

Microorganisms as vital additives in Waste Management

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Abstract: Microorganisms play necessary roles within the maintenance of the many natural and synthetic development within the environment. They serve positive functions that build life easier and higher for man. One in every of such areas that microorganism's area unit adopted is in waste management. The right disposal of the voluminous waste that humans generate in their daily activities may be a nice challenge that government and environmental agencies area unit unceasingly seeking higher ways that of addressing. A crucial method of with success combating this menace is thru the utilization of microorganisms. Thus, this paper examines the varied applications of microorganisms within the management of municipal waste. It reviews the varied roles of microorganisms within the atmosphere, like in waste product and soil treatment, energy generation, oil spillage and hot contamination. It conjointly discusses waste generation and management ways, and a few specific uses of microorganisms (bacteria, fungi, algae, virus and protozoa) in waste management. It concludes by light some recent advances in microbiological waste management.

Indexed Terms- Micro-Organisms, Waste Management, Composting, Waste Water, Anaerobic Digestion, Municipal Solid Waste, Environmental Pollution.

I. INTRODUCTION

Micro-Organisms are present everywhere in the environment where they play an important role. So many Microbes have unique adaptation to some specific environmental conditions like one who inhabited dead sea and pink snow caused by *Chlamydomonas nivalis*. Microbes play a great role in Natural Recycling of living Materials. Bio-degradable substances are those which are naturally produced and can be easily broken down by living organisms like Bacteria and Fungi. Micro-organisms have been very indispensable in searching for solutions for various problems which mankind has encountered in maintaining the quality and for stabilizing proper ecosystem. Even they have been used to maintain a proper and positive effect in human and animal health, municipal and industrial waste treatment, genetic engineering, etc. In India with a population of 130 Crores, Waste generation and Disposal is the most difficult challenge faced. The main sources of waste are industrial, agricultural and domestic waste's and is grouped into all three forms of Matter (Solid, Liquid and Gas). The Waste which creates most of the problem is Solid and Liquid Waste's. Out of all waste, Plastic is the most dangerous waste as it is Non- Biodegradable.

II. ROLE OF MICRO-ORGANISMS IN THE ENVIRONMENT:

It requires a lot of chemical synthesis to convert Natural Resources into other useful form. It even leads to pollution while producing any Product. All the process of converting these Natural Resources involve use of Micro-Organisms (Bacteria, Fungi, etc.). Micro-Organisms are very important for the environment as well as Human. They play a very important role in all the aspects like carbon and nitrogen cycle, even in recycling the natural resources. Also, Micro-Organisms are vital as they perform some very important roles such as recycling other organisms' dead materials and

waste products through decomposition. Micro-Organisms give a main of its quality in higher- order, multi-cellular organisms.

III. APPLICATION OF MICRO-ORGANISMS:

- i. *Sewage Treatment:* Most of all oxidative sewage treatment processes merely depends upon a large range of Micro-Organisms to get oxidized in small organic constituents which are not manageable for the process of sedimentation or flotation. Anaerobic Micro-Organisms are there for reducing big solid Globules, producing methane gas (amongst other gases) and a sterile mineralized residue.
- ii. *Soil treatment:* The atmospheric nitrogen fixation leads to nitrogen cycle or nitrogen fixation. Diazotrophs can be used for this. Nutrients and minerals are generally produced by microorganisms in the soil which is readily available for plants which helps in formation of hormones with triggering growth. Diversification of microbes results in more yielding varieties and less plant diseases.
- iii. *Energy Generation:* In Fermentation, Micro-organisms help to produce ethanol. In Bio-gas Reactors Micro-Organisms helps in producing Methane. Many Scientists are still researching over it and recently on the use of Algae to produce fuel and searching on key factors leading to bacteria for fuel generation by agricultural and urban waste.
- iv. *Oil Spillage and Radioactive Contamination:* There are various type of Bacteria's in this environment that could clean various pollutants like Spilled Petroleum. When there is an oil Spill, *Alcanivorax*, a specific strain that increases population.
- v. A specific Strain called *ALCANIVORAX* increases population due to the large amounts of Nutrients which are provided them. Some bacteria helps in growth of nanowires and can be used in immobilization of harmful elements



Fig. 1: Site view

The nano wires grown by some types of bacteria can also be used to immobilize harmful elements – like uranium – and keep them away from spreading. Recently in Michigan State University, researchers stated that geobacter bacteria found naturally in soil which electroplates uranium which is insoluble and undissolved and contaminate groundwater..

