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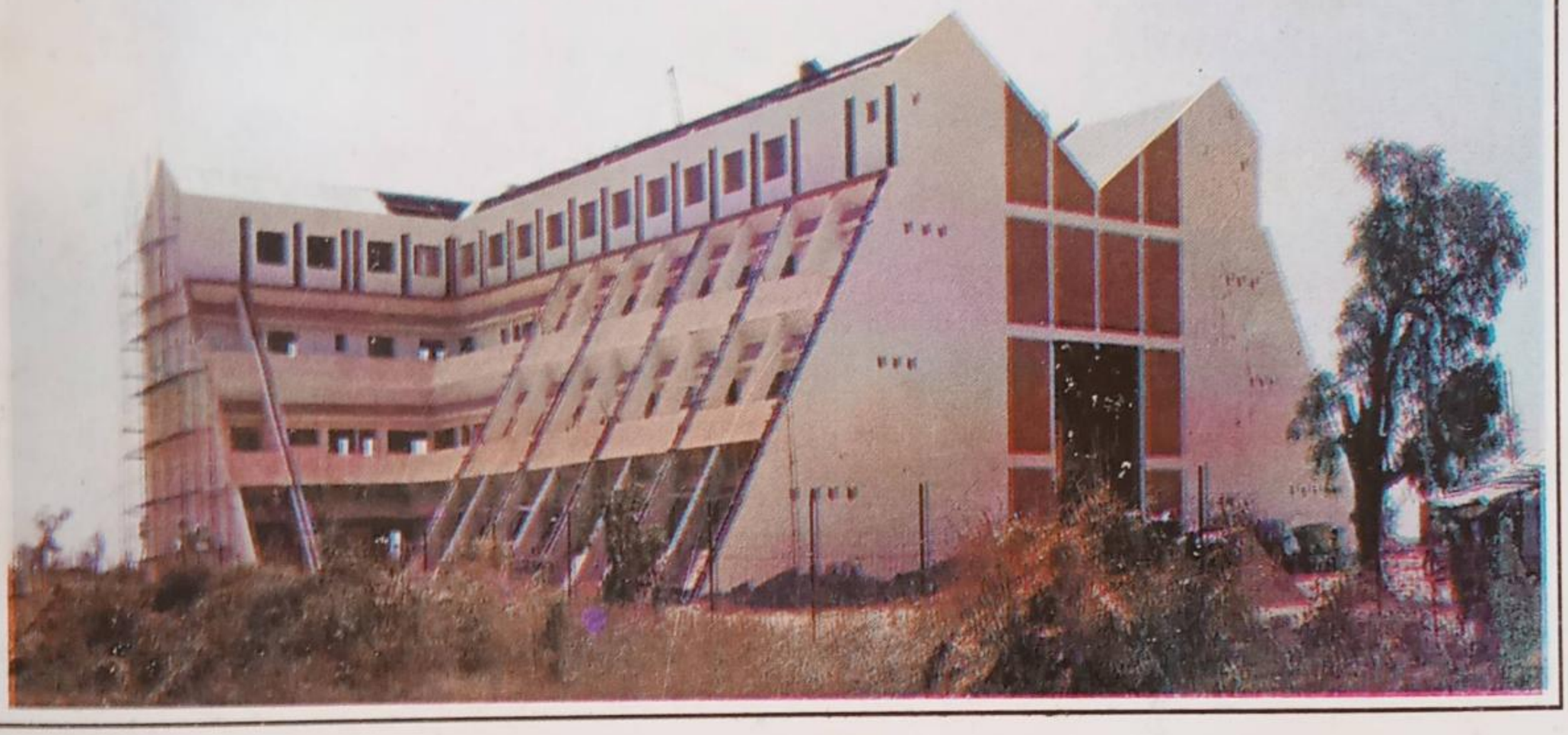

BOOK OF PROCEEDINGS

Theme:

PRESERVING THE ENVIRONMENT

Date:

27th-29th February 2008

Edited by:

