aerators by using either mechanical aeration, that is using surface aerators with either a vertical or horizontal shaft or by air diffusion.

Semyon P. Levitsky (2005) A device for water saturation by gas using enhanced air- water interaction is studied experimentally. The flow of gas and water in the device is organized in a away providing efficiency gas dispersion into fine bubbles at relatively low gas and liquid supply pressures. It permits water oxygenation to be improved and the aeration expenses to be reduced as compared with existing aerators. The setup for experimental study of the device and the measurement procedure are described.

Jencynadayil (2015) Aeration is the process by which the area of contact between water and air is increased either by natural methods or by mechanically devices. In other words it is the method of increasing the oxygen saturation of the water. Aeration is one of the most techniques frequently employed in the improvement of the physical and chemical characteristics of water. The scrubbing action physically removes gases from solution in the water, allowing them to escape into the surrounding air. Carbon dioxide and hydrogen sulphide can be removed by scrubbing action. It will also remove taste and odors from water if the problem is caused by relatively volatile gases and organic compounds. Oxidation is the addition of oxygen which can help in the removal of certain gases and minerals like iron and manganese from water.

3.2 GAS STRIPPING:

Gas stripping involves the mass transfer of gas from the liquid phase to the gas phase. The transfer is accomplished by contacting the liquid containing the gas that is to be stripped with a gas that does not contain the gas initially.

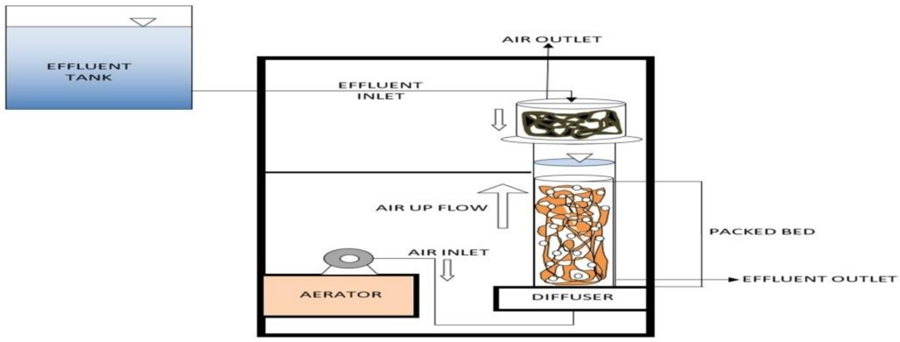


Fig.1.Gas stripping

Gas stripping is a process by which a liquid, usually water or wastewater, is brought into intimate contact with a gas, usually air, so that some undesirable. Substances present in the liquid phase can be released and carried away by the gas. The major objectives of wastewater treatment were the removal of SS (suspended solids), BOD (biochemical oxygen demand), and coliform bacteria. It is only very recently that the removal of inorganic nutrients, such as nitrogen and phosphorus, has been brought into focus. This is because it has been realized that the discharge of these nutrients into surface waters can result in excessive growths of algae and other aquatic plants, a phenomenon commonly referred to as "eutrophication."Municipal wastewater and many industrial wastes are among the principal contributors of these nutrients to surface waters. For example, the average concentrations of nitrogen and phosphorus in typical domestic wastewater are, respectively, about 35-45 mg/L as N and 10-15 mg/L as P. Yet, nutrient concentration of as low as 0.3-0.5 mg/L of nitrogen and 0.01-0.05 mg/L of phosphorus have been reported to cause eutrophication. Therefore, to eliminate this problem, a high efficiency of nutrient removal in the waste treatment process must be achieved. The removal of substances having reasonable equilibrium vapor pressures at ambient temperatures, including ammonia, carbon dioxide, hydrogen sulfide, and many VOCs (volatile organic compounds), by any of the processes known as gas stripping has proven to be efficient and cost effective.

3.3 METHODS USED TO CONTACT PHASE:

In practice two methods are used to achieve contact between phases so that mass transfer can occur: (1) continuous contact and (2) stages contact. Three flow patterns are used in practice: (1) concurrent, (2) concurrent and (3) cross flow. In addition the contact medium may be fixed or mobile. The most common flow pattern in mass transfer operations is the countercurrent mode.