IV. WASTE MANAGEMENT IN OTHER COUNTRIES

Solid wastes may be outlined as non-liquid and nongaseous product of human activities, thought to be being useless. It might take the sorts of refuse, garbage and sludge. the amount and rate of solid waste generation in an area depends on the densely populated area, socio-economic standing of the voters and also other sorts of industrial activities occurring within the space. Wastage leads to polluted environment with odour nuisance. It become breeding place for number of flies and insects.

They'll conjointly cause health hazards excluding being eyesores and sources of unpleasant odours, terribly soft, refuse is drop in drainages or canals and on watercourses with freedom. The unsanitary mode of wastes disposal, like open elimination, excretion in open and also the selling of refuse in pits, rivers and evacuation channels area unit widespread and also the resultant contamination of the setting contributes to environmental degradation.

V. WASTE MANAGEMENT METHODS

Waste management is that the assortment, transport, process or disposal, managing and observance of waste materials to minimize its consequences on humans and atmosphere. Solid waste treatment techniques act to scale back the volume and toxicity of solid waste, reworking it into a lot of convenient and/or useful type. In Awosusi, waste management is viewed as a method of supply reduction, refuse utilisation, controlled combustion and controlled landfill; energy generation from waste (energy recovery) and finally, solid waste disposal, if the aforementioned don't provide applicable resolution. variety of processes square measure concerned in effectively

managing solid waste. These embody observance, collection, transport, processing, recycling, burning, landfilling and composting. This embodies differing types of ways like follows thermal treatment (whereby the method use heat to treat waste materials) like burning, chemical action and transmutation, and open burning; dumps and landfills like sanitary landfills, controlled dumps and bioreactor landfills; biological waste treatment like composting and anaerobic digestion.

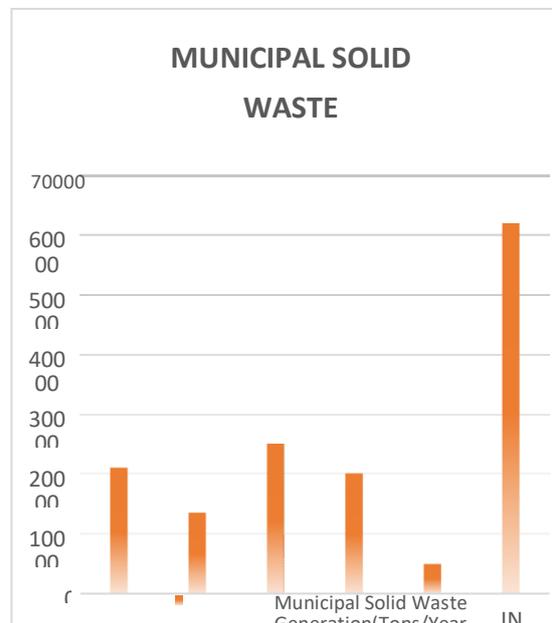


Fig. 2: Graphical representation of solid waste

VI. USE OF MICRO-ORGANISMS IN WASTE MANAGEMENT

The Micro-Organisms that inhabit the aerobic biological treatment systems embody bacterium, and other microbes. The expansion of any type of Micro-Organisms during an industrial wastage disposal system can rely on the chemical characteristics of the economic waste, the environmental limitations of the actual waste system and therefore the organic chemistry characteristics of the Micro-Organisms. All of the Micro- Organisms which grow during a given industrial waste disposal system contribute to its over-all characteristics, each smart and unhealthy.

It is important to acknowledge the role created by every form of organism to total stability of the organic wastes if the waste treatment system is to be properly framed and executed for max potency.

A. BACTERIA:

Bacteria is the basic biological unit in waste water treatment. Due to variation in chemistry and nature of this, it can metabolize most. Obligate aerobes, and facultative microorganism can found altogether aerobic waste treatment systems. Growth of any explicit species depends upon its competitive ability to get a share of the on the market organic material within the system. Bacterial predomination can usually divide itself into two important groups: the microorganism utilizing the organic compounds within the waste, and also the microorganism utilizing the lysed product of the primary cluster of Micro-Organisms. The microorganism utilizing the organic compounds within

