Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 04 (JULY-AUGUST, 2023)
Available online at http://www.agriarticles.com
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Bio-Waste Management for Sustainable Agriculture

(Nihal S. Titirmare, *Prasad B. Margal and Aniket S. Gaikwad)
Ph.D. Research Scholar, Department of Soil Science and Agricultural Chemistry, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India
*Corresponding Author's email: prasadmargal@gmail.com

- India faces major environmental challenges associated with waste generation and inadequate waste collection, transport, treatment and disposal.
- Current systems in India cannot cope with the volumes of waste generated by an increasing urban population, and this impacts on the environment and public health.
- The priority is to move from reliance on waste dumps that offer no environmental protection, to waste management systems that retain useful resources within the economy.
- Waste segregation at source and use of specialized waste processing facilities to separate recyclable materials has a key role.

Solid Waste Generation Status in World

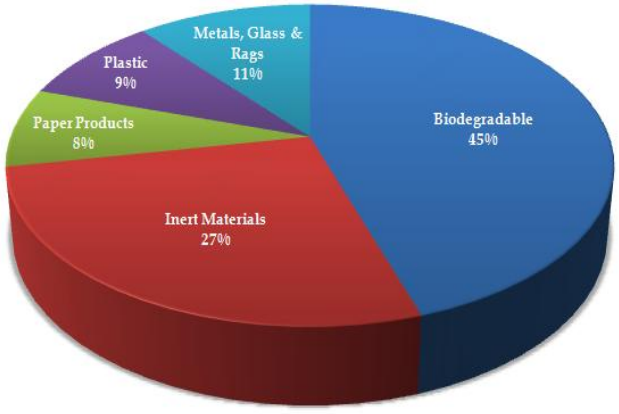
- In 2016, the worlds' cities generated 2.01 billion tonnes of solid waste.
- It was amounting to a footprint of 0.74 kilograms per person per day.
- With rapid population growth and urbanization, annual waste generation is expected to increase by 70% from 2016 levels to 3.40 billion tonnes in 2050.
- **World Bank Report(2018)**

Municipal solid waste composition in India

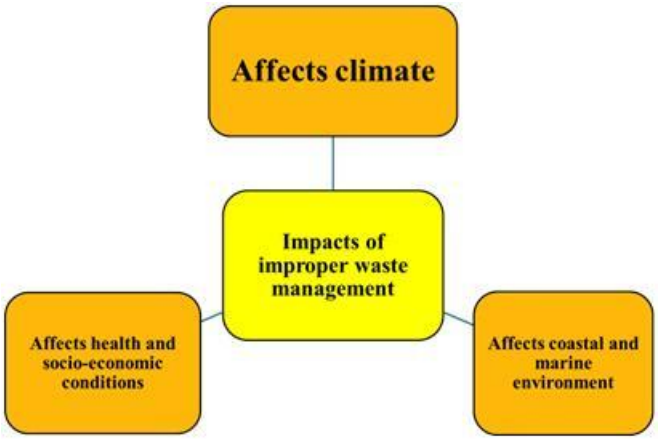
- 40%- 60% compostable waste
- 10%- 30% recyclable waste
- 30% inert waste

Why Waste Management?

- To control different types of pollution, i.e., air pollution, soil pollution, water pollution etc.
- To conserve all our natural resources including forest, minerals, land, water and our environment.
- For proper and judicial use of land resource (not for trash) and conserve its aesthetic value.
- For maximum utilization of embedded nutrients of wastes.
- For producing energy by the recycling of waste.
- For an overall sustainable agricultural production and environmental protection.



Impacts of Waste if not Managed Wisely



Types of Waste

- **Solid wastes:** wastes in solid forms, domestic, commercial and industrial wastes

Examples: yard waste, crop residues, plastics, Styrofoam containers, bottles, cans, papers, scrap iron, and other trash

- **Liquid Wastes:** wastes in liquid form

Examples: domestic washings, chemicals, oils, waste water from ponds, manufacturing industries and other sources

Classification of Waste According to their Properties

- **Biodegradable waste**
- Capable of undergoing aerobic and anaerobic decomposition.
- It includes municipal solid waste (sometimes called biodegradable municipal waste or BMW) as green waste, food waste, paper waste, and biodegradable plastics.
- Other biodegradable wastes may include human waste, manure, sewage, sewage sludge and slaughterhouse waste.
- **Non-biodegradable waste-**
- Cannot be degraded (plastics, bottles, old machines, cans, styrofoam containers and others).

