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Waste Management and their Utilization

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***Abstract*- More production equals more waste, more waste creates environmental concerns of toxic threat. An economical viable solution to this problem should include utilization of waste materials for new products which in turn minimize the heavy burden on the nation's landfills. Recycling of waste construction materials saves natural resources, saves energy, reduces solid waste, reduces air and water pollutants and reduces greenhouse gases. The construction industry can start being aware of and take advantage of the benefits of using waste and recycled materials. Studies have investigated the use of acceptable waste, recycled and reusable materials and methods. The use of swine manure, animal fat, silica fume, roofing shingles, empty palm fruit bunch, citrus peels, cement kiln dust, fly ash, foundry sand, slag, glass, plastic, carpet, tire scraps, asphalt pavement and concrete aggregate in construction is becoming increasingly popular due to the shortage and increasing cost of raw materials. In this study a questionnaire survey targeting experts from construction industry was conducted in order to investigate the current practices of the uses of waste and recycled materials in the construction industry.**

Key words: Global warming, HDPE/PET, MPPW, fly ash.

I. INTRODUCTION

Today everywhere there are problems by plastic materials, fly ash and other materials so we use this material as fiber in civil application according to their properties, the reinforced soil technique allows the most any kind of fill soil, however the use of granular material having good drainage capacity and high internal friction angle is suggested. Earth structure such as highways and airport pavements, embankment, landfills, foundation earth slopes and retaining walls are built with soil reinforcement for improved safety against sliding or bearing failure and to improve the settlement response. In the present investigation HDPE/PET & MPPW (Medical plastic packing waste Stripes) are used as reinforcing material. These fiber strips have adequate tensile strength and retain the same strength for long span of time and steel waste is also used in concrete as a steel aggregate.

The waste materials that are commonly known are blast furnace slag, fly ash, silica fume(from Power Plants) recycled aggregates (from Demolition sites), solid waste, plastic waste (Domestic waste) and rubber waste (commercial waste). Partial replacement of Portland cement with waste materials like blast furnace slag, fly ash, silica fume (from Power plants), recycled aggregates (from Demolition sites), solid waste, plastic waste (Domestic waste) and rubber waste (commercial waste) will be a great help in reducing environmental pollution and also in reduction in manufacturing of cement and other material that required for the construction activities. . One of the major challenges of our present society is the protection of environment.

Table 1 Waste Generation in Raipur

CITY	Waste quantity generated	waste generation rates (kg/c/d)
Nashik	157	0.19
Lucknow	12.48	0.21
Gandhi Nagar	44	0.21
Ranchi	208.2	0.23
Allahabad	509.2	0.51
Nagpur	503.5	0.23
RAIPUR	***600***	***0.25***

II.DIFFERENT TYPE OF WASTE MATERIAL AND ITS UTILIZATION

(A) Plastic waste-

The rapid Urbanization and Industrialization in India has resulted in large deposition of Plastic waste. Plastic waste, consisting of carry bags, cups etc. can be used as a coating over aggregate and this coated stone can be used for road construction as cement and asphalt concrete. Co-processing of plastic waste as Alternative Fuel and Raw Material (AFR) Co-processing refers to the use of waste materials in industry process such as cement, lime or steel production and power stations or any other large combustion plants. Co-processing indicates substitution of primary fuel and raw material by waste, recovering industry and material from waste. Another option for disposal of plastics waste has been considered by CPCB conversion of plastics waste into liquid fuel.

(B) Fly ash-

Fly Ash is a mineral by-product of coal combustion in thermal power plants. It is generally finer than cement and consists of mostly of spherical glassy compounds of complex composition. It is a waste material and dumped on the land adjoining thermal power plants and townships. Fly ash

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brick (FAB) is a building material, specifically masonry units, containing class C fly ash and water. Compressed at 28 MPa (272 atm) and cured for 24 hours in a 66 °C steam bath, then toughened with an air entrainment agent, the bricks last for more than 100 freeze-thaw cycles. Owing to the high concentration of calcium oxide in class C fly ash, the brick is described as "self-cementing". The manufacturing method saves energy, reduces mercury pollution, and costs 20% less than traditional clay brick manufacturing.

