Waste Management in Fishery Industry: A Review

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***Abstract*—This project present fish waste management processors with an introduction to the concepts of fisheries waste characterization and the various types of treatment utilized in order to minimize improper waste disposal in environment. This topic includes various characteristics of fish waste, separate treatment of liquid fish waste and solid waste using chemicals and Indore composting method and proper disposal.After carrying out and performing the above mentioned processes on fish waste, results will be analysed and compared with required standard results.Depending upon the acquired results, the treated liquid waste will be disposed in water body and solid fish waste (compost) can be used as fertilizer.Economy of above processes is one of the major considerations before treating the fish waste.**

Keywords—Fish, fishery, waste, waste management, industrial waste, chemicals, compost.

I. INTRODUCTION

Fish waste management has been one of the problems having the greatest impact on the environment. Fish farming detrimental effects on the marine environment in particular have become an issue of public concern.

The fish processing schemes in terms of raw material, source of utility and unit processes vary between plants. Most of the processing industries, fish processing operations produce waste such as solid waste and liquid waste. This waste contains organic contaminants in soluble, colloidal and particulate form. In fishery waste water the contamination present are undefined mixtures of mostly organic substances.

II. CHARACTERIZATION OF WASTE

The volume and concentration of waste from fish processing depends mainly on the raw fish composition, additive used, processing water source and the unit process.

A. **Solid waste***:*

Solid fish waste is generated from the unwanted parts of fish including heads, tails, frames, offal and skin.

The decomposed fish which dies during fishing combines for solid waste in fishery industry.

The rejected fish during the processing or stale fish also forms the solid waste.

B. Liquid waste

a. Solids content: Suspended solids may affect the aquatic life by reducing the amount of light passing through the water.
b. Ph: Effluent: ph from fish processing plants is usually close to neutral. The results of average ph range from 5.7-7.4 with an average ph of 6.48
c. Nitrogen and phosphorous: excess quantity of nitrogen and phosphorous may cause proliferation of algae and affect aquatic life in a water body. For biological treatment, a ratio of N: P of 5:1 is recommended for proper growth of the biomass.

III. LITERATURE REVIEW

The idea behind this project is basically from various research paper related to environment, fishery industries, waste management etc. which where combined to execute this project.

Physicochemical process for fish processing wastewater treatment [1].. Fish canning industry waste water treatment for water use [2]. Biological treatment processes for fish processing waste water-a review [3]. Efficiency of different coagulants combination for the treatment of tannery effluents: A case study of Bangladesh [4] .Utilization of byproducts and waste materials from meat, poultry and fish processing industries: a review [5]. Use of food waste, fish waste and food processing waste for china's aquaculture industry: need and challenge [6]. Physicochemical characterization of oil extraction from fishing waste for bio fuel production [7] Recycling of seashell waste in concrete: a review [8]

IV. METHODOLOGY

Different methods can be used for disposing fish waste for creating a healthy and pollution free environment.

Fish waste is separated as solid waste and liquid waste.

A. Solid waste:

ADEC solid waste program allows different methods for managing commercial fish waste on land.

i. **Landfill disposal:** Commercial fish waste may be disposed in a permitted landfill willing to accept it.
ii. **Land application:** Gish waste may be ground and tilled into agriculture or silviculture land as fertilizer, provided the waste is processed and treated as prescribed in the solid waste regulation.
iii. **Composting:** Fish waste can be composed to create a usable product. Several successful composting projects have been operated in Alaska. Depending on the volume of waste involved, a composing operation may require a solid waste treatment permit or plan approval.

Different methods of composting are aerobic and anaerobic process. fish waste composting is done by aerobic process known as Indore method which is as follows:

Procedure of Indore method:

i. A layer of coarse is first put at the bottom of a pit to a depth of 5-6 cm, which is 7.5 cm deeper for 25 cm width at the pit edges. Water is poured to a thickness of 5 cm in the depressed portion.
ii. On the top of this, a second layer of refuse is spread, which sandwiches the water. This is repeated after every one week till it reaches the height of edge of the pit.
iii. About 60 cm on longitudinal side is kept vacant for turning operations
iv. The first turning is manually carried out after 4-7 days using long handled rakes and the second turning after 5-10 days.
v. Further turning is not necessary and composting will be complete in a period of 1 month.

