THE CONCEPT OF TOFU WASTE TREATMENT SYSTEM USING AEROBIC METHOD (ANALYSIS STUDY IN ACEH BESAR DISTRICT)

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ABSTRACT

Along with increasing human needs, comes the factory or industry as a raw material processing.In a very large amount of production each day will produce results remnants of unused processing.Human as actor of consumption would also "pull out" wastes as a result of the use of goods production.This waste is called household waste.To that required precise handling in the processing of industrial wastes and household waste.In general, liquid waste dumped into the soil, rivers, lakes and seas.Wastewater treatment technologies is key in preserving the environment.To choose the right technology, one must know the general idea of the methods of the existing waste water treatment, whether on the working principles on the application of these methods, advantages and disadvantages, and also the cost factor.thereuloh village a Tofu industrial district located in Aceh Besar, that most of its production is sold in Banda Aceh and Aceh Besar.But things are forgotten where almost all the Tofu industry yet have sewage treatment systems.Currently the waste discharged into the river and a small portion is used for animal feed.Planning proper waste management system is to use the aerobic method, considering the processing system is fairly easy and very simple with good quality of processed products in order to use the concept of Tofu waste treatment using aerobic, is quite simple and very easy maintenance.

Keyword: industrial, sewage, know, aerobic

I. INTRODUCTION

1.1 Background

Along with increasing human needs, there are created gratification or fulfillment of human needs which leads to industrial plants as raw material processing and processed in such a way into semi-finished goods and finished goods, to then be consumed by the public.In a large number of production each day will produce large number of remnants as well. Then, society as agents of consumption would "pull out" wastes as a result of the use of the production processes.This waste is called household waste.Event though a little more "secure" than industrial waste, it is not mean it can carelessly throw away; because even small number of waste can give a great contribution in terms of destruction of the environment.Therefore, it is necessary for the proper handling of wastes in the processing

industry and household waste. Effluent or wastewater is water that is not used anymore, which is a result of human activities everyday.By increasing the population with all its activities, the amount of waste water is also increasing.In general, liquid waste dumped into the soil, rivers, lakes and seas.

Wastewater treatment technologies is key in preserving the environment.Whatever kinds of domestic or industry waste water treatment technology it must be designed to be operated and maintained by the local community.So the processing technology should correspond with the technological capabilities of the community. To choose the right technology, one must know the general idea of the methods of the existing waste water treatment, whether on the working principles on the application of these methods, advantages and losses, and also the cost factor.It is important in the concept of industrial waste water treatment is an attempt to prevent or suppress the pollution to a minimum, namely through the control of the production process itself.Only in the next stage is the wastewater generated in order not to pollute water bodies (rivers, ditches, etc.) or in other words, it will fulfilthe specified quality standards.

Thereuloh village is one of village in sub districtinginjayaAceh Besar, where most people have a domestic industry of fried coconut, crackers from cow skin and tofu or tempeindustry.Especially for the tofu and tempeindustry this village is a well-known industry center in Aceh Besar; most of its production is sold in Banda Aceh and Aceh Besar.However, almost all the tofu industry does not have sewage treatment systems.Currently the waste discharged into the river and a small portion is used for animal feed.

Tofu is a traditional food in Indonesia, which is favored by almost all levels of society.It is containing good nutrition and tofu is also relatively inexpensive and simple.It tastes good and the price is affordable by the whole society.Currently, tofu industry in Indonesia is still done with a simple technology, so that the level of efficient use of resources (water and raw materials) still low and the level of waste production is also relatively high.Industrial activities in Indonesia is dominated by small-scale businesses with limited capital.In terms of location, the business is also very spread all over Indonesia.Human resources involved in the general level of education is relatively low, and many do not waste treatment.Therefore, this study tried to do the treatment of wastewater from tofu production by using a rapid sand filter.

1.2. Formulation of the problem

Not many tofu industries pay attention to the system of processing liquid waste, so the liquid waste directly piped into water bodies without treatment, therefore this paper would like to see opportunities using waste treatment systems out using aerobic.

1.3. Objectives

1. To know the exact processing system and can be applied to tofu industry in reuloh village.
2. To be able to inform the public that have tofu industry to use the concept of waste treatment out using aerobic methods.

