An Overview Reuse of Solid Waste for Constructing Building Materials

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Abstract— Waste generation and its management are being widely debated across the globe and in recent years, it has become a niche spot. After the advancement in industrial revolution, different types of waste came into existence which is often non-biodegradable and highly hazardous. A large proportion of the waste is not properly managed and dumped in unplanned sites that are creating severe environmental hazards. Implementation of the 3R's as a substantial measure to reduce, reuse and recycle the generated solid waste will have a profound socioeconomic impact acts as a sustainable and socioeconomic option for solid waste management. In recent years, increased emphasis has been placed on developing recycling techniques for industrial waste products, with the goals of protecting the environment. Recycling of such waste as building materials appears to be viable solution not only to such pollution problem but also to the problem of economical design of buildings. It increases the popularity of using environmental friendly, low cost and light weight construction materials which benefits to the environment.

Key words: Environment Protection, Reuse, Reuse, Recycle, Solid Waste, Building Material

I. INTRODUCTION

Solid waste management is one of the major environmental encumbrances in many Asian countries. World population growth, urbanization, rising living standards and rapid technological development as well as modern lifestyles and consumption patterns contribute to the increase in solid waste and the changes in its composition have contributed to an increase both in the quantity and variety of solid wastes generated by industrial, mining, domestic and agricultural activities [1],[7]. Our world is facing severe problem of population. People are using various kinds of products, which are produced from household, industries, hospitals, public place, etc from which solid waste is generated in large quantities. Due to which pollution is generated [5].

Solid waste means any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations, and from community activities, In simple words Solid wastes are any discarded or abandoned materials [11].

The major quantity of wastes generated from agricultural sources include sugarcane baggase, paddy and wheat straw and husk, wastes of vegetables, food products, tea, oil production, jute fibre, groundnut shell, wooden mill waste, coconut husk, cotton stalk etc. The major industrial non-hazardous inorganic solid wastes are coal combustion residues, bauxite red mud, tailings from aluminum, iron, copper and zinc primary extraction processes. Mining/Mineral waste include Coal washeries waste, mining overburden waste tailing from iron, copper, zinc, gold, aluminums industries Non-hazardous other process waste include Waste gypsum, lime sludge, lime stone waste, marble processing residues, broken glass and ceramics, kiln dust. Hazardous Waste includes Metallurgical residues, galvanizing waste, Tannery waste [6].

Wastes are materials which are discarded after use at the end of their intended life-span. Sustainable waste management involves managing waste in an environmentally sound, socially satisfactory and a techno-economically viable manner. The significance of integrated solid waste management systems in recent years increased due to the growing number of populations and problems of waste management issues affecting the daily lives of people and the impact on the environment. Implementation of the 3R's will have a profound socioeconomic impact, also modern 3R's (Reduce, Reuse and Recycle) strategy acts as a sustainable and socioeconomic option for solid waste management. 3R's (Reduce, Reuse, and Recycle) system were proposed with priority on source minimization, intermediate treatment then final disposal and enlighten the waste generators to practice 3R's as a substantial measure to reduce, reuse and recycle the generated solid waste there all day.

The 3R's are concerned with better resource efficiency in accordance with the following principles:

- Reduce – Eliminating the generation of waste, where possible by stopping it coming on to site in the first place
- Reuse – Making use of materials in their original state on the same site or at other sites
- Recycle – Turning materials into new products for other purposes.

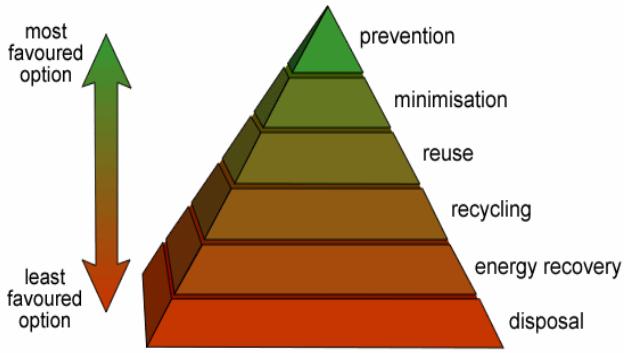

Fig. 1: Waste Hierarchy Source: [8]

Solid waste is defined as any unwanted material intentionally thrown away for disposal because it has no longer value as useful material. Generally solid waste is of two types biodegradable and non-biodegradable. Biodegradable solid waste is that wastes which are easily decompose by micro-organisms where as non-biodegradable solid wastes are those waste which does not decompose by micro-organisms. Industrial solid waste is defined as waste that is generated from any industrial or manufacturing process or waste generated from non-manufacturing

activities. Industrial solid wastes would soon become a major problem as some of them are non-biodegradable and usually burned thus releasing highly toxic fumes and pollutant in the surrounding atmosphere. Therefore, an alternative is to turn these solid wastes into useful product which may serve two benefits [3].