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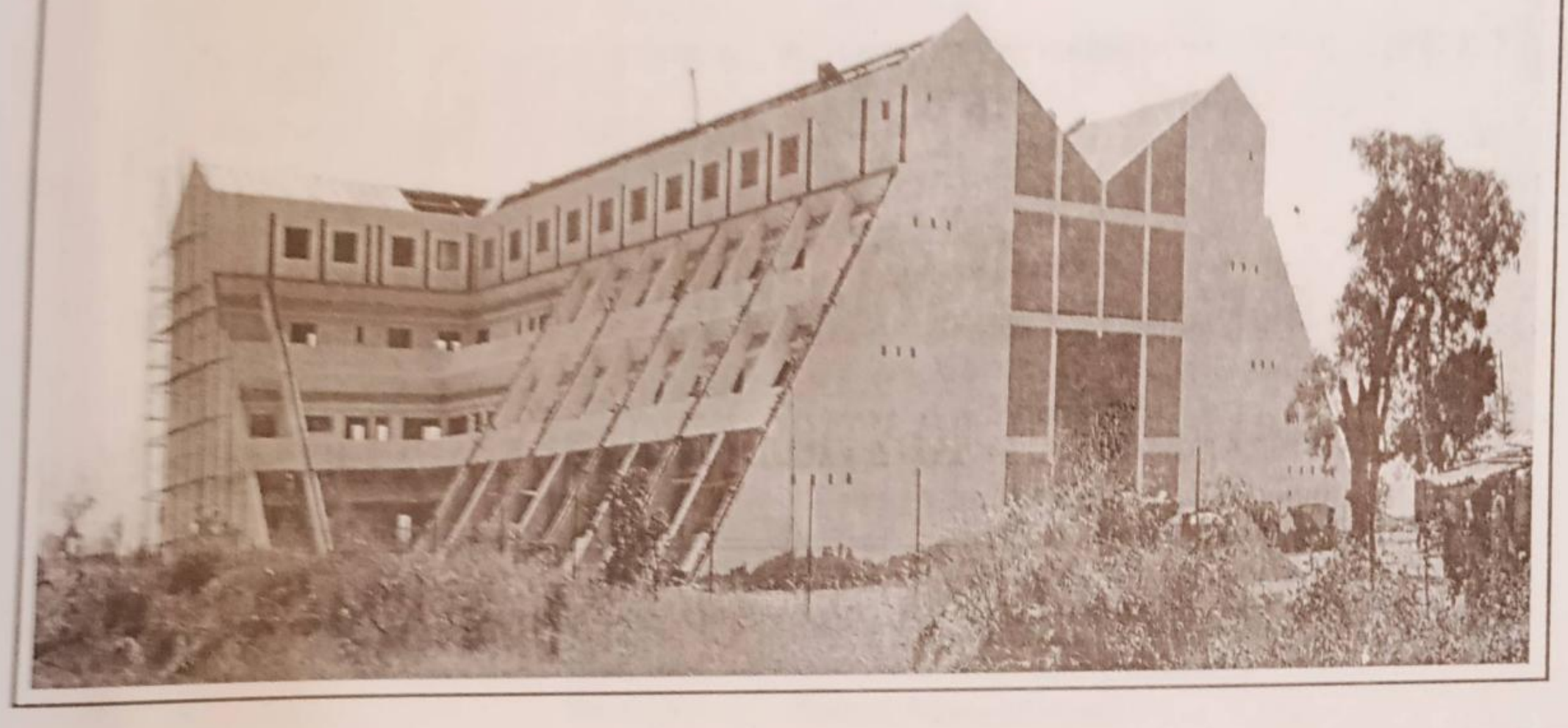

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BIODEGRADING: A Giant Stride Towards Solving Urban Solid Waste Problem

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ABSTRACT
Man's daily activities result into generation of waste, but the rate and volume of waste generated differ place to place and country to country. Population, consumption and technology are crucial factors in determining the amount of waste produced. However, solid waste problem has become a serious environmental problem of our generation with its subsequent effect on water, air, land and consequently on the quality of the environment. This paper examines the source of waste disposal, biodegrading of polymers- a new method in waste management, the advantages of biodegradable materials; that is, decomposing easily when exposed to favorable humidity and soil conditions. The studies conclude that if sustainable environment is to be achieved, then biodegradability of polymers should be encouraged. Though they may be expensive yet the benefits far outweigh their cost.
Keywords: *Biodegrading, environment, polymers, solid waste, sustainability.*

INTRODUCTION

These days, more than ever before there is a rapid increase in population growth. With this rapid population growth also comes the great need for resources and so consumption rate increase. The major concern however is not as much about the consumption level as it is about the bye-products that come up in its us. (W. Herbst, 2007). The problems of waste generation and management especially in our cities have become one of the most intractable environmental problems facing us today. The gathering and disposal of solid wastes became a major public health issue of our time and this needs some urgent attention if our environment is to be protected.