II. REVIEW OF THEORY

2.1. Water

Water is a natural resource which circulate under the influence of the weather so there is something a cycle called "Cycle Hydrology" This cycle is important because it supply the land area water.The water will evaporate due to the heat of the sun.This evaporation occurs in surface water, which is in the upper soil layers (transpiration, respiration).Water vapor enter the atmosphere and would form the cloud and in certain weather conditions can be cooled and transformed into droplets and falls back to the earth's surface as rain.This rain water will flow directly into surface water (run off), seep into the soil (percolation) and becomes both shallow and deep groundwater and some are absorbed by plants.Ground water will arise as surface water from the spring. Water surface together with shallow ground water and water body will evaporate again to be a cloud.So this hydrological cycle will be repeated *(Darmono, 2001).*

2.2. Waste

In general, the so-called waste is residue resulting from an activity and the production process, both at household, industry, mining, etc.The presence of waste at a specific time and place is undesirable because it has no economic value. Therefore, the public is less concerned with the coming of waste.There is a study that suggests that the location of the septic tank, *cubluk* (pond), and landfills adjacent to ground water resources, will lead to decreased water quality.Of the 636 samples, 285 samples of point groundwater source have been contaminated with bacteria *Coli*.Chemically, 75% of these sources do not meet the quality standards of drinking water parameters assessed from the elements nitrates, nitrites, iron, and manganese. *(Source: waste management industry - Prof. TjandraSetiadi, Wikipedia)*

2.3. Wastewater treatment

Wastewater before it is released to final disposal must undergo processing beforehand.In order to implement an effective waste water treatment,it is required good management plan.Wastewater management can be done naturally or with the help of the equipment.Natural wastewater treatment is usually done with the help of stabilization ponds while the water treatment with the help of tools such as done in the Installation of Waste Water Treatment Plant / WWTP.

Wastewater treatment aims to prevent pollution at the water sources, protect animals and plants that live in water, to avoid soil contamination and eliminate breeding sites and disease vectors.While the requirements ofWastewater Management Systems are not causing the contamination of sources of drinking water, do not cause contamination of surface water, do not cause pollution on the flora and fauna that live in the water, not plagued by the vector or insect which causes illness, do not opened and must be closed, does not cause foul odor or scent.

Methods of Waste Water Management.
There are several methods that can be used to manage wastewater, including:

a. Dilution (disposal by dilution).
   Waste water discharged into rivers, lakes or sea to dilute by the water body.In this way the wastewater will undergo natural purification.However, this way can contaminate the surface water with pathogenic bacteria, larvae and eggs worm, and other germs that are in the waste water.If this is the only way that can be applied, then the requirements have to be met: a river or lake water should not be used for other purposes.The volume of water sufficient to dilution lasts less than 30-40 kali.The water must contain enough oxygen.In other words, the water must flow (not to be stagnant) so as not causing smell.

b. Cesspool
   Cesspool shape resembles the well but is used for disposal of waste water.Created in the sandy soil so that the waste water easily seeps into the soil.The top should be cemented to be impermeable to water.If cesspool already full (± 60 months), the mud inside can be sucked out of the cesspool or it can be created originally in series, so that when one is full, water will flow into the next cesspool.Distance cesspool from clean water wells is at least 45 meters and at least 6 meters away from the house foundation.

c. Infiltration wells (seepage pit)
   Infiltration wells isa well to accommodate the wastewater that has undergone treatment in another system, for example, from aqua privy or septic tank.In this way, the water just stayed in infiltrate into the soil.This infiltration wells made in the sandy soil, with a diameter of 1-2.5 meters and a depth of 2.5 meters.It can until 6-10 years.

d. Septic tank
   Septic tanks, according to WHO, is the best method to manage wastewater although it is expensive, complicated and require extensive land.Septic tank has four parts, among others:

   a. Space decay
      In this room, the dirty water will be detained for 13 days and will undergo decomposition by spoilage bacteria will produce gas, liquid and sludge.Gas and liquids will be entered into the dosing chamber through the pipe.Mud will go into a mud room.

   b. Mud room.
      Mud room is a reservoir of mud.When the chamber is full, the mud can be pumped out.

   c. Dosing chamber.
      In the dosing chamber there is a McDonald siphon that serves to regulate the speed of the water to be supplied to the filtrate field.

d. Filtrate field.
This field will absorb the fluid out of the dosing chamber and filter out pathogenic bacteria and other germs.This filtrate field a minimum length of 10 meters and is made on sandy soil.

e. System Riool (sewage).
System riool accommodate all the dirty water from homes and companies, and sometimes pollutant from the environment.If used to collect rain water riool system is called a combined system; whereas if the rain water tank is separated then called a separated system.In order not to harm the interests of another, dirty water flowed to the other end of town, for example to the area of animal husbandry, agriculture, fisheries or land.Dirty water that still need processing.