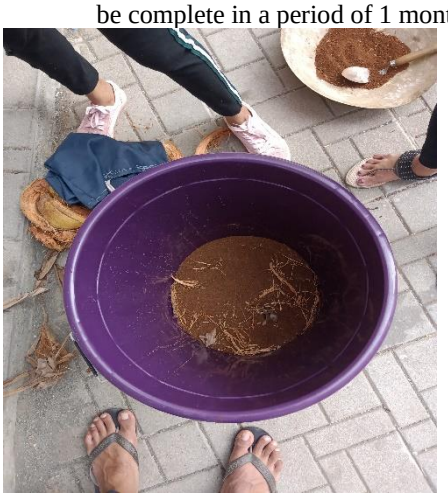

Fig.1: Compostig

B. Liquid waste:

i. Ph: The ph of the liquid determine the acidic content in the liquid. The ph value of the liquid should be between 6 to 8.5.
ii. Filtration using sand bed: sand filters, also called as fluid bed filters, promote biological filtration in the aquarium. They work by suspending sand with water pressure, allowing beneficial bacteria to colonize the sand. These bacteria break down fish wastes into less toxic compounds.
iii. Coagulation followed by filtration: coagulation-flocculation is a conventional pre-treatment method (typically in combination with sedimentation and rapid sand filtration)used to separate the suspended and dissolved compounds (turbidity) from the water in (semi-) centralized drinking water treatment plants.
iv. Aeration: Activated sludge process: The activated sludge process is a type of waste water treatment process for treating sewage or industrial waste waters using aeration and a biological floc composed bacteria and protozoa.
v. Trickling filter: A trickling filter is a type of wastewater treatment system. It consists of a fixed bed of rocks, coke, gravel, slag, polyurethane foam, sphagnum peat moss, ceramic or plastic media over which sewage or other wastewater flows downward and causes a layer of microbial slime (biofilm) to grow, covering the bed of media.
vi. Oxidation ditch: In some areas, where more land is available, sewage is treated in round or oval ditches with one or more horizontal aerators typically called brush or disc aerators which drive the mixed liquor around the ditch and provide aeration. Oxidation ditches are installed commonly as “fit & forget” technology with typical design parameters.
vii. Addition of chemicals: specialized chemicals such as chlorine, hydrogen peroxide (bleach),act as a gets that disinfect, sanitize, and assist in the purification of wastewater at treatment facilities.
viii. Jar test: jar testing is a pilot scale test of the treatment chemicals used in particular water. It stimulates the coagulation/ flocculation process in a water treatment plant and helps operators determine if they are using the right amount of treatment chemicals, and, thus, improves the performance.

Jar testing procedure is as follows:

i. For each water sample (liquid water) a number of beakers are filled with equal amount of water sample.
ii. Each beaker of the water sample is treated with a different dose of chemicals
iii. Other parameters may be altered besides dosage, including chemical types, mixing rate, aeration level/time, filtration type, etc.
iv. By comparing the final water quality achieved in each beaker, the effect of the different treatment parameters can be determined
v. Jar testing is normally carried out on several beakers at a time, with the results from the test guiding the choice of parameter amounts in the later tests.