For centuries back and up to this present time, man's non degradable waste products have generally been hauled along with the degradable wastes for disposal in open gullies, valleys or abandoned pits. This disposal method has led to more deterioration of the local environment around the dumping grounds. Hence, the destruction the natural beauty of our environment (Ahmed, 2000).

Looking straight at the present problem, we see that it needs urgent attention, since hiding waste underground relocates troubles into the future, burning waste distributes toxins into the air and pollutes our water. There is therefore the urgent need for a safe and reliable method of disposing our solid waste, especially the non degradable waste like polymer products. It is in view of this that this paper seeks to examine the advantages of biodegrading in solid waste management in order to achieve a sustainable environment.

WASTE AND SOLID WASTES GENERATION

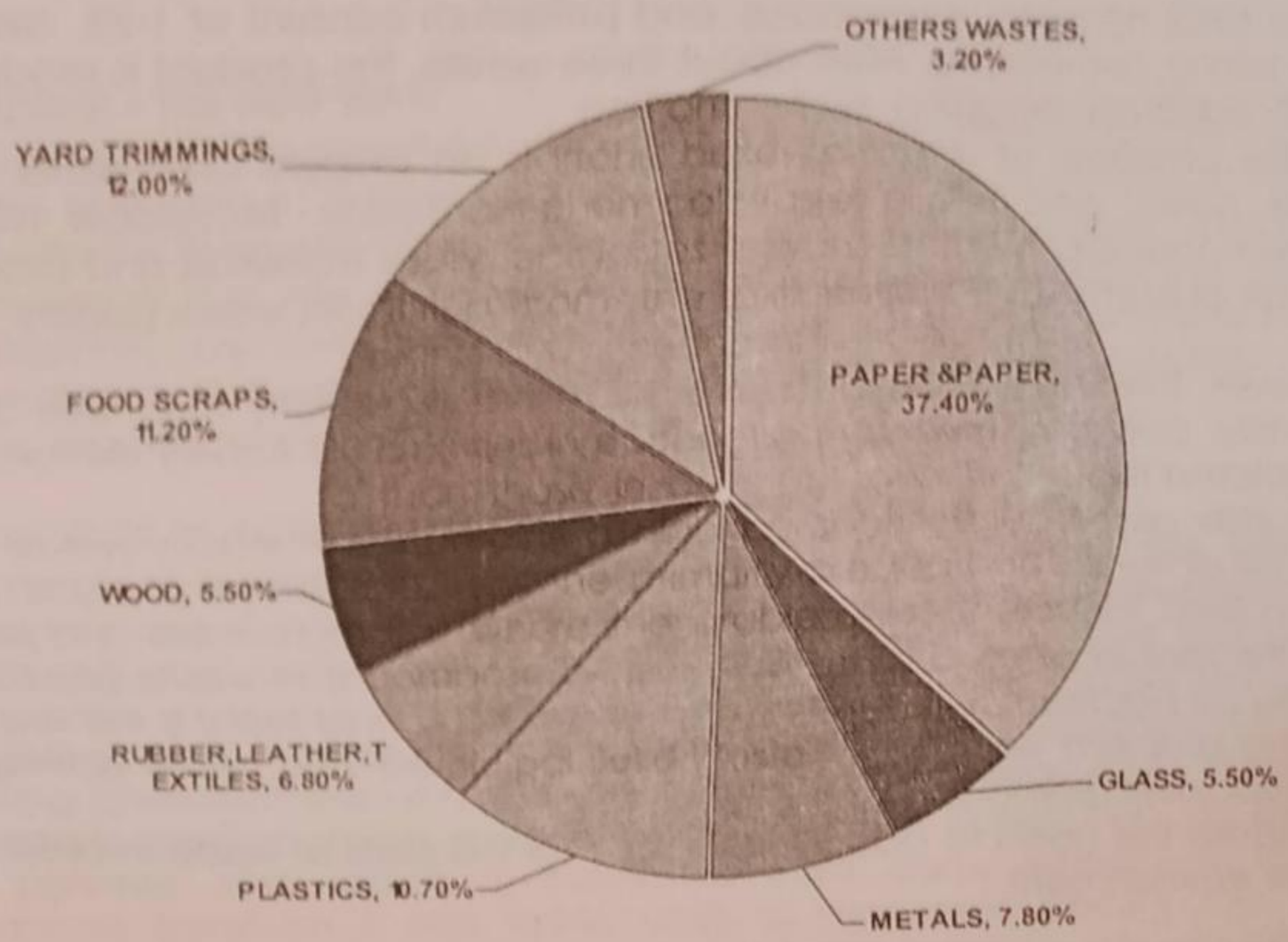
Waste is defined by Adedibu, (1982), as the non-gaseous and non- liquid waste resulting from domestic activities of the inhabitants of a particular residential area. It is the unwanted residue of the resources within human disposal. Basically, wastes are of two types, that is, solid waste and liquid waste. Liquid wastes are liquid contaminants that affect water. They could be in form of oil spillage, toxins from textiles factures etc. While solid wastes are unwanted solid materials such as garbage, paper, plastics and other synthetic materials, metals and wood.