The processing is carried out, among others:

a. Screening (screening)
Screening is intended to capture objects that float above the water surface.

b. Sedimentation
In this process, the waste water flowed into a large tub (sand trap) so that the flow becomes slow and the mud and the sand settles.

c. Biological process
This process uses microbes to destroy organic substances in the waste both aerobic and anaerobic.

d. Filtered by sand filter (sand filter).

e. Disinfection
disinfection with chlorine (10kg / 1 million wastewater) to kill pathogens.

f. Lastly dilution
the waste water discharged into rivers, lakes or the ocean so diluted.All of the wastewater treatment process is done in a special installation that was built at the threshold of the city.

2.4. Tofu waste

Tofu wastewater is a source of environmental pollution.Generated pollution load caused serious damage, especially to the waters around the tofu industry.Given the origin of the waste water coming from the different processes, the different characteristics also vary.For waste water originating from washing and soaking the polluting value is not so high that they can be discharged into waterways.As for the waste water coming from the cooking process the polluting value is quite high, thus should be treated before it is discharged into the

water.In general, this tofu wastewater directly discharged into the river through the channels.When the river water is flowing rapidlyand unblocked the dilution pollution (the carrying capacity of the environment is still good) then the waste water does not pose a problem.But if the environmental carrying capacity has been exceeded, the waste water contains a lot of organic ingredients will undergo a process of decomposition by microorganisms can contaminate the environment.Parameter tofu wastewater that usually measured include temperature, pH, suspended solids (TSS) and the need for oxygen (BOD and COD).Temperature is usually measured by using a mercury thermometer with Celsius scale.The pH value of the water is used to express the condition of acid (hydrogen ion concentration) of waste water.The pH scale ranges from 1-14;pH value range 1 to 7 including acidic conditions, pH 7-14 including alkaline conditions and pH 7 is neutral (Kaswinarni,F, 2007).

Most sources of wastewater generated by industrial tofu manufacturing is separate from the viscous liquid blob know called whey.This fluid contains high levels of protein and can be readily biodegradable.Liquid waste is often dumped directly without first processing so as to produce foul odors and pollute rivers.Other liquid waste sources derived from soy laundering, laundering of process equipment, cooking and the solution was soaked soybeans.The amount of waste water produced by the industry out of making out roughly 15-20 l / kg of raw material soybeans, while the pollution load of approximately 30 kg Total Suspended Solids (TSS) / kg of raw material soybeans, Biological Oxygen Demand (BOD) 65 g / kg of raw material soybeans and Chemical Oxygen Demand (COD) 130 g / kg of raw material soybeans.(Elly YS, 2006).

2.5 Aerob Method

In tofu wastewater treatment aerobic biological process is an advanced process to degrade the organic matter content that remaining after the anaerobic process.Aerobic treatment system is used for the prevention of the onset of the odor problem during waste handling, in order to meet the requirements for effluent and waste stabilization before being discharged into the body of water (Kaswinarni,F, 2007). Aerobic waste treatment process means the process by which oxygen is dissolved.Oxidation of organic materials using molecular oxygen as a final electron acceptor is the primary process that produces chemical energy for microorganisms in this process.Microbes that use oxygen as a final electron acceptor is aerobic microorganisms (Kaswinarni,F, 2007).Aerobic wastewater treatment system that is widely used among other things to the activated sludge system, biology plates spinning (Rotating Biological Contractor = RBC) and ditch oxidation.

2.5. Anaerobic Method

The anaerobic process is essentially a process that occurs due to microbial activity is carried out when there is no oxygen.Anaerobic process can be used to treat various types of biodegradable waste, including waste food industry one of which is the waste out.The anaerobic biological process is a tofu wastewater treatment system that is widely used. Concerning the system is easy to set, cheap and provide good results.The anaerobic

biological process is one of the wastewater treatment system by using microorganisms that work in anaerobic condition.Collection of microorganisms, usually bacteria, involved in the transformation of complex organic compounds into methane.The rest are synergistic interactions between variousgroup of bacteria that play a role in breaking down waste.Group non-methanogen bacteria responsible for the hydrolysis and fermentation consist of facultative and obligate anaerobic bacteria.Microorganisms isolated from anaerobic digesters is *Clostridium* spp., *Peptococcusanaerobus* ,*Bifidobacterium* spp., *Desulphovibrio* spp., *Corynebacterium* spp., *Lactobacillus* , *Actonomyces* , *Staphylococcus*,and *Escherichia coli* (Kaswinarni,F, 2007).