Classification of Wastes According to their Effects on Human Health and the Environment

- **Hazardous wastes-** Substances unsafe to use commercially, industrially, agriculturally, or economically and have any of the following properties- ignitability, corrosively, reactivity & toxicity.
- **Non-hazardous wastes-** Substances safe to use commercially, industrially, agriculturally, or economically and do not have any of those properties mentioned above. These substances usually create disposal problems.

Classification of Solid Wastes

TYPES OF WASTES	SOURCE	DESCRIPTION
Municipal Solid wastes	• household garbage, construction & demolition debris, sanitation residues etc.	➢ Solid wastes. ➢ Managed by any municipality.
Agricultural wastes	• crop residues, yard waste.	➢ Generated from farming activities. ➢ Mostly biodegradable.
Bio-medical wastes	• syringes, live vaccines, laboratory samples, body parts, bodily fluids etc.	➢ Solid or liquid wastes. ➢ Intermediate or end products generated during diagnosis, treatment & research activities of medical sciences.
Industrial wastes	• chemical solvents, pigments, paints, paper products, industrial by-products, metals etc.	➢ Solid, liquid and gaseous wastes. ➢ Generated by manufacturing & processing units of various industries like chemical, petroleum, coal, metal, gas, sanitary & paper etc.
Fishery wastes		➢ Wastes generated due to fishery activities.
Radioactive wastes	• byproducts of nuclear processes. • radio-isotopes, chemical sludge.	➢ Waste containing radioactive materials. ➢ Usually these are or not directly involved in nuclear activities, e.g. etc.
E-wastes	• discarded electronic devices.	➢ Generated from any modern establishments.

➢ Sustainable Agriculture

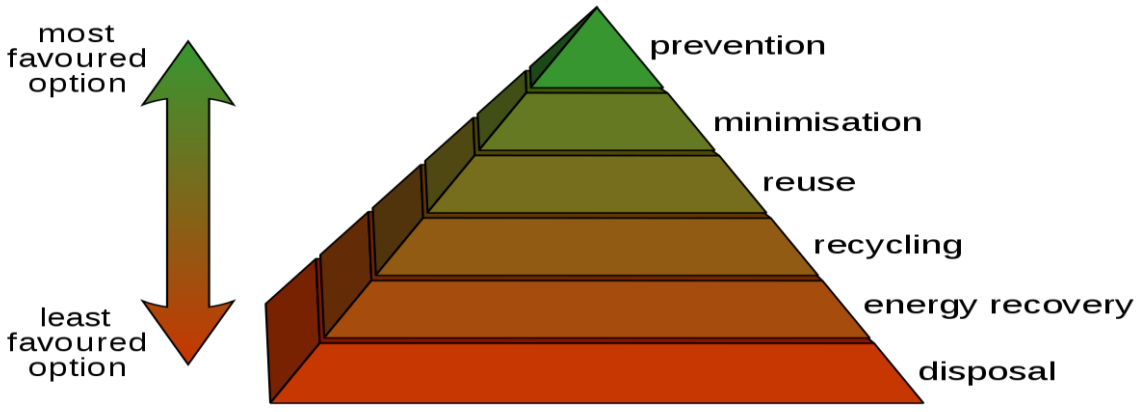
- The management and conservation of the natural resource base, and the orientation of technological change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations (FAO, 1988).
- Sustainable agriculture is minimal dependence on synthetic fertilizers, pesticides & antibiotics and more dependent on use of **manures**, crop rotation & minimum tillage (Edwards, 1987).