3.4 MASS BALANCE ANALYSIS:

A steady state material balance used for the removal of a dissolved gas from wastewater is given by

Mole of solute Mole of soluteMole of solute Mole of solute
Entering in a + entering in a =leavingin+leavingin
Liquid state gas state liquid state gas state

3.5PACKING MATERIAL:

The function of packing material in a gas stripping is to provide a large wetted surface area for the mass transfer of contaminants to the gas phase, or ambient air. Several shapes and sizes are available, such as rings, saddles, and spheres. The packing material used in this process is fiber spherical balls. When selecting a packing material, several factors must be balanced. It offers a large surface area for the mass transfer will usually present more resistance to concurrent air flow, causing a higher gas pressure drop. Different materials offer better resistance to Corrosivity, encrustation, or unfavorable water conditions.

3.7DESIGN:

Design of gas stripping for the removal of contaminants.

1. Liquid loading rate = 700 mg/L
2. Size of fiber spherical ball = 50mm
3. Stripping factor = 3
4. Henry's constant 30 degree c= 3×0.75=2.25
5. Pressure drop = 200(N/m^2)/m

$S=\frac{G}{L}\times\frac{H}{P}$

G= moles of incoming gas/unit time
L=moles of incoming liquid/unit time
H=Henry's law constant
P= Total pressure

$S=\frac{G}{L}\times\frac{2.25}{1}$

$3=\frac{G}{L}\times\frac{2.25}{1}$

3L=2.25G

L/G=0.75

x- axis

$x=\frac{L'}{G'}\ \left(\frac{}{\rho L-\rho G}\right)^{1/2}$

$x = \frac{L'}{G'} \left(\frac{\rho G}{\rho L}\right)^{1/2}$

$= 0.75 \left(\frac{1.204}{998.2}\right)^{1/2}$

=0.0347

0.0347 @ pressure drop 200(N/m^2)/m ordinate value is 0.04

$G' = \left[\frac{((\text{Value of y axis})(\rho G)(\rho L - \rho G))}{(Cf)(\mu l)0.1}\right]^{1/2}$

$G' = \left[\frac{((0.04)(1.204)(998.2 - 1.204))}{(25)(0.001)0.1}\right]^{1/2}$

G’ =1.957 kg/m^2s

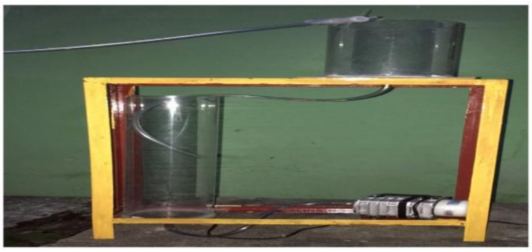
L’= 0.75×G’=1.46 kg/m^2s

Substitute known values and solve for the diameter of the tower.

$D = \left[\frac{((4/\pi)(\text{rate 0f flow})(\rho L) \times (1\ \text{Day}))}{4.8}\right]^{1/2}$

$D = \left[\frac{((4/\pi)(700)(998.2) \times (1/86400))}{4.8}\right]^{1/2}$

D= 1.46m



GAS STRIPPING REACTOR

4. OBSERVATION AND TABULATION:

Parameter	Zeroth day	Tenth day	Twenth day
pH	6.2	8.1	8.1
BOD	2583	66	2.1
COD	4857	275	8.0
Chloride	323	199	499
Phosphorous	60	9.0	8.9
TDS	2220	703	1260
TSS	1954	42	8.0
Oil and grease	2069	57	<4
Nitrogen	24	4.2	4.5

5.PROGRAM OF WORK

The program of work carried out during the phase I and work to be carried out the phase II are given below.

- Framing of the objective
- Review of literature
- Materials and methodology

6.CONCLUSION

- Collection of domestic wastewater in large scale
- Continuous treatment of domestic wastewater for a time period of 60 days
- Intermediate parameter testing
- Solving the problem faced due to continuous run if any.
- Final test result and implementation of any other process needed.

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