There are three basic stages are included in the overall process of anaerobic oxidation of waste processing, namely: hydrolysis, fermentation (also known as asidogenesis), and methanogens (Kaswinarni,F, 2007).During hydrolysis, fermentative bacteria transform organic material insoluble complexes, such as cellulose into molecules soluble, such as fatty acids, amino acids and sugars.Complex polymer material is hydrolyzed into monomers, for example: cellulose into sugar or alcohol.Monomer molecules can be directly utilized by subsequent bacterial group.Hydrolysis of complex molecules catalyzed by extra cellular enzyme such as cellulose, protease, and lipase.Nevertheless, anaerobic digestion process is very slow and limited in breaking down waste cellulolytic containing lignin.In the fermentation process (asidogenesis), bacteria asidogenic (acid-forming) transforms sugars, amino acids, and fatty acids into organic acids (acetic acid, propionate, butyrate, lactate, format) alcohols and ketones (ethanol, methanol, glycerol andacetone), acetate, CO2and H_2.

The main product of the fermentation process is acetate.Resultof fermentation varies depending on the type of bacteria and the culture conditions such as pH andtemperature.Methanogens process carried out by a group of microorganisms known as methanogens bacteria.There are two groups of methanogen bacteria are involved in the process of methane production.The first group, *aceticlastic methanogens*, acetic split into methane and carbon dioxide.The second group, hydrogen-utilizing methanogens, which use hydrogen as an electron donor and CO2as an electron acceptor to produce methane.Bacteria in an anaerobic process, i.e. bacteria *acetogens*,also capable of using CO2to oxidize and form acetic acid.Where acetic acid is converted to methane.About 72% of the methane produced in anaerobic digesters is the formation of acetate.Factors that affect the process of anaerobic (Monnet, 2003), that is:

Temperature, anaerobic process can occur under two conditions of temperature range, i.e. mesopilik condition, which is between 20-45°C, generally 35°C and thermopilik condition, which is between 50-65°C, generally 55oC.The optimal temperature of the anaerobic process varies depending on the composition of nutrients in the digester, but most anaerobic process should be maintained constantly to support the level of gas production.Thermophilic digester is more efficient in terms of time of stay, the level of capacity, and the amount of gas production, but in others it requires a higher heat input and has a high sensitivity that makes the process more problematic than mesopilik digestion.

Time Live. The residence time is the time required to achieve the perfect degradation of organic matter**.** The residence time varies with process parameters, such as temperature and composition of the waste processing.The residence time for the waste that is treated in a digester mesopilic inrange of 15-30 days and 12-14 days for thermophilic digester.

pH. The pH optimum for the process asidogenesis and methanogenesisare different.During asidogenesis formed acetic, lactic and propionic acid, thus the pH drops.Low pH may inhibit the process asidogenesis and pH value below 6.4 can be toxic for the methane forming bacteria (optimum pH for methanogenesis process is between 6.6 to 7).The optimal pH range for all that is between 6.4 to 7.2.

The ratio of carbon and nitrogen (C: N).The relationship between the amount of carbon and nitrogen present in organic matter defined by the ratio of C: N. C: N ratio in the process of anaerobic between 20: 30. The ratio of C: N are high indicates that the rapid consumption of nitrogen by methanogen bacteria and produce lower gas production.In addition to the C: N ratio is low causing the accumulation of ammonia and pH values exceeding 8.5, and this is toxic to methanogenbacteria.