According to Yusuf (2000), factors such as inadequate knowledge of the composition of solid wastes, the rate to which population generates wastes, inadequate and uncoordinated infrastructural facilities for waste disposal, and rural- urban drifts are the major causes of poor environmental sanitation. It is therefore evident that the volume of waste generated in a particular area is directly related to the level of income (standard of living) and population of that area. The Federal Environmental Protection Agency (FEPA) has categorized waste into three (3) main types as follows:-

A. the municipal waste arising from residential, institutional, commercial and street-left-over, include pieces of papers, food waste, plastic and rubber, pieces of metal, tins, cans, leaves and grasses among others.
B. the industrial waster such as cartons, boxes, crates, scraps, of building materials, wood and celluloid materials, chemical wastes-oil and plastics.
C. Toxic wastes: This category of wastes is very harmful to health for example, carbon monoxide entitled from the exhaustible fumes of cars, machinery, chimney, generating plants and other combustible items (FEPA 1991).

According to Jerry (2006) cities in economically developed countries produce far more solid waste per capita than those in developing countries and that waste from developed countries typically contains a high percentage of synthetic materials that take longer time to decompose than the primarily biodegradable waste materials that decompose easily. Hence, that is where the problem lies that are the synthetic waste which takes longer time to decompose.

Fig. 1 **Components Of Municipal Solid Waste**



SOURCE: *America Environment Protection Agency, 2000 data (adopted from Microsoft Encarta 2006)*

SOLID WASTE DISPOSAL METHODS

In solving urban waste problems, a good number of methods could be employed. These methods could either be short term or long term but are largely capital intensive but the benefits far outweigh the cost. Disposal of solid wastes on land is by far the most common method and probably accounts for more than 90% of the refuse disposal methods. Incineration accounts for most of the remainder, whereas composting of solid waste accounts for only an insignificant amount. Selecting a disposal method depends almost entirely on costs, which in turn are likely to reflect local circumstances. (Jerry, 2006). The following are the available methods of dealing with urban waste.

Landfill: Sanitary landfill is the cheapest satisfactory means of waste disposal if only suitable land is within economic range of the source of the wastes: Typically, collection

and transportation account for 75% of the total cost of solid waste management. In a modern landfill, refuse is spread in thin layers, each of which is compacted by a bulldozer before the next is spread. When about 3m (about 10ft) of refuse has been land down, it is covered by a thin layer of clean earth, which also is compacted. Pollution of surface and grand water is minimized by lining and contouring the fill, compacting and planting the cover, selecting proper soil, diverting upland drainage and placing wastes in sites not subject to flooding or high ground water levels.

Incinerator: In incinerator of conventional design, refuse is burned on moving grates in refractory-lined chambers; combustible gases and the solids they carry are burned in secondary chambers. Combustion is 85-90% complete for the combustible materials. In addition to heat, the products of incineration include the normal primary products of combustion-carbon dioxide and water as well as oxides of sulfur and nitrogen and other gaseous pollutants, nongaseous products are fly ash and unburned solid residue.

Composing: Composting operations of solid wastes include preparing refuse and degrading organic matter by aerobic microorganisms. Refuse is presorted, to remove materials that might have salvage value or cannot be composted, and is ground up to improve the efficiency of the decomposition process. The refuse is placed in long piles on the ground or deposited in mechanical systems, where it is degraded biologically to a humus with a total nitrogen, phosphorus, and potassium content of 1-3%, depending on the material being composted. After about three weeks, the product is ready for curing, blending with additives, bagging, and marketing.