- The reduction of wastes that reduced the amount of solid waste to landfill sites.
- Reduces pressure on natural sources.
- Introduction of new materials in the construction sector which benefits to environment.

In recent years, increased emphasis has been placed on developing recycling techniques for industrial waste products, with the goals of protecting the environment. Recycling of such waste as building materials appears to be viable solution not only to such pollution problem but also to the problem of economical design of buildings. It increases the popularity of using environmental friendly, low cost and light weight construction materials which benefits to the environment [2].

II. SOME STUDY OF LITERATURE

D. Rajput, S.S. Bhagade et al (2012), they use the cotton waste and recycle paper mills waste as new composite material. The physical and mechanical properties of brick material with Paper waste, cotton waste and cement are investigates. Waste Crete bricks with varying content of cotton waste (1-5 wt %), recycle paper mills waste (85-89 wt %) and fixed content of Portland cement (10 wt %) have been prepared and tested as per the standards [2].

Halil Murat Algin, Paki Turgut (2007), They conducted a parametric experimental study to investigates the potential use of Cotton Waste (CW) and limestone powder waste (LPW) combination for producing the low cost and lightweight composite as building material. Large amounts of cotton and limestone waste are accumulated all over the world which causes certain serious environmental problems and health hazards. The physical and mechanical properties of concrete mixes such as compressive strength, flexural strength, ultrasonic pulse velocity (UPV), unit weight and water absorption value/ability are investigates [3].

Jain D, Kothari A (2012), they study the effect of human hair on cement concrete to investigate various characteristics like compressive strength, crushing, flexural strength and cracking control to reduce environmental problems. They conducted experiments on concrete beams and cubes with different proportions of human hair such as 0%, 1%, 2%, 2.5% and 3% by weight of cement. For each combination of proportions of concrete one beam and three cubes are tested to determine their mechanical properties [4].

Raghatate Atul M (2010), in this paper the experiment work is based on to investigate the potential use of plastic bags to improve the certain properties of concrete. The properties of concrete containing varying percentages of plastic waste were tested for compressive strength and split tensile strength. Plastic bags which are commonly used for packing, carrying vegetables, meat etc are non-biodegradable thus creates serious environmental problems. The disposal of large quantity of plastic bag may cause pollution of land, water bodies and air. The proposed concrete which is made up by adding plastic in concrete may help to reuse the plastic bags as one of the constituent's material of concrete to improve the certain properties of concrete. To study the compressive strength and split tensile strength concrete cube and beam with various proportions of plastic bags i.e. 0 %, 0.2 %, 0.4 %, 0.6%, 0.8 % and 1% by weight of cement is made. After that the concrete cube and beam is allowed to soak in curing tank at normal temperature for 3 day, 7 day and 28 day to test the different properties of concrete cube and beam [9].

Silvana Krsteva, Vineta Srebrenkoska et al (2011), they worked on to investigate the possibilities of reusing cotton textile waste generated during the manufacture in textile industry as reinforcement in production of composite materials. In experimental work materials like cotton fabric, cotton textile waste used as reinforcements and phenol phormaldehyde resin used as matrix. Composites materials were manufactured by compression molding which contains the 60 wt % of reinforcement. The mechanical and thermal properties of composites material were analysed and compare with those fiber reinforced composites made based on cotton fabric and phenolic resin [10].

III. RESULTS AND DISCUSSION

From the experimental study D. Rajput, S.S. Bhagade et al, determines that Paper cotton waste cement combination can be potentially used in the production of lighter and economical brick material which can be used as internal partition wall and this is the half weighs of that the conventional clay brick. The observations during the tests show that bricks with 1-5 % addition of cotton waste and 10 % cement to paper cotton waste exhibit a compressive strength of 21-23 Mpa which is several times greater than the conventional clay brick and satisfies the requirements for a building material to be used in the indoor structural applications [2].