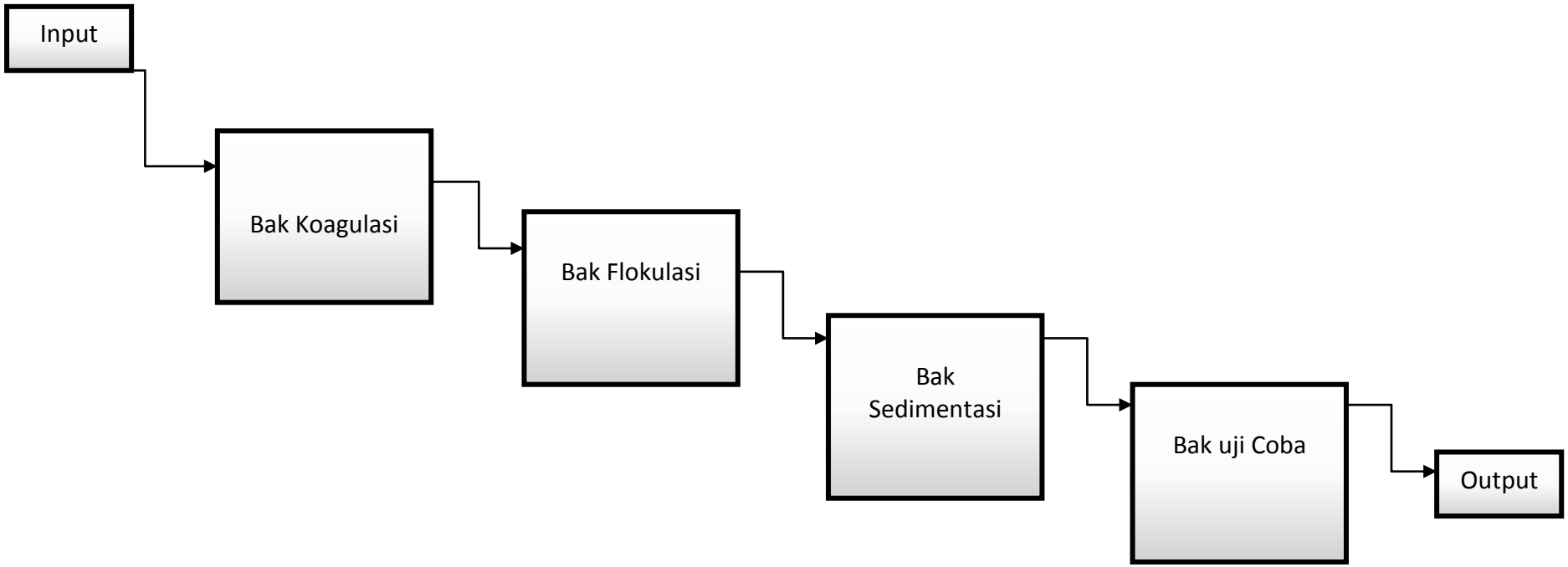
Mixing, mixing in the digester, improving contact between microorganisms with substrates and enhance the ability of the bacterial population to obtain nutrients.Mixing also establish a temperature gradient within the digester.Mixing overload can damage the microorganisms and therefore slow mixing is preferred.

III. DISCUSSION

The field observations is showed that the tofu industry that located in reuloh villageof inginjayasubdistrict, acehbesar district has not had a proper sewage treatment systems, and today most sewage flowed into the river.This will have an impact on the environment, especially the water pollution of the river.

The results obtained from the above description that the planning of appropriate waste management system is to use the aerobic method, considering the processing system is fairly easy and very simple with very good quality of processed products.The concept of a wastewater treatment system that can be used for tofu industrtyat reulohvillage ofinginjayasubdistrict, acehbesar district are as follows;

Schematic Processing Waste To Know In Aerob in GampongReuloh District Ingin JayaAceh Besar District Method Using Aerob



The explanation of each section are as follows:

A. Input

Input is wastewater tofu that will be processed first before piped into water bodies.

B. Bak Coagulation

Bak is intended for rapid stirring and affixing the chemical Alum (Aluminum Sulfate) as a coagulant, which can be mixed evenly affixed.Rapid stirring system doby gravity, and design criteria that influence the velocity gradient (G) and residence time (td).

C. Bak Flocculation

Bak is different from the coagulation bath, jetted tubs are slow stirring which is to form the floc-floc of suspended particles.Design criteria that influence the velocity gradient (G) and residence time (td).Stirring system also with gravity, and buildings used usual with systems baffle (baffle) and helicoidal flow.In the flocculation basin is this which is the process of rapid stirring process dissolved oxygen in the waste water out, so that it will form a floc-floc large.

D. Bak Sedimentation

Bak to mengenadapkanfloc-floc growing and flow in this unit should occur laminar flow so that floc-floc formed is not broken anymore.So at this tub-flocfloc will settle by gravity.

E. Bak test Try

The tub is a tub trial meant that serves to control the results of waste water which had precipitated out of the sedimentation basin.Where the test equipment used on the vessel's trial is in biological Like :

1 Water hyacinth
2 Tilapia fish
3 Goldfish

in addition to the testbiological wastewater tofu at this tub can also be taken by the laboratory.If the tub is still not meet quality standards, the water from the tub, these trials can Recikel bath to the coagulation bath and do the processing bath.

F. Output

Output is wastewater tofu who has met the requirements of waste water quality standard that has been able discharged into the river.

IV. CONCLUTION

1 Wastewater treatment system planned out quite simple and can be done or essy to maintain.Only in the making must be considered within the manufacture of insulation in the flocculation basin is aimed at more in the formation of floc-floc enlarged.

2 The volume of sludgein the sedimentation basin must be considered aims for efficiency decreased levelsCOD in waste water out

3 The residence time in the sedimentation basin and tub, trials must be considered the longer it stayed the greater reduction of COD.

4.1. Suggestion

Ongoing research needs of each variation of the residence time in each bath tub especially on flocculation, sedimentation tanks, tubs or trial, before the processed wastewater know piped into water bodies.

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