Recycling: The practice of recycling solid waste is an ancient one. Metal implements were melted down and recast into another form. Today, recyclable materials are recovered from municipal refuse by sorting out the waste materials and processing into other materials or forms e.g. toilet tissue can be produced from waste papers.

However, these methods discussed have not sufficiently help with our polymer waste. Naturally, polymers are non-bridgeable in nature. Sujit Banerji reinforces this fact when he declared that:

"The little plastic shopping bay your local grocer generously hands out to you may outlive all of humanity. In Mumbai, annually over 20,000 tonnes of plastic is left to last for eternity in BMC landfills. The fact that plastic is non-biodegradable and just refuses to go away is the root of all problems. Unlike vegetable and paper waste, plastic cannot be decomposed by bacteria or other living organisms. You could toss it is the sea or bury it in the earth, the problem will not go away. It will stay there and cause damage". (Indian express Newspapers (Bombay) Ltd. 1998)

There is therefore the need to adequately cater for this class of waste in order to achieve a sustainable environment.

THE NEED FOR A SUSTAINABLE WASTE MANAGEMENT SYSTEM

Generally, bad refuse/waste disposal schemes as a whole characterize most of the urban centres in Nigeria. Refuse mounds and dumps are common features of the contemporary urban centres. In most cases, many people dispose their wastes in cities gutters, drains, streams and rivers. The waste material so deposited become clogged up and flooding results at the onset of a rainy season as the available water ways have been blocked due to the deposit (Yusuf, 2000).

Waste management therefore relates to waste handling, controlling and monitoring of the technique adopted in managing the available waste (Mabogonje, 1974). In 2004, the U.S.A. waste management Agency developed the waste management Hierarchy which they referred to as the Three R^s ($3R^s$) - Reduce. Reuse and recycle. In this hierarchy, waste management strategies were classified according to their durability in terms of waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefit from products and to generate the minimum amount of waste.