➢ Criteria of Sustainability

- Ecologically sound
- Economically viable
- Socially just
- Humane
- Adaptable

➢ Waste Management Hierarchy

- Waste hierarchy refers to 3Rs: Reduce, Reuse, Recycle

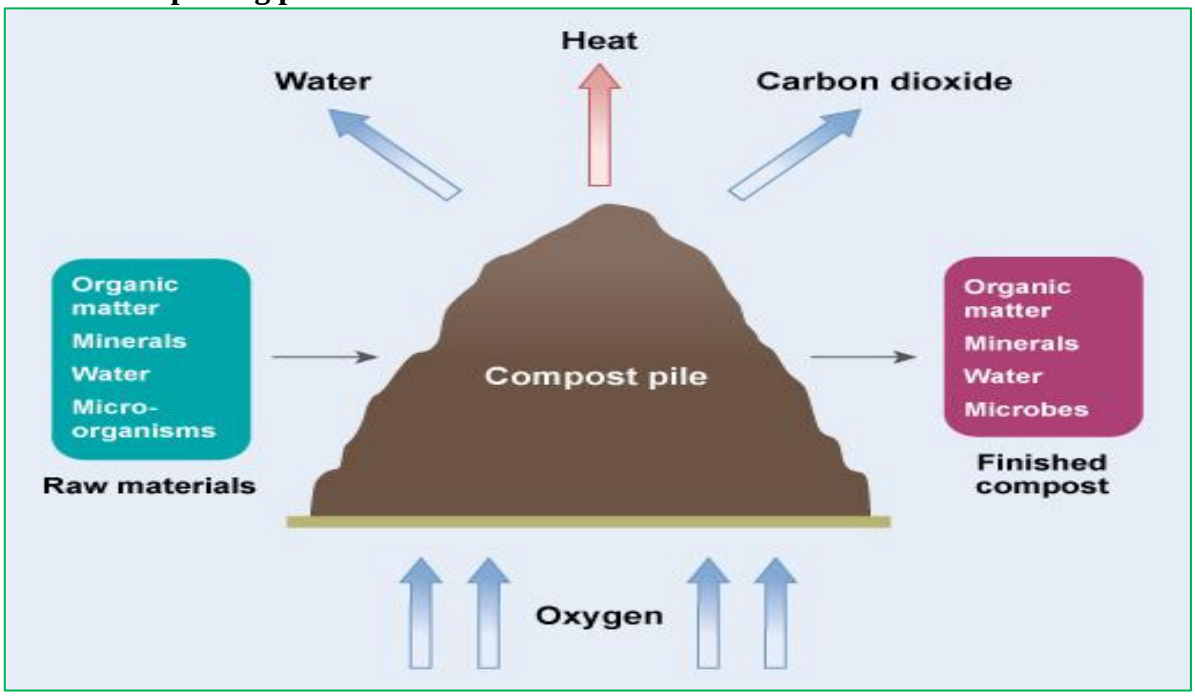


Waste management methods

➢ **Composting-**

- Composting is an aerobic method of decomposing organic solid wastes into a humus-like material, known as compost .
- It can therefore be used to recycle organic material.
- The process involves decomposition of organic material, which is a good fertilizer for plants.
- The waste generated in India has more organic content about 50% as compared to 30% generated by developed countries