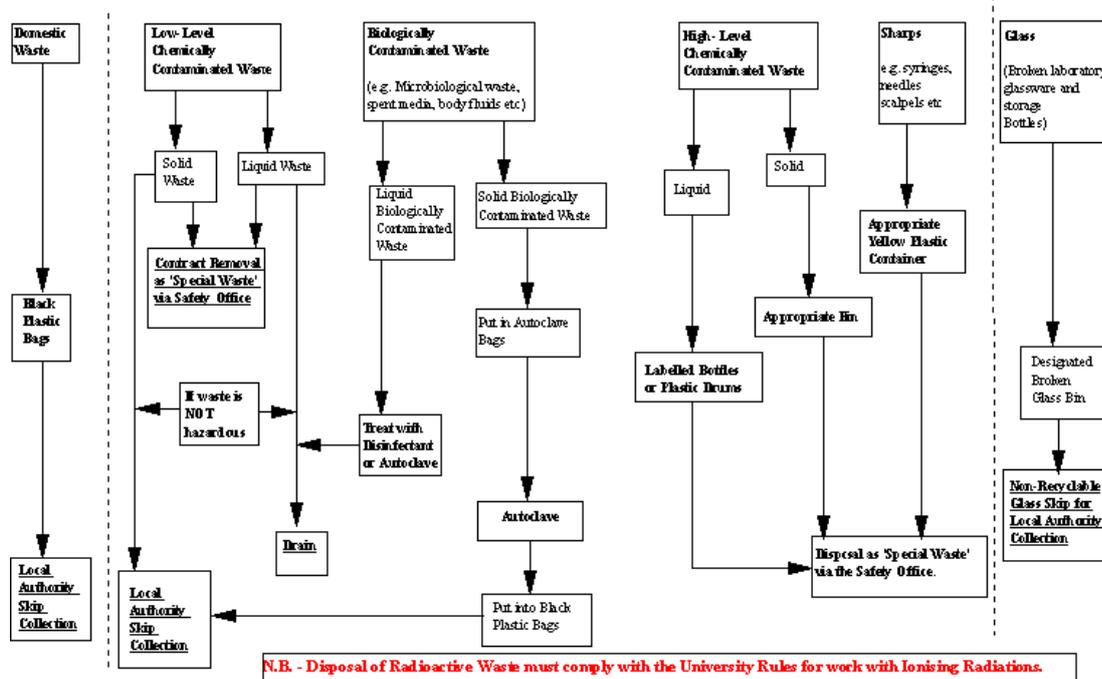


Fig. 3: Work flow

the waste are the foremost necessary cluster and can verify the characteristics of the treatment system. Species with fastest growth rate and having the ability for utilization of organic matter in bulk can predominate. The extent of secondary predomination can rely upon the length of starvation. Depletion of the organic substrate is followed by death and lysis of the predominate microorganism unless of the cellular components of the microorganism permits alternative microorganism to get older. Since all biological treatment systems are usually overdesigned as a security issue, secondary predomination can occur. apart from the metabolic characteristics of the bacteria, the foremost necessary characteristic is their ability to flocculate. All of the aerobic biological waste treatment systems rely upon the activity of the Micro-Organisms and their separation from the liquid section for complete stabilization. It was 1st thought that activity was caused by one microorganism species, Zoogloea ramigera, however recent studies have shown that there are many alternative microorganisms that have the flexibility to flocculate. it's been postulated that all microorganism have the flexibility to flocculate beneath bound environmental conditions. The prime factors poignant flocculation are the surface charges of the microorganism and their energy. The electrical surface charge on microorganism grown in dilute organic waste systems has been shown to be below the important charge for auto-agglutination, 0.02 volts. this implies that motion provides spare energy to beat the loathly electrical forces when 2 microorganism approach one another and to allow the Van der Waal forces of attraction to predominate and hold the two microorganisms along. Autoagglutination doesn't ensue if the energy of the system is sufficiently high to permit the microorganism to multiply and to be speedily motile. Autoagglutination, or activity, happens solely when the bacteria lack the energy of motility to beat the Van der Waal forces. Once floccule has begun to kind, a number of the bacteria die and lyse. Associate in Nursing insoluble fraction of the Micro-Organism cell is left that is primarily polyose. The older the floccule becomes, the additional

polyose builds up and also the less active Micro-Organism are entrained in it.

B. FUNGI:

Fungi play a vital role within the stabilization of organic wastes just exactly the Micro- Organism, fungus will metabolize usually each style of chemical mixtures found in industrial effluents.. The fungi have the potential ability to predominate over the Micro- Organism however they are doing not except beneath uncommon environmental conditions. The thin nature of most of the fungi found in industrial wastes makes them undesirable since they are doing not kind a decent compact floccule and settle simply. For this latter reason, considerable efforts are exhausted to form the environmental conditions additional favourable for Micro-Organism predomination than for thin fungi.