(C) Rice husk-

Rice husk ash (RHA) is an agricultural based pozzolanic material, generated by rice mills in huge quantities. This paper summarizes the experimental work of concrete in which ordinary Portland cement (OPC) cement were replaced by Rice husk ash (RHA). Due to the wide use of concrete the cost of building materials increasing very quickly in some parts of the world also in developing country like India so only the industries, business cooperation, government and few individual can afford it. This rising cost can however be reduced by use of alternative building materials that are locally available and cheap. Some industrial and agricultural waste products may be use as building material. There are different wastes available in large quantities that have properties to make concrete. Rice husk is one of them; Rice husk is a by-product of agricultural waste generated in rice mills. During milling of paddy 80% weight found out as rice and remaining 20% weight received as husk. This husk is used as fuel in industries to generate steams and other purposes. This husk contains about 75 % organic fickle matter and the remaining 25 % of the weight of this husk is converted into ash during the firing process, this ash is known as rice husk ash (RHA).

(D). Construction and demolition waste-

The waste that are generated from the construction waste known as construction waste and demolition waste. The usage of construction and demolition wastes as an aggregate for the manufacture of concrete is considered in new research studies. Recycled aggregates are the aggregates obtained from construction and demolition waste (CDW), from residential, commercial, industrial structures or from pavements. These aggregates can be re-used in all the construction activities with some % of volume of construction, in order to have the same mechanical properties of hardened concrete, without disposing these waste materials in to the environment. It has been felt that recycling would be the most promising waste management process for the disposal of materials. This will also help in less dependence of aggregates required in making rigid or flexible pavements over a long period. Due to issues related to sustainability and limited natural resources, it is clear that the use of recycled, like crushed concrete and asphalt, will be very useful in cost of saving also.

(E).Animal blood waste-

How could cattle become any more useful? Their hide is already used to produce leather, their milk is used for cheese butter and, well, milk, they taste great in a burger and continue to serve as draft animals in many parts of the world. British architecture school graduate Jack Munro has found a way to make a building material using one of the few materials from cattle that currently largely goes to waste – blood. Munro's "Blood Bricks" are created by first mixing fresh blood with an anticoagulant (EDTA) to prevent it thickening too quickly. Although he used bullocks, blood from other animals could also be used. He then adds **sodium azide** as a preservative to prevent decomposition and bacteria growth. After a number of unsuccessful attempts at creating a glue by adding chemicals such as glacial acetic acid, Munro turned to the simpler combination of blood and water that is then mixed with sand. Placing the resulting mixture in formwork and baking it for an hour at 70° C (158° F) for an hour causes the blood proteins to coagulate to produce a stable, waterproof brick. With Munro estimating that 30 litres (7.9 gal US) of blood could be recovered from a single bullock and sand plentiful, he believes Blood Bricks have the potential to replace mud bricks as a building material in arid regions. To this end, he is looking to raise enough money to build a prototype home using Blood Bricks in Siva, Egypt. If he's successful, we might start seeing a lot of "red brick" homes being built in similar areas.

(F).Waste steel-

In civil construction steel is used in a major amount. Generally in civil construction we saw that the steel was wasted i.e. steel bars of different- different diameters and other steel sections or channels. The main causes of wastage are resulted from cutting, damages during storage and rusting also from a major part of wastage.

Table 3 Different type of gases

Table 2 Average material wastage among different types of projects

TYPE OF PROJECT	Average Material Wastage
Public Housing	3.95 %
Private Housing	5.32 %
Private Commercial	3.94 %
Composite Building	5.07 %
Industrial	3.00 %
Monastery	4.37 %
School	– %

These wastage steel bars are chopped in small size as the course aggregate maximum size then it mixes into the concrete for various structure members like raft foundation.

(G).Garbage-

Kitchen waste disposal units increase the load of organic carbon that reaches the water treatment plant, which in turn increases the consumption of oxygen. Metcalf and Eddy quantified this impact as 0.04 pound of biochemical oxygen demand per person per day where disposers are used. An Australian study that compared in-sink food processing to composting alternatives via a life cycle assessment found that

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while the in-sink disposal performed well with respect to climate change, acidification, and energy usage, it did contribute to eutrophication and toxicity potentials. This may result in higher costs for energy needed to supply oxygen in secondary operations. However, if the waste water treatment is finely controlled, the organic carbon in the food may help to keep the bacterial decomposition running, as carbon may be deficient in that process. This increased carbon serves as an inexpensive and continuous source of carbon necessary for biologic nutrient removal. The use of garbage as biogas. Biogas typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Biogas is a renewable energy source and in many cases exerts a very small carbon footprint. Biogas can be produced by anaerobic digestion with anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials.

