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Devising of organic fertilizer from fish and crab wastes: Waste to best technology

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Abstract
The present study was carried out to use of today's waste for tomorrows best. Disposable of fish waste is one of the big issues in urban area. A disgusting smell of the waste really problematic to the common people. In urban areas fish sellers throw away fish wastes into open space, because of this various health problems arises. To tackle this problem fish manure can be prepared after some processon fish waste. Composting made from fish wastes could provide an effective source of nutrient-rich fertilizer. NPK is essential growth factors for the plants. Nitrogen (N) Phosphorous (P) and Potassium (K) are expressed in the %, they are 1.18%, 0.48% and 0.58% respectively. This technique is not known to the many people hence Popularization of this technique among fish sellers, researchers and common people is the need of day. This will also helpful to proper disposable of fish waste and by manufacturing of the biofertilzer gives an employment opportunity without any cost.

Keywords: Fish waste, organic fertilizer, compost

Introduction
Wastes are the remains of anything that we use; they are also main pollutants of our environment. Wastes are of different types depending on their source, slaughterhouses are serving a social cause for the flies and pathogenic microbes, as breeding gourds for these disease causing and disease spreading agents. Domestic wastes (wastes originating from houses) includes leftovers of food, vegetables, fruit waste, waste paper, old cloths, polythene bags, broken pieces of furniture, glass and scrap metal. This group of waste can be broadly classified into two categories as biodegradable and non biodegradable. The biodegradable waste comprise of decaying wastes such as vegetable matters, egg shells, fish waste such as scales, skin, digestive tract, fins etc., paper, garden waste. These wastes are easily broken down by a class of microbes known as decomposers. The domestic waste that we discard everyday reach the local garbage dumps. From there they reach main garbage dump of the city or town. Many times, however, one often finds garbage carelessly dumped along the roadside or near the garbage dumps. The garbage dump is a grave threat to the people and the flora and fauna of the surrounding areas. The decomposition or stabilization of organic matter by the action of microorganisms has been taking place in nature since life first appeared on the earth.
"Composting" mans attempt to control and directly utilize the natural process for sanitary disposal and reclamation of organic waste material. The final product of composting is called "Compost". Fish waste composting is the part of Environmental Biotechnology. The Environmental Biotechnology aims for bioconversion of organic wastes into resources which leads to protect the environment from getting polluted. Environmental Biotechnology involves harnessing diverse desired species and strains of bacteria to convert organic wastes into value added products i.e. waste to best technology [1].
Composting is an excellent method of recycling organic waste with possible use in modern agriculture. The application of all sorts of organic waste products by turning them into compost has, above all, an economic- ecological value and is regarded to be environmentally friendly [2, 3]. It enables obtaining a valuable organic fertilizer, which is substrate of humus and applying it. Among others, in crop production for consumption purposes [4].
Compost is useful to enhance the role of physical properties like total porosity, available water content, saturated hydraulic conductivity and organic matter. Fish waste may be excellent component for compost production [5, 6]. Compost should be sanitarily safe and rich in humus and biogenic substances without destructive effect on the environment and be possible to apply

to the soil [7]. Composting is an alternative solid waste management (SWM), it can be used for the recycling of organic matters into useful products, in addition, it can be used for control the increase of waste [8]. The process is considered to be the most efficient environmentally and most agronomically sound, where compost can be used as a soil conditioner, organic fertilizer as well as containing high nutrient to the soil. Composting fish wastes is a relatively new, simple and environment friendly alternative to disposing of fish wastes [9]. Composting made from fish wastes could provide an effective source of nutrient-rich fertilizer. Conversion of fish waste into compost is cost effective for large fish processing plants. Because of high nutrient content in fish waste, they can be used for local gardening and agricultural crop production [10].

Animal by-products of the fishing industry, half-dead fish, or products derived from the processing of fish for consumption purposes can be applied in agriculture and gardening as fertilizer, upon having first been subjected to proper processing; they can be composted and used along with other organic material [11].

Fish waste composting is an old method but unfortunately in inland fisheries sector, this technique is not used so far. India is No.2 in Fresh water aquaculture next to China. Maharashtra plays an important role in inland fisheries. Many coastal states now move towards the fish waste composting business as they have enough production recorded from Mariculture. But unfortunately in state of Maharashtra where there is an ample fish production is recorded in the form of Sea water and inland fisheries, no big industry or none of the fish farmers engage in fish waste composting business.