The thin fungi predominate over the Micro-Organism at low atomic number 8 tensions, at low pH, and at low element. Low atomic number 8 tension results from an occasional atomic number 8 offer .. Under reduced atomic number 8 levels, metabolism doesn't proceed to greenhouse emission and water however stops with the formation of organic alcohols, aldehydes, and acids. If the system lacks spare buffer, the organic acids depress the hydrogen ion concentration to the more favourable vary for fungi. Thus, it is often seen that low atomic number 8 tension and hydrogen ion concentration are often reticulated. several of the fungi grow well at hydrogen ion concentration four to five whereas few Micro-Organism are able to grow to a tolerable degree to vie. Fungi need less element than Micro-Organism per unit mass of living substance. In element deficient wastes, the fungi are able to synthesize additional active masses of living substance from the wastes than are the Micro-Organism and predominate. Micro- Organism average some 10% to 12% element whereas fungi vary from five to six element. beneath traditional environmental conditions fungi are going to be present and can aid within the stabilization of the organic matter. However the fungi are of secondary importance and cannot predominate.

C. ALGAE:

The algae are the third sort of biological plants that play a neighbourhood within the over-all stabilization of organic wastes. Since the alga acquire their energy for synthesis from daylight, they are doing not ought to metabolise the organic compounds just like the Micro-Organism and also the fungi. to create living substance the alga primarily utilizes the inorganic parts of the wastes, for instance, ammonia, greenhouse emission, phosphate, magnesium, potassium, iron, calcium, sulphate, sodium and alternative ions. it's doable to possess alga and also the Micro-Organism predominate along since they are doing not utilize the same waste parts. Throughout living substance synthesis, the alga unleashes atomic number 8 that is taken by the Micro-Organism to motivate complete aerobic stabilization of the organic matter. within the absence of daylight, the alga must obtain the energy needed to remain alive from the metabolism of organic matter within the same manner as Micro-Organism and fungi. This organic matter usually comes from hold on food among the cell however in some Protoctista species it will come from the organic material within the wastes.

VII. MICROBIAL WASTE MANAGEMENT

Generally, solid waste will broadly speaking be classified into perishable and non- biodegradable. The biodegradables (biowastes) square measure those solid wastes generated, that can be rotten by microorganisms and doesn't constitute major sources of pollution for a protracted amount of your time.6 They embody paper product and wastes of plant origin, wastes of animal origin (faecal matter, carcass, droppings, and poultry waste products).

These teams of solid waste even if they're simply degraded by organism in bottom time, give off offensive odour and represent nuisance to the aesthetic setting quite the non- biodegradable solid wastes. They can conjointly represent an honest environment for the thriving of moribund microorganisms that might simply foul fresh food product and sources of water within the urban cities in India. On the opposite hand, non- biodegradable solid wastes aren't degradable by microorganisms. this means that different means of treatment like burning, landfill, and use square measure used as ways in which of disposing them.

Examples of this cluster of solid wastes square measure solid wastes of scientific discipline and smelting industries (abandoned vehicles, motor cycles, vehicle half and scrap metals, iron, zinc, atomic number 13 sheets and different metals, machine parts); solids wastes of construction industries (sand, gravel, hydrocarbon wastes, concrete and waste building materials); solid waste of plastic industries (plastic buckets, cable insulators, tyres, chairs, tables, plastic wrap luggage, plastic bottles, cutleries, sachet water containments, etc.) and glass product.

VIII. SOLID WASTE MANAGEMENT

Management of solid waste reduces or eliminates adverse impacts on the setting and human health and supports economic development and improved quality of life. Composting is that the most often used biological solid waste treatment methodology that is that the controlled aerobic decomposition of organic waste materials by the action of tiny invertebrates and

microorganisms. Composting may be a technique during which organic waste materials (food, plants, paper) square measure rotten so recycled as compost to be used in agriculture and landscaping applications. The foremost common composting techniques embody static pile composting, vermin- composting, windrow composting and in-vessel composting.

IX. CONCLUSION

Waste is any material, that have very little or no worth to producer or client. Humans with nearly all activities produce waste. the most important element of municipal solid waste represents organic fraction, principally from domestic, agricultural and industrial sources. There are a unit many alternative strategies of managing municipal waste streams. These include physical, chemical and biological strategies. standard waste management practices typically involve one negative consequence or the opposite. This necessitated the look for and development of biological techniques, including the employment of microorganisms that manufacture environmental-friendly outcomes.

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