Table 4 Different Type of waste and their utilization

Compound	Formula	%
Methane	CH4	50-75
Carbon dioxide	CO2	25-50
Nitrogen	N2	0-10
Hydrogen	H2	0-1
Hydrogen sulphide	H2S	0-3
Oxygen	O2	0-0.5

(H).Waste glass-

A highly transparent material produced by melting a Mixture of silica, soda, ash and CaCO3 at high Temperature, and then by cooling the melted mixture for Solidification without crystallization is known as glass. Glass has proven its importance in our lives through manufactured products such as sheet glass, bottles, Glassware, and vacuum tubing. However, it is not biodegradable and therefore creates a problem for solid waste disposal. The disposal into landfills also does not provide any environment-friendly solution (Shao et al., 2000). Hence, the use of waste. Glass in construction materials can be a worthy solution to the environmental problem caused by this solid waste. A clean dry glass powder is useful as a substitute for Portland cement in concrete. The finely ground glass having a particle size finer than 38 _m contain a high Amount of amorphous silica, which exhibits a pozzolanic Behaviour. Hence, the use of ground Glass in concrete can be advantageous with respect to Hardened properties and durability. Moreover, using Waste glass as fine aggregate would produce better workability in concrete, provided its geometry is almost spherical and preferable to produce a workable mixture.

Table 4 Different Type of waste and their utilization

S/No	Type of solid wastes	Source details	Recycling and utilization potentials
1	Agro-waste (organic)	Baggage, rice and wheat straw and husk, saw mill waste, ground nut shell, jute, sisal, cotton stalk, vegetable residues	Cement boards, particle boards, insulation boards, wall panels, roof sheets, binder, fibrous building panels, bricks, acid-proof cement, coir fibre, reinforced composites,
2	Industrial waste (inorganic)	Coal combustion residues, steel slag, bauxite red mud, construction debris	Bricks, blocks, tiles, cement, paint, fine and coarse aggregates, concrete, wood substitute products, ceramic products
3	Mining/mineral waste	Coal washers waste; mining waste tailing from iron, copper, zinc, gold and aluminums industries	Bricks, fine and coarse lightweight aggregates, tiles
4	Non-hazardous waste	Waste gypsum, lime sludge, lime stone waste, broken glass and ceramics, marble processing residues, kiln dust	Blocks, bricks, cement clinker, hydraulic binder, fibrous gypsum boards, gypsum plaster, super-sulfated cement
5	Hazardous waste	Contaminated blasting materials, galvanizing waste, metallurgical residues, sludge from waste water and waste treatment plants,	Boards, bricks, cement, ceramics, tiles
6	Quarry dust	Mining/mineral	Fine and coarse aggregates, concrete, bricks, tiles, blocks, surface finishing materials

(I). Rubber tires-

Rubber tires are a ductile, non-biodegradable material that can exist for a long time without any degradation. The growing amount of waste rubber tires has resulted in an environmental problem in several countries, open burning and using as a fuel are considered the easiest way to get rid of the waste rubber tires, even though these processes lead to a very serious health hazard. Since the waste rubber tires cannot be biodegradable even after a long period of landfill treatment, material and energy recoveries are viable alternative to the disposal of this solid waste. Several investigations were carried out on the use of scrap tire particles in Portland cement concrete. The processed rubber tires were used to replace fine and coarse aggregates depending on the fineness of particles. As concrete has become the most widely used construction material, the incorporation of rubber tire particles in concrete would be a very good and promising way to utilize the large quantities of waste rubber. The use of scrap rubber tire particles in concrete Would not only make a good use of such waste materials but also help to improve some concrete properties.

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The rubberized concrete shows excellent flexibility, ductility and energy absorbency as compared with conventional concrete. Furthermore, the tire rubber is preferable for use in self-consolidating concrete since it effectively interacts with cement matrix to produce high flow ability along with good cohesiveness.