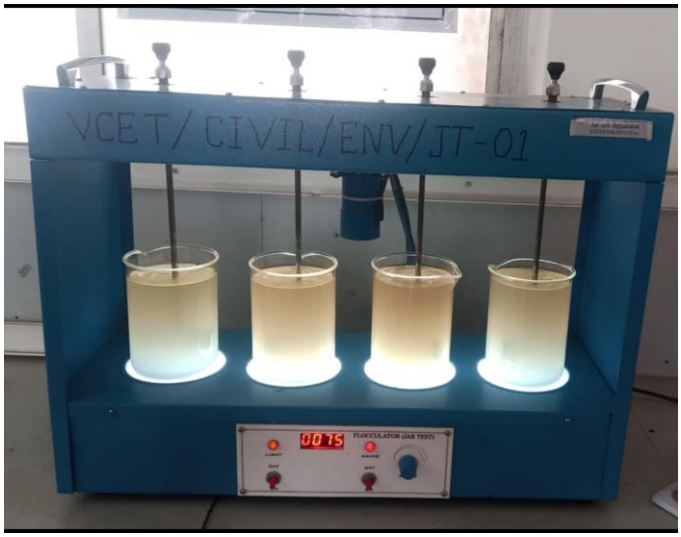

Fig.2: Jar testing

V. EXPECTED RESULTS AND DISCUSSION

The expected result from the study is to generate good quality of compost from solid waste and to determine the characteristics of waste water from fish waste .the compost should be of good quality with characteristics like:

i. Its colour should be dark brown.
ii. The moisture content should vary between 68% to 70%
iii. The ph should range between 7.2-7.8
iv. The C/N ratio shoulb be 20-30
v. The temperature should be between 43-66 degree per Celsius
vi. It should not smell like ammonia

In liquid waste treatment the first step for implementing an integrated solution is an industrial plant is to examine the possibilities to avoid and/or reduce waste at source through the application of measures good manufacturing practices etc; one of the main practices to be considered will be implementation of measures aimed at reducing water consumption. The results will be compared with the ones from literature. From literature review we can find that coagulation-flocculation method is the most suitable process to treat waste water using different dosages and different types of coagulation and flocculants.

VI. RESULTS

Liquid waste treatment results:

For Moringa Oleifera:

1.When MOSP was added to the sample and followed by rapid stirring, the resulting cationic protein from MOSP was distributed to all parts of the liquid and then interacted with the negatively charged particles that caused turbidity in water.

2.Such interactions disturb the forces that stabilize the particles so that it can bind to small particulates to form a precipitate. From it was shown that 96.70% of turbidity removal in with 60mg of Moringa oleifera.

3.The lowest turbidity value of waste water after treatment is 3.83NTU.

4. When Moringa oleifera concentration exceeded the optimum dosage, turbidity was increased because all colloids have been neutralized and precipitated with an optimum dosage, so the excess coagulants will cause turbidity in water as they did not interact with oppositely charged colloidal particles.

For Alum:

1.When Alum was added to the sample and followed by rapid stirring, the resulting alum crystals got dissolved and was distributed to all parts of the liquid and then interacted with the negatively charged particles that caused turbidity in water.

2.In case of alum, the turbidity removal was 92.60% in with 80 mg of alum.

3.The lowest turbidity value of waste water after treatment with alum was 5.0NTU.

4.As the alum dosage increases, the turbidity surely increases but over dozing of coagulant leads to charge reversal and particles start restabilising. A higher than the optimum dose of coagulant thus results in less turbidity removal.

Solid waste treatment results:

1.After two months of aerobic decomposition process, the compost was formed. The compost formed was sent to lab for various test to be conducted inn order to know whether the compost have attained desired property of compost.

2. The below characteristics have been achieved by compost as end result

CHARATERISTICS	VALUE
Temperature	55oC
pH	7.1
Odour	Did not smell like ammonia
Colour	Dark Brown
C/N ratio	25
Moisture Content	69%

VI. CONCLUSION

Fish waste stands for one of the continuously gaining ground waste management fields. An effective waste management strategy is generally comprised of 3 parts including waste minimization, waste characterization, and waste utilization. The statistical experimental design and response surface methodology were found to be efficient tools to optimize some parameters. Depending on the purpose of the treated water, it might be necessary for other integrated systems.

[a] Sample of a Table footnote. (*Table footnote*)

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