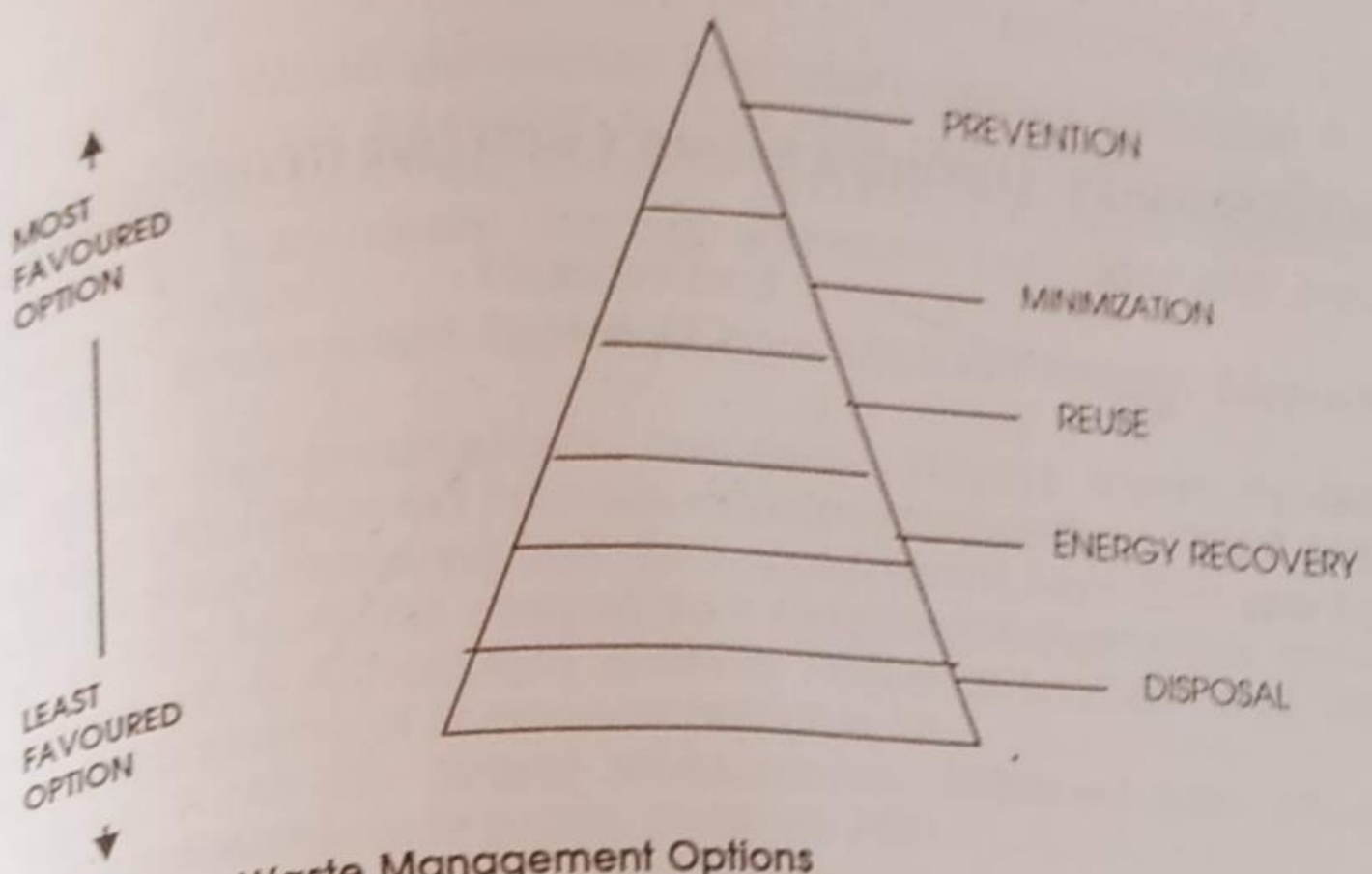


Fig II: **Waste Management Options**
Source: Waste management Manual (U.S.A. Govt. 2004)

BIODEGRADING – THE NEW WAY

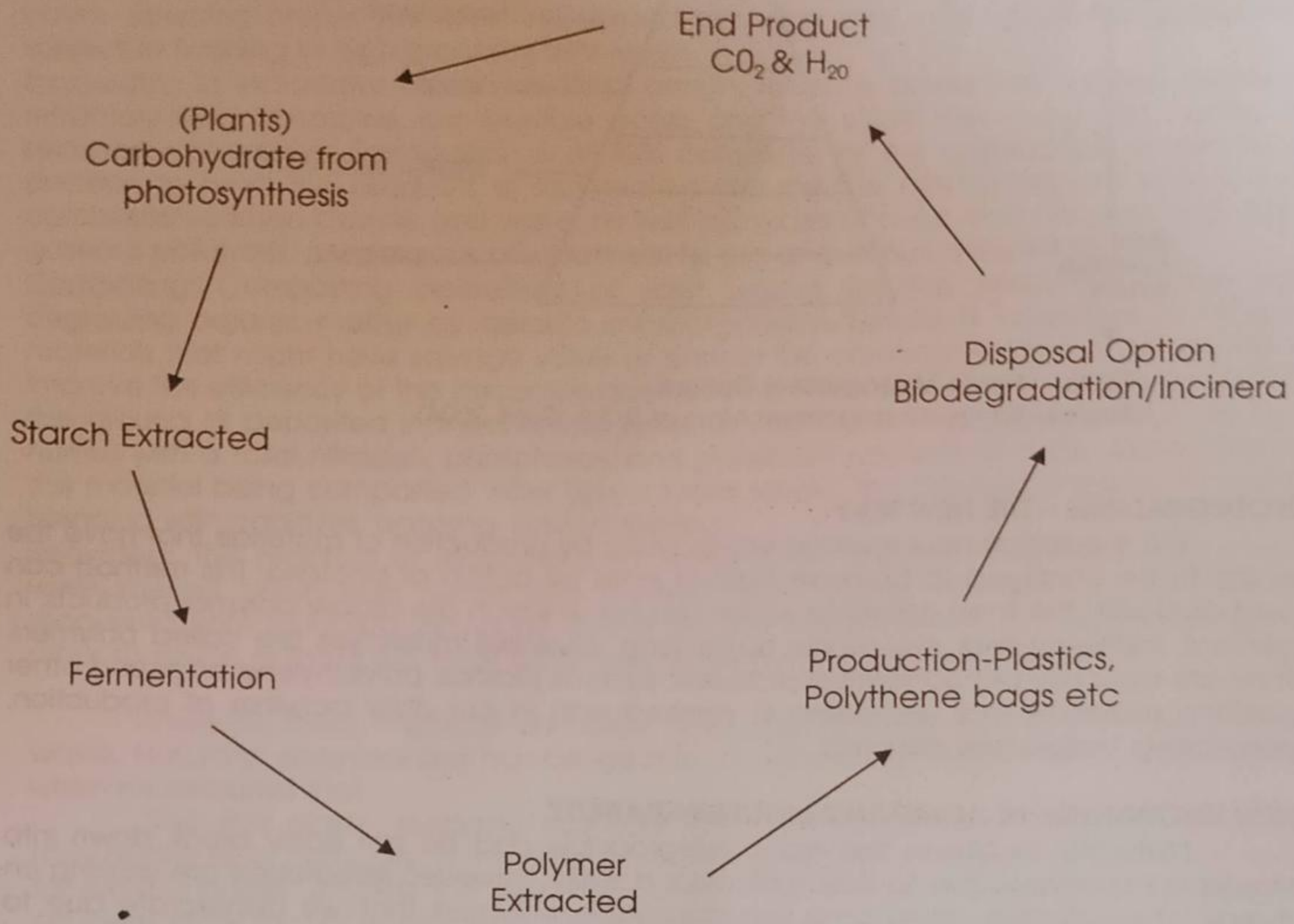
This is a rather new method which works by production of materials that have the ability to be changed to harmless natural state by action of bacteria. This method can help deal with the most notorious waste around us which are usually polymer products. In general, materials that are made up of long, chainlike molecules are called polymers. They are basically petrochemical products, such as plastics, polyethylene bags and other packing materials that we come in contact with in our daily activities of production, purchasing, usage and disposals.