(J). Organic fibers-

Organic fibers can be produced from a number of solid wastes such as bamboo, coconut, date palm, oil palm, sugar palm, sugarcane, and vegetable wastes. Some of these fibers are chemically more inert than either steel and glass fibers. They are also cheaper and more importantly most of them can be natural. Bamboo fibers can be extracted from the bamboo wastes. This kind of fibers is useful to produce polymeric composites such as bamboo fiber reinforced plastic and polyester composites reported that bamboo fiber reinforced plastic composite can be used in a number of applications as a suitable replacement for the commercially available glass fiber reinforced plastic (GFRP) composite. Coconut fibers can be used with Portland cement to manufacture fiber-cement board. In a recent research, coconut fibers were used in reinforced concrete beam along with rice husk and sugarcane waste fibers the performance of composite beam was evaluated under monotonic loading and compared with conventional concrete beam. It was found that the beam's resistance to cracking due to seismic load improved in structural systems. Date palm has a fibrous structure consisting of four types of fiber. They are leaf fibers in the peduncle, baste fibers in the stem, wood fibers in the trunk and surface fibers around the trunk, which can be utilized to produce construction products. It was observed that the flexural strength and toughness improve whereas the
Compressive strength decreases with the increased length and percentage of date palm fibers. Oil palm fiber is a non-hazardous biodegradable material extracted from oil palm's empty fruit bunch through decoration process. The palm fibers are clean, non-carcinogenic, and free from pesticides and soft parenchyma cells. These fibers are versatile as well as stable and can be processed into various dimensional grades to suit specific applications such as erosion control.

III.METHODOLOGY

(A).Data collection-

Primary and secondary sources of data collection have been employed. The study uses three sources of information for the primary data collection. This includes interviews, survey; collection of information from a group through interviews or application of questionnaire and observation interviews, and participant observation.

(B). Interview-

The first part of the primary data collection has been attained through interviews because this was the most possible way of getting information from people with knowledge about municipal solid waste management issues. The four municipalities from two major cities in Tanzania were contacted through e-mails and telephone calls and based on the field of study representatives from each municipality were chosen basing on their knowledge and understanding of the waste management systems and their administrative responsibilities. In all 6 interviews with 9 interviewees were conducted. The interview among the interviewees lasted for 30 and 90 minutes depending on their involvement and the information required. A semi- structured interview has been suitable for the research this is because it left room for discussion

(C) Participant observation-

Participant observation has been used as a way to examine the problem on the ground. Being a native of Raipur and knowing most places in India contributed to the observation. Participant observation in the solid waste management system has been an eye opener to both revealed and those not revealed in the interviews.


एग्रीमेंट पर किए आयुक्त एवं कंपनी के अधिकारियों ने हस्ताक्षर

हर घर से उठेगा कचरा

Fig 1 News article for the waste collection

Fig No-02 Trenching ground Sarona, Raipur (C.G)

IV. RESULT

This report focuses on the various options available for the disposal of solid waste and the utilization of waste into useful product. The present solid waste management crisis in Raipur is impact on public health and environment and quality touch upon the effort toward solid waste management in the past. The future scope of this report is that it will provide the options and various methods for utilization of waste so that the waste can be minimized and properly managed in the future and clean environment and human health**.** During different industrial, mining, agricultural and domestic activities, huge quantity of solid wastes are being generated as by-products, which pose major environmental problems as well as occupy a large area of lands for their storage/disposal. There is a tremendous scope for setting up secondary industries for recycling and using such huge quantity of solid wastes as minerals or resources in the production of construction materials.

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V. CONCLUSION

The overall conclusion of this study on present status of solid waste management and their utilization are as follows….

- Government is making significant efforts to keep city clean and hygienic.
- New techniques have been developed for proper management of solid waste.
- We are reducing, reusing and recycling the solid waste with the help of new techniques and efforts
- Various programs are keeping running for creating awareness among the peoples.
- Conversion of waste materials into useful materials, e.g. Animal excreta into organic materials like manure, humus.
- Encourage and facilitate organized recycling system.
- Need for e-waste policy and legislation.
- The idea of reusing the waste material is very exciting and encouraging specially when it will be helpful in minimizing destruction to earth's crust and green forest cover by virtue of reduced mining.
- By suitable recycling and reuse, these waste materials will not contribute to waste loads at dumping and disposal sites.
- Construction industry can contribute towards its commitment to protection of environment by encouraging use of recycled concrete stones and bricks.
- Recycling and reuse of the waste materials are found to be an appropriate solution to the problems of dumping hundreds of thousand tons of waste on natural soil.

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