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Current Status of Fish Waste Management In Karwar City

Mr. Waseem Ahmad¹, Mr. Santosh Bhumbhar²

¹UG Mechanical Engineering Student, Girijabai Sail Institute of Technology, Karwar, Karnataka, India

²Assistant Professor, Mechanical Engineering Dept, Girijabai Sail Institute of Technology, Karwar, Karnataka, India

Abstract: Fish waste management has a major problem with environmental and disposal of fish waste, due to rapid urbanization and Fish waste is high disposal costs. Captured fisheries generate a high amount of waste. It has been evaluated that for one tonne of fish consumed, an equal volume of fish material is eliminated either as waste or as a low value by-product. The study was aimed to determining the current status of fish waste management strategies for Karwar city. In fish waste management fish waste by-product utilisation, waste fish oil was used as raw material for Biodiesel production. It has 2 stage processes; esterification and transesterification were applied to convert waste fish oil to biodiesel and also to produce biogas from fish waste.

Keywords: Fish waste, Biodiesel, Biogas, Fish waste management.

I. INTRODUCTION

The catching and processing of fish generates a large amount of waste, which includes viscera, fins, scale and bones. India only generates more than 2 metric million tonnes of waste. Due to its high organic content, fish waste is classified as certified waste which is even more costly to dispose. This practice is coming under increased the careful and detailed examination to environmental issues and becoming an increasing concern and cost burden to the whole sea food (fisheries) industry.

At present there are approx.

400 fish processing units in India with a daily capacity of 10,000 tonnes. There are around 500 pre-processing units functioning in India along with 12 Surimi plants and 5 canning units. India is one of the global leaders in fish production where fish export reached 11.5 lakhs in 2015 – 2016 of which roughly 50% i.e. 5.5 lakhs tonnes has been disposed as wastes. Fishing generates large quantities of waste daily in fish processing industries.

Disposal of wastes generated in sea food processing plants has always been a problem. Just like any other industry, the sea food industry also contributes to the production of CO₂ in all the stages of its production, starting from farming until it reaches to the retailer's. Direct disposal of these fish solid waste leads to environmental pollution barrowing to its high nutritive content. The inappropriate disposal of organic wastes (fish waste) may result in environmental problems, such as ground water and surface water pollution through the leaching of nitrates and other pollutants in the manure. These wastes could be converted into eco-friendly compost through bioconversion process.

Capture and culture fisheries generated a significant amount of waste. It has been estimated that for one ton of fish consumed, an equal volume of fish material is eliminated either as waste or as a low value by-product.

II. SURVEY ON FISH WASTE IN KARWAR CITY

According to the survey fish waste generated in the India is 2 metric million tonnes of waste per year. The second most population country in the world is India which contributes 18% to the population and 2.4% worlds land area. India has a coast line length of 8,121 km long coastline which is the world's third largest fish producing nation, the coastline of the 3 districts amount to 300 km with a continental shelf of 27000 sq. km. Further there are 8000 ha of brackish water area also in the state. The area from Bhatkal in the south to Majali in the north falls within the operational of the Karwar Research Centre of CMFRI.

Karwar is the headquarters of Uttarkannada district and also largest town in the district population. Karwar municipal council (KMC) comprises of 31 wards and it is situated on National Highway No. 17 (NH 17). Area of the Karwar city is 27.15 sq, kms and the population of the Karwar city is 155213 and this city is having around 16369 houses, and only 1 fish market which are situated at the centre of the Karwar cit. Survey conducted in month of Jan, Feb March 2019.

