Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 06, Issue: 01 (JAN-FEB, 2026)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Effective Bio fertilizer Production from Discarded Waste Material of Fish

*Dr. Rakhi Das
Assistant Professor, Dept. of Aquaculture, SAGE University, Bhopal, M.P, India
*Corresponding Author's email: rakhi.d@sageuniversity.edu.in

At present, fish waste creates hazardous environmental challenges in the fishing and aquaculture industries with mass quantity of fish processing by-products added annually worldwide. Waste materials contain fish heads, bones, scales, viscera and other organs of fishes and aquatic organisms; comprise around 30 to 70 % of the total fish or aquatic organism's weight depending upon the species and their part of utilization. These vast waste streams have a great potential to transform as a valuable resource for organic crop production through bio-fertilizer production. Waste materials from unused parts of fishes are a great source of plant nutrients such as nitrogen, phosphorous and trace minerals. Manufacture bio fertilizer from fish waste not only control the environmental pollution it also can significantly increase soil fertility, upgrade crop production and contribute to a circular economy in sustainable agriculture inputs. Transformation of fish waste materials into effective organize bio fertilizer is an innovative approach

Advantages of Fish Waste Bio- fertilizer

Bio fertilizer manufactured from fish waste offers multiple advantages for both agriculture and the environment:

- **Nutrient enriched product**: In general, fish waste carry high levels of nitrogen, phosphorous, calcium, magnesium, zinc, and iron. Findings of these combined nutrients in one product making it an excellent all purpose fertilizer.
- **Evolved soil structure**: The organic compounds in animal based fertilizers upgrade soil aggregation; water retention capability and aeration lead improvement in root systems.
- **Initiate microbial activity:** Fish based bio fertilizer promotes beneficial soil microorganisms that upgrade nutrient cycling and disease resistance.
- **Slow Release Properties**: Unlike chemical fertilizers, fish based bio fertilizers release essential nutrients gradually, deducting the risk of nutrient leaching and contributing sustained plant nutrition.
- **Environmental Viability**: Transforming fish waste into bio fertilizer convert organic waste from landfills, lowering greenhouse gas emissions and reduce dependency on synthetic fertilizers.
- **Economic merit:** Diverts waste disposal costs into income generating products, building economic opportunities for fishing communities and small scale farmers.

Types of Fish Waste appropriate for Bio fertilizer

In India, fish processing Industry and fish markets produce by-products after processing of fishes, and these dumped by-products can be use for bio fertilizer production:

- **Fish Offal:** Viscera, gills and internal organs highly enriched in nitrogen
- **Fish Heads and Frames**: Skeletal parts of fishes reaming after filleting rich in phosphorous and calcium content
- **Skins and Scales**: Contain collagen and different kind of minerals

- **Whole Fish:** Non valuable unmarketable or spoiled fish
- **Fish Processing Water:** Fish market's washed out water or fish processing water can be utilized as liquid content in fermentation

Bio fertilizer Manufacturing Techniques

There are various methods for transforming fish waste into bio fertilizer; every process has its own advantages and effective implications. The selection of methods depends on available resources, production scale, desired product and local regulations.

Composting (Aerobic Decomposition)

Composting is ideal for manufacturing solid bio fertilizer and particularly effective for small to medium scale operations.

Requirement of materials

Chopped or ground fish waste, Carbon reach any materials including sawdust, dry leaves, straw or coconut coir, composting bin with good drainage, pH and thermometer, pitchfork.

Step by step process

- **Layer building**: Make a base layer of carbon material (10- 15 cm thick), l then add a layer of fish waste (5-7 cm), and cover with another layer of carbon material. Continuing layering until materials are utilized, covering end layer with carbon layer to control odors.
- **Moisture Adjustment:** The pile should contain 50 to 60 % moisture. Adding water if too dry or more carbon if too wet.
- **Initial mixing:** Thoroughly mix the materials to assure even distribution and promote decomposition.
- **Management of Temperature:** The pile will heat up to 50 to 65°C within 2-3 days. This thermophilic phase kills pathogen an initiate decomposition. Monitor temperature regularly.
- **Periodical Turning:** Turn the pile periodical during the first month to provide oxygen and distribute heat evenly. This protects anaerobic pockets and offensive odors.
- **Maturation period:** After 4 to 6 weeks, deduct the turning frequency to once every 1- 2 weeks. The temperature will gradually decrease as decomposition slows.
- **End product:** Compost will be ready in 2 to 3 months when it looks like dark brown, crumbly, with an earthy smell and no recognizable fish materials.

Implication doses

- **Pre Planting**: Mix 2- 5 kg per square meter into soil 2-3 weeks before planting
- **Top dressing:** Use 1- 2 kg per square meter around established plants, ignoring direct contact with stems
- **Potted Plants:** Mix compost 10 – 2- % by volume into any potting mediums.

Conclusion

Efficient nutrient rich profile of fish based fertilizers enriched with their soil upgrading contents help to create an effective growth of plant. In organic farming, fish based bio fertilizer can be an excellent choice for sustainable agriculture. Growing of global awareness of circular economy principles pressurized to reduce waste and minimize the application of chemical fertilizer. In future, Fish waste based bio fertilizer can play the lead role in agriculture worldwide.

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