In Bhokar fish market Indian major carps i.e. *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* were sold in high percentage, among these three species *Catla catla* and *Labeo rohita* have high demanded fishes. Along with IMC exotic carps such as *Cyprinus carpio*, *Hypophthalmichthys molitrix* and *Ctenopharyngodon idella*, *Oreochromis mossambicus*, *Channa Sps*, *Pangasius Sps*, *Clarias gariepinus* etc fin fishes were also prefers by the people from this area in high quantity. Bhokar is a tribaltaluka in Nanded district people from this region used *Barytelphusa cunicularis* freshwater crab in their diet as folk medicine hence this crab have more demand specially in weekly marketon Thursday. The waste from these fishes generated in the form of digestive system, scales, fins, gills, kidney, liver, air bladder, testis, ovary, other organs and carapace & heaptopancreas of crab collected from the market.

Hence this work was undertaken to record the possibilities of preparation of organic fertilizer from fish and crab wastes.

Materials and Methods

Experimental layout

A pit of size 7X3X3 was constructed at the college premises with the help of hiring service. The Pit was constructed by using brick, sand and cement of single wall.

Fish waste

50 kg fish waste was used for this experiment. Fish wastes (head, tail, intestine, fins, dead fishes etc.) and crab waste (carapace) were collected from the local weekly fish market at Bhokar Dist. Nanded. The wastes obtained were brought to the experimental place. The collected waste was chopped into small sized pieces on the spot with the help of fish sellers.

Agro waste

The saw dust was brought from local saw mill. Agro-industrial waste such as soyabean residue was procured from Mr. Suresh Zankare farm at Chikala Tq. Hadgaon Dist. Nanded.

Bacteria

Bacterial culture of *phosphate solubilizing bacteria* (PSB), *Bacillus*, *Azatobacter* and *Rhizobium* provided by department of Microbiology D. B. College, Bhokar.

Soil Analysis

Estimation physical and chemical properties of soil, as per the standard procedure described by [12], Some parameters were estimated at Krishi Vigyan Kendra Dhar (Madhya Pradesh) and Department of Soil Science Vasantrao Naik Marathwada Agricultural University, Parbhani on hired basis.

Results and Discussion

The fish waste was spread in a pit in a first layer. When these fish waste added in a pit a disgusting smell was recorded. The saw dust was used for the next layer as a source of carbon; the third layer was of garden waste and the soil. Four thlayer was of partially decomposed dung. A bad smell was observed for first 5 days from the pit thereafter nosmell was observed. A protective covering was applied in the pit for avoiding the disturbance of dog, cat and other predator animals. A daily observation was made in the morning, watering is an essential factor for humid condition and for growth of microorganisms, hence watering was done thrice in a week to the fish waste composting unit. Temperature of the pit was recorded regularly, after the month all the layers were mix thoroughly and four bacteria were added in the experirnental pit viz. *phosphate solubilizing bacteria* (PSB), *Bacillus*, *Azatobacter* and *Rhizobium* were beneficial bacteria for rapid decomposition process.

After a month all layers were mixed weekly for the enough aeration and this work was repeated for the rest of the time i.e. for whole experiment. A green mat shade was constructed over the pit for avoiding direct sunlight. This enables protection from the sun, animals and maintains good condition for the microorganisms, microorganisms needs wet and humid condition for the proper decomposing the material.

Every month fish waste material was checked for the decomposing process. The fish waste had started decomposing in the month of September and October. The 50% decomposition process was recorded in the month of November while in the last week of January all the fish waste were decomposed 100%. It was recorded that fish waste was converted into compost in 180 days. This compost was filtered through mesh for clearing the stones and other unwanted materials in the last week of February 2019.Total 70 kg compost was devised in this experiment from the fish waste.

Table No. 1 and 1.1 depicted the analysis of compost prepared from fish waste. Color of the compost was black while there was no foul smell recorded from the fish waste compost.

pH is an important factor, it gives an approximate index of compost maturation [13]. It acts as a possible indicator and plays a crucial role in biological activity [14]. Observed that the range of pH values suitable for bacterial development is 6.0-7.5. In our study the pH is 7.22 recorded, According to [15] the finished compost may have pH above 7, between 7 and 8.5. Hence our finding is similar with this finding.

Temperature is one of the most important parameter in any reaction; during the whole experiment temperature of the pit was recorded daily. It was found that in first week the temperature was between 28 ºC to 33 ºC, the highest temperature 42 ºC was recorded in the month of October 2018. [16] reported that home composting of organic waste takes place within three temperature ranges known as psychrophilic (0 to 20 °C), mesophilic (20 to 40 °C) and thermophilic (over 45 °C). As per [17] mesophilic temperatures allow effective composting. In our study temperature range was mesophilic, hence the temperature was enough in order to complete the process of composting.