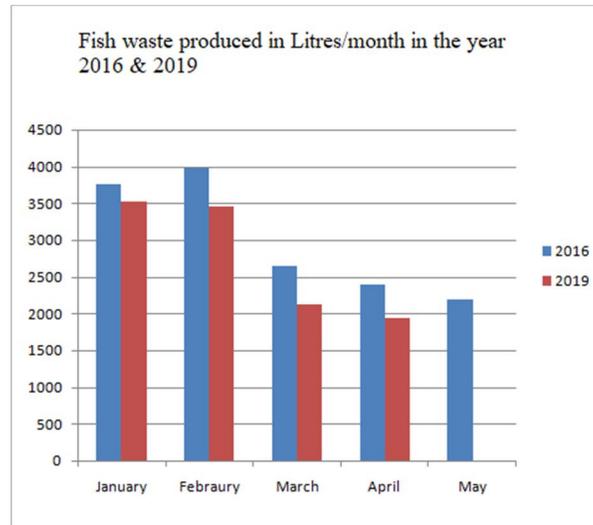


Fig-1 Fish waste generated in Karwar city per month in the year 2016

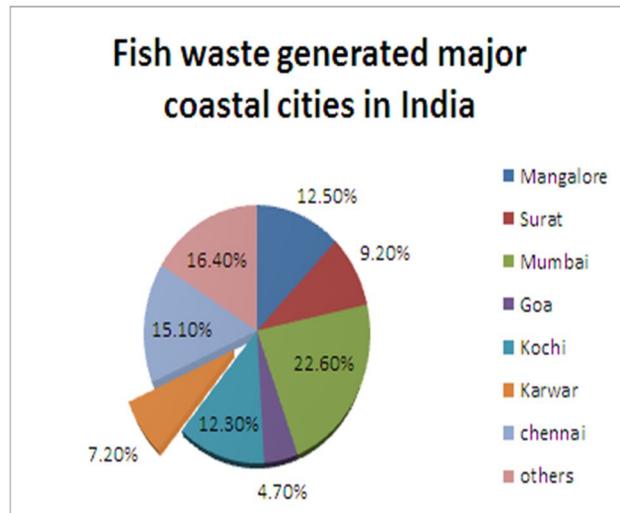


Fig-2 Fishwaste generated in the major coastal cities in India.

Table-1 Fish imported and exported approximately in Karwar city

Types of Fish	Fish Waste generated approximately in tons per year	
	Import in tons per year	Export in tons per year
Croakers	1488.8	340.52
Sardine	7602.49	1960.49
Indian Mackerel	6345.48	1820.12
Mullets	118.85	28.96
Pomfret	417.73	216.43

Issues concerning to management of fish waste generated in Karwar city.

- A. Majority of the municipal authorities do not have awareness to proven waste processing and disposal facilities for fish waste.
- B. Cities and towns, in future will not have waste lands for land filling of fish waste.
- C. Landfill is taking around 2 acres of land, this land is totally waste in future and there is no land for land filling so we should use this waste into useful purpose



Fig-3 Fish waste at the market in Karwar city



Fig-4 Fish heads waste generated in Karwar city fish market



Fig-5 Karwar main fish market, situated at the centre of the city.

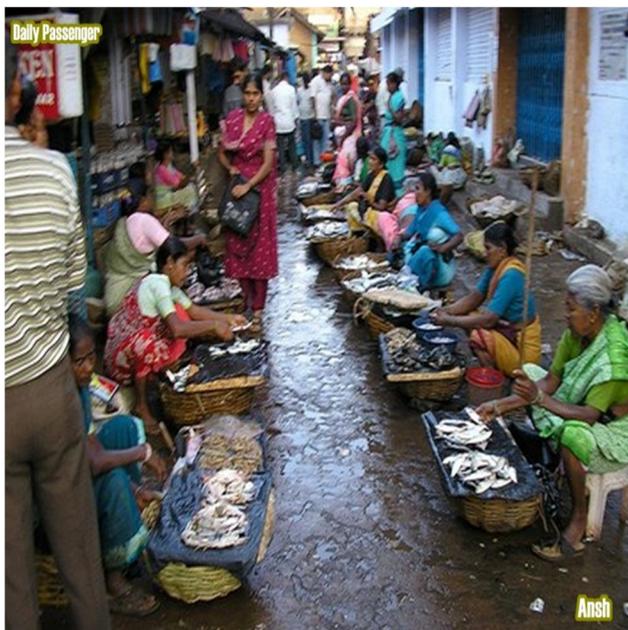


Fig-6 Small fish markets, situated in small villages near to Karwar.

There is a main fish market situated at centre of the Karwar city. There are 50 members for cutting of the fish which are consumed by humans. The waste left out is sent for land filing or given as food for the pet animals like pigs, cats, dogs etc...