NEW KNOWLEDGE IN ACHIEVING BIODEGRADABILITY

Naturally, polymers are non-biodegradable and do not easily break down into simpler components due to their molecular stability. However, researchers are working on a way of producing developing biodegradable polymers that will disintegrate due to bacterial action or exposure to sunlight. According to Terry, (2003), starch is a natural polymer. Starch as a natural polymer is a white, granular carbohydrate produced by plants during photosynthesis and it serves as the plant's energy store. Cereal plants and tubers normally contain starch in large proportions. This starch can be modified into a different polymer. First, starch is harvested from corn, wheat or potatoes, then microorganisms transform it into lactic acid, a monomer. Finally, the lactic acid is chemically treated to cause the molecules of lactic acid to link up into long chains which bond together to form a polymer called polylactide (PLA).

Polylactide (PLA) can be used for products such as plants pots and disposable nappies. It has been commercially available mostly in the developed countries since 1990; and certain blends have proved successful in medical implants, sutures and drug delivery system because of their capacity to dissolve away over time. Terry, (2003) also observed that polymer can be produce by bacteria action. This involves getting bacteria to produce granules of a polymer called Polyhydroxyalkanoate (PHA) inside their cells. Bacteria are simply grown in culture, and the polymer is then harvested. Unfortunately, these PLA and polymers are significantly more expensive to produce and, as yet, it is not having any success in replacing the widespread use of traditional petrochemical polymers. But when we consider the benefit, if far outweigh the cost.

FIG. III: BIODEGRADABILITY- STRIKING A BALANCE WITH OUR ENVIRONMENT



Source: Adopted from William D. Luzier (1991)

BENEFITS OF BIODEGRADABLE POLYMERS

- The development of biodegradable polymer based on the starch seems particularly for several reasons to be better and could be cheaper because starch is cheap, available raw material all year round, has the attribute of decomposing easily within various environmental conditions and besides, can be cremated.
- With the use of biodegradable polymers, there will definitely be a drastic reduction in pollution level, hence, positive impact on both plants and human health.
- The ability of these polymers to decay means that there will be reduction in levels of waste left for disposal.
- Biodegradable polymer may be expensive to achieve, however in the long run it is cost effective, thus playing a preventive role for future challenges.

CONCLUSION

Biodegrading is the easiest and fastest way of dealing with urban solid waste, but Biodegrading is only possible where there are Biodegradable products. Unfortunately, the production of these Biodegradable as with PLA and PHA polymers are very expensive, but in the long run could be far cheaper when considering the benefits. All we need is a possible legislation to regulate the production of these polymers, the infrastructures for the collection of these Biodegradable and the development of the idea that this process is a valid solution to eliminating urban waste.

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