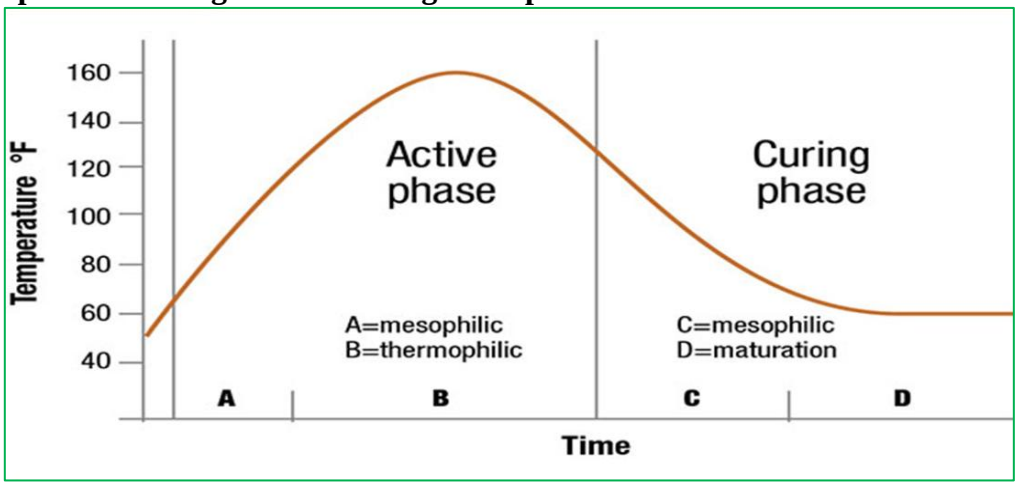
▪ **The Composting process**



○ **Methods of Composting-**

- On site composting
- Vermicomposting
- Aerated windrow composting
- Aerated static pile composting
- In vessel composting
- Anaerobic composting

○ **Temperature changes in an Average Compost Pile**



➢ **Vermicomposting-**

- Vermicomposting is the process of conversion of biodegradable matter by earthworms into vermicast.
- It provides a way to treat organic wastes more quickly.
- In the process, a major fraction of the nutrients contained in the organic matter is converted to more bioavailable forms.
- Vermicompost contains water-soluble nutrients and is an excellent nutrient-rich organic fertilizer and soil conditioner.
- It also generates products that have lower salinity levels that are therefore more beneficial to plant mediums.

Earthworm Species

❖ **Epigeics :**

Eisenia fetida

Eudrilus eugeniae

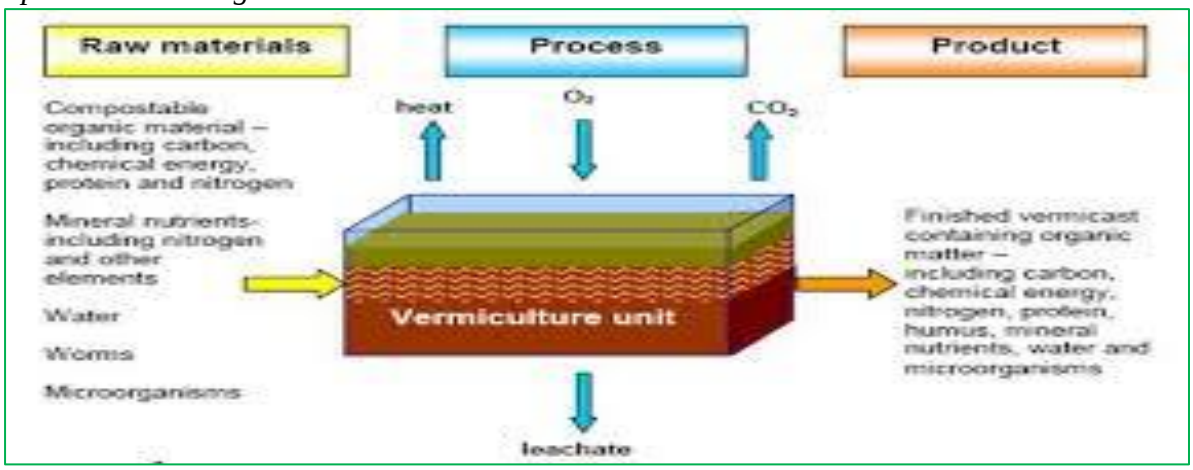
❖ **Anecics:**

Lumbrics terrestris

Lumbrics rubellus

❖ **Endogeics:**

Aporrectodea caliginosa



Conclusion

❖ Bio waste management plays a crucial role in promoting sustainable agriculture. Effective management of bio waste ensures the utilization of organic resources in a manner that minimizes environmental impact, enhances soil fertility, and reduces reliance on synthetic inputs.

❖ By adopting sustainable practices such as composting and vermicompost, bio waste can be transformed into valuable organic fertilizers and soil amendments. These products not only provide essential nutrients to crops but also improve soil structure, water-holding capacity, and microbial activity. As a result, the overall health and productivity of agricultural systems are enhanced, leading to increased yields and improved food security.

❖ Proper bio waste management reduces the release of greenhouse gases, such as methane, into the atmosphere.

❖ Bio waste management practices contribute to the conservation of natural resources. Instead of relying heavily on chemical fertilizers and synthetic pesticides, farmers can utilize bio waste-derived products, reducing the need for non-renewable resources and minimizing pollution of water bodies and soil.