III. METHODS AND METHEDODOLOGY

There are two major methods of converting fish waste generated into useful products are as follows.

- 1) *Biodiesel production from fish waste.*
- 2) *Biogas production from fish waste.*

A. Biodiesel Production Process

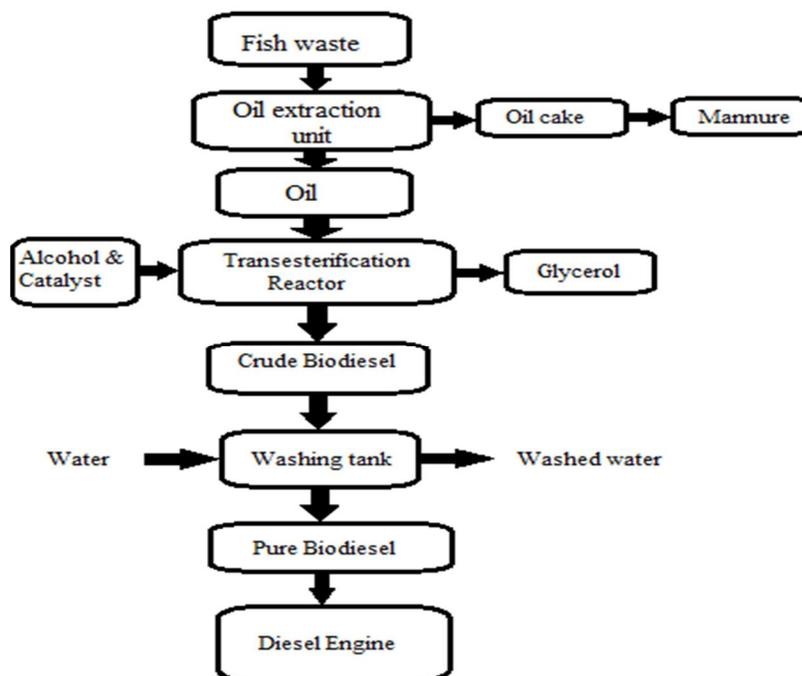


Fig-7 Flow chart of Biodiesel production from fish waste.

Firstly fish waste is sent into oil extraction unit then in the oil extraction unit the oil is removed and sent to the transesterification reactor, in the process alcohol and catalyst is supplied and then the glycerol is removed. Then the oil further removed comes in the form of crude biodiesel, then it is sent to washing tank where water is supplied to the tank and the oil is washed properly. Then the oil passing through washing tank comes out in the pure form of biodiesel, and then this pure biodiesel is used to run the diesel engine.

- 1) **Materials:** Fish waste in the form of a fish skin, gills, heart, stomach of fish and fish head is collected from the fish market. An analytical grade chemicals methanol, ethanol, H₂SO₄, NaOH were used. This reaction is produced with the help of esterification & transesterification processes.
- 2) **Preparation of Fish Oil:** A certain amount of fish may be like 3 to 5 kg fish waste in the form of a fish head, fish gills, heart, stomach of fish and fish skin is washed. Then the fish waste is added with water as solvent and it is kept to get boiled. The result of boiling fish waste in the form of the oil layer that is formed on the upper stew of the fish waste. Oil is then taken out and put into separation funnel where it gets separated from the solvent. After that the fish oil is separated with solvent, about 150-200ml oil is gained. This oil can be used as raw material for biodiesel production or stored in glass bottles.
- 3) **Biodiesel production from waste fish oil:** The first step is to reduce FFA content of the waste fish oil by the esterification process that is carried out using 1 kg waste fish oil, methanol (oil to methanol ratio 1:6) and 2% H₂SO₄ as acid catalysts. Then it is mixed, the mixture is esterified at constant temperature of 60 degree Celsius for 2 hour with stirring speed 600 rpm. The esterification process yield's the liquid product with water then it is separated in the separating funnel and the left water remaining is removed out by heating. Then, the oil is dissolved in methanol and 2% NaOH. Then the oil, NaOH and methanol mixtures are sent to transesterified process for 60 minutes at temperature 60 C and speed of stirring 600 rpm, respectively. Then the process is stopped where the liquid products are having two layers, the top layer containing the biodiesel and the bottom layer containing glycerol. Biodiesel is taken out from the reaction products using separating funnel for 1 hour. It was purified by washing with distilled water and then shaking for 5 minutes. The washing process was carried out 3 times. Then, biodiesel is dried in an oven at 90degree Celsius to remove the water content. Hence, this is how biodiesel is produced from fish waste oil by esterification and transesterification processes.