Bacteria are important to fast degradation of biowaste material. According to [18] bacteria are responsible for most of the initial decomposition and heat generation in compost.

The EC value was 1.81dsm^{-1}, this value is within the range as describe by [19] in minimum quality standards for city/urban compost and vermicompost. [20] also studied that EC range is in the optimum range (2.0 to 4.0) for growing media.

Organic carbon is also very important factor; the organic carbon of the fish waste compost was 11.55% recorded, when it was compared with quality standard ofcity/urban compost and vermicompost, this value was found in an average level. [21] done experiment on some physical and chemical properties of compost, he was recorded organic carbon ranged from 16.6 to 23.89% for different compost types. Our results are similar with [22] who recorded the optimum value of total organic carbon higher than 10%.

Free carbonate was also calculated from the fish waste compost, it was categorized in Good category. The value of free carbonate was 4.8% recorded and this was permissible limit according to [19] quality standard of city/urban compost and vermicompost.

NPK is essential growth parameters for the plants. They are taken by the plants from the soil. Nitrogen (N) is responsible for the growth of leaves. The value of Nitrogen in fish waste compost was calculated 1.18%. As per the (19) this value is high as compared to quality standard of city/urban compost and vermicompost. Our results are according to [23] and [21] also found the same values 0.99 to 2.01% and 0.95 to 1.68% respectively.

Phosphorous (P) and Potassium (K) are expressed in the %, they are 0.48% and 0.58% respectively. Their appearance in the compost is in good quantity. Both the parameters were studied earlier by [21] phosphorous was in the range of 0.27 to 1.13% at different compost type found by him. Whereas Potassium (K) another important factor was in the range of 0.27 to 2.11% in his similar studies. Our results are matching with these findings.

Along with macronutrient, micronutrients are also important for the growth of plant. In our study the fish waste compost having average value of micronutrients. Zinc (Zn), Iron (Fe), Manganese (Mn) and Copper (Cu) were analyzed and calculated 85.8 ppm, 128.2 ppm, 75.2 ppm and 91.33 ppm respectively [24]. conducted study on effect of vermicompost and compost on lettuce production.In their study, they recorded Zinc (Zn), Iron (Fe), Manganese (Mn) and Copper 76 ppm, 991 ppm, 141 ppm and 16 in vermicompost whereas in compost the value of these micronutrients were 69 ppm, 1049 ppm, 144 ppm and 15 ppm respectively. Another work was carried out by [25] on effect of compost and compost tea on organic production of head lettuce; they also studied Zn, Fe, Mn and Cu in their work. The value of Zn, Fe, Mn and Cu were 185 ppm, 2636 ppm, 250 ppm and 163 ppm recorded respectively. The above findings are similar with our results.

Fig 1: Various steps involves in preparation of organic fertilizer from fish and crab waste (Photo 01-06).

Table 1: Analysis ofcompost prepared from fish waste on dry basis

Parameters	Color	Odour	pH	EC (dsm^{-1})	OC%	FC %	N %	P %	K %
Fish waste compost	Black	Absence of foul odour	7.22	1.81	11.55	4.8	1.18	0.48	0.58
**Quality standard of city /Urban compost	Dark brown to black	Absence of foul odour	6.5-8.5	Below 4	12	Below 5	0.8	0.4	0.4
**Vermicompost	Dark brown to black	Absence of foul odour	6.5-8.5	--	18	--	1.0	0.8	0.8
Remarks	Ok	Ok	Good	Good	Average	Good	High	Good	Good

EC- Electrical conductivity, OC- Organic carbon, FC- Free carbonates, N- Nitrogen,
P -Phosphorous, K- Potassium.
** Minimum quality standards for city/urban compost and vermicompost as per FCO (2013), Manna *et. al.* (2015).

Table 1: Analysis some micronutrients in fish waste compost on dry basis

Parameters	Zn (ppm)	Fe (ppm)	Mn (ppm)	Cu (ppm)
Fish waste compost	85.8	128.2	75.2	91.33
Remarks	Good	Average	Average	Average

Conclusion

Composting overcoming the disposal problem and produces a viable product. Composting is a pollution free practice and it reduces the potential for surface and groundwater foulness. Composting demolish disease-causing organisms and fly larvae. Compared to other disposal alternative, composting is not a costly method of fish waste disposal.

At the end it was concluded that, there was no disgusting smell from the fish waste fertilizer. Fish waste can be converted into organic manure, it canbe useful to fish farmers or sellers who throw the fish waste. If we can dump it in proper way for decomposing, it can generate employment by selling this manure generate money. This waste can be a huge source of NPK production and helpful to farmers for organic farming.

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