B. Biogas Production

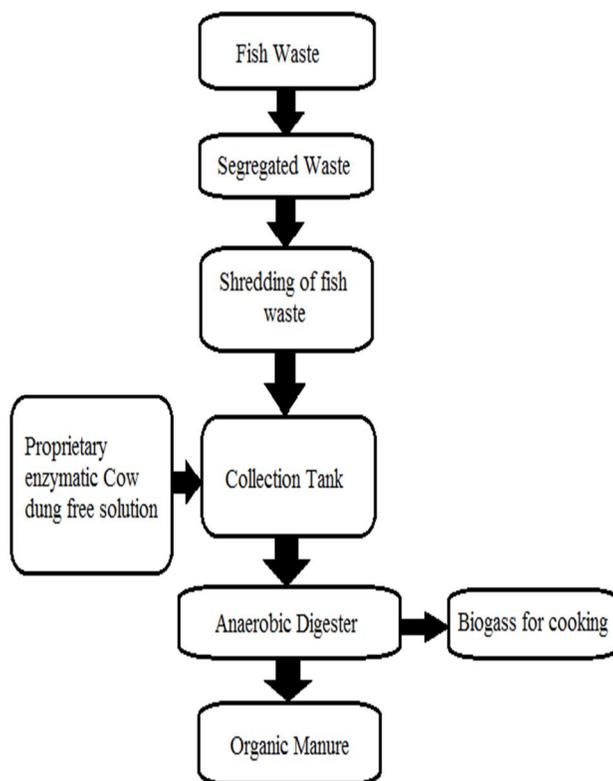


Fig-8 Flow chart of Biogas production from Fish waste.

Firstly a certain amount of fish waste is taken and sent to the segregated waste block. In segregated waste the fish waste is divided like fish bones, fish skin, fish heads etc... then the segregated waste is further sent to shredding of fish waste block, where the shredders are useful machines for the volume reduction of bulky waste. Shredding of waste grinders all the waste into small particles and send it further to collection tank, here in collection tank all the waste is collected and stored. Then the collected waste is sent to the anaerobic digester, anaerobic digestion is a collection of processes by which microorganisms break down biodegradable material in the absence of oxygen. The process is used for industrial or domestic purposes to manage waste or produce fuel. Then the produced biogas is used for cooking purpose and the left out is used as organic manure. Use biological and physicochemical means. Biological treatments use microorganisms to metabolise the organic polluting matter into energy and biomass. These micro organisms can be aerobic or anaerobic. The most used aerobic processes are activated sludge system, aerated lagoons, trickling filters or bacterial beds. In anaerobic processes, the anaerobic microorganisms digest the organic matter in tanks to produce gases (mainly methane and CO₂) and biomass. Anaerobic digesters are sometimes heated, using part of the methane produced, to maintain a temperature of 30 to 35 degree Celsius. In the physicochemical treatments, also called coagulation-flocculation, a chemical substance is added to the effluent to reduce the surface charges responsible for particle repulsions in a colloidal suspension, thus reducing the forces that keep its particles apart. This reduction in charge causes flocculation and particles of larger sizes are settled and clarified effluent is obtained. The sludge produced by primary and secondary treatments is further processed in digesting tanks through anaerobic processes or sprayed over land over land as a fertilizer. In the latter case, care must be exercised to ensure that the sludge is freed of its pathogens.

IV. CONCLUSION

An effective waste management strategy is generally comprised of 3 parts including waste minimization, waste characterization, and waste utilization. Appropriate measures should be taken to reduce the fish waste generated in Karwar city. Complete utilization of fish waste generated into useful fuels such as biogas, and biodiesel. The biogas production process is used to convert fish waste into biogas fuel compounds such as biodiesel. The fish wastes can be completely utilized to produce bio fuels. Produced bio fuel compounds can be used for various applications.

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