From the observation of Halil Murat Algin and Paki Turgut, the test results show that the effect of 10-40 % CW replacements in the combination CW-LPW matrix does not exhibit sudden brittle fracture even beyond the failure loads and indicates high energy absorption capacity. The produced new CW-LPW composite material is 60 % lighter than conventional concrete bricks. The test results show that concrete with 30 % replacement of CW 7 Mpa compressive strengths and 2.19 Mpa flexural strength requirements for building material to be used in structural application. The results show that the CW-LPW combination provides the result which satisfies the relevant international standards so this combination can be used in the production of lightweight and economical new brick material [3].

By testing of concrete beams and cube Jain D. and Kothari A. are found that comparison between the concrete with 1% hair and plain concrete it is observed that there is an increase in 10% in compressive strength and 3.2% flexural strength. Comparison between the concrete with 1.5% hair and plain concrete it is observed that there is an increase in 22% in compressive strength and 8.6% in flexural strength. According to the test performed on cubes and beams it is observed that there is remarkable increment in various properties of concrete and strength of concrete by the addition of human hair as fibre reinforcement [4].

Raghatate Atul M, test results showed that the compressive strength of the concrete goes on reducing with increase in plastic pieces but the rate of reducing compressive strength is very low. The tensile strength of the concrete showed that the after addition of plastic pieces the tensile strength is increasing by various proportions. Compressive strength of the concrete is affected by the addition of plastic pieces and it goes on decreasing as the percentage of plastic increases addition 1 % of plastic in concrete cause about 20 % reduction in strength after 28 days curing. The tensile strength observations show the improvement in tensile strength of concrete up to 0.8 % after that it is decreases with addition of plastic. Thus it is concluded that the use of plastic can be possible to increase the tensile strength of concrete [9].

Silvana Krsteva, Vineta Srebrenkoska et al results show that the mechanical properties of composites materials based on cotton textile waste are decreased about 25 % but the thermal stability for both composites material reinforced with cotton fabric and cotton textile waste is similar. From experimental work it can be concluded that cotton textile waste could be successfully used for production of composites material which can used as construction material [10].

IV. CONCLUDING REMARKS

From the brief study of literature it can be conclude that various types of wastes generate during the industrial processes of materials and household waste such as cotton waste, paper waste, hair waste, plastic waste, natural fibers, which can be successfully used as additives for concrete material to improve the mechanical strength of concrete. The mechanical strength of the concrete mixture is increases with the different proportions as compare to the normal concrete. From the literature it is proved that different types of waste materials are used for the construction and building materials for environment protection and economical design of the building.

REFERENCES

[1] Asokan Pappu, Mohini Saxena, Shyam R. Asolekar, "Solid wastes generation in India and their recycling potential in building materials", Pg no 2311-2320
[2] D. Rajput, S.P. Raut, S.S. Bhagade, Sachin A. Mandavgane, "Reuse Of Cotton And Recycle Paper Mill Waste As Building Material", Elsevier 2012, Vol 34, Pages 470-475
[3] Halil Murat Algin And Paki Turgut, "Cotton And Limestone Powder As Brick Material", Elsevier 2008 Volume 22, Issue 6, Pg. No 1074-1080
[4] Jain D. And Kothari A, "Hair Fibre Reinforced Concrete", Research Journal Of Recent Sciences 2012, ISSN 2277 – 2502, Pg. No 128-133.
[5] Kanthe V.N, Chavan P.G, " Solid Waste Used As Construction Material", IOSR Journal of Engineering (IOSRJEN) ISSN: 2250-3021 , PP 75-77
[6] Md. Safiuddin, Mohd Zamin Jumaat, M. A. Salam, M. S. Islam and R. Hashim, "Utilization of solid wastes in construction materials", ISSN 1992 – 1950, International Journal of the Physical Sciences Vol. 5(13), pp. 1952-1963, 18 October, 2010
[7] N. E Ali, H. C Sion, "Solid waste management in Asian countries: a review of solid waste minimisation (3'r) towards low carbon", Earth and Environmental Science, 2014, Vol 18
[8] "National 3R Strategy for Waste Management", Department of Environment Ministry of Environment and Forests Government of the People's Republic of Bangladesh November 2009
[9] Raghatate Atul M, "USE OF PLASTIC IN A CONCRETE TO IMPROVE ITS PROPERTIES", 2012, ISSN : 2249–8974
[10] Silvana Krsteva,Vineta Srebrenkoska And Goran Demboski, "Using Of Textile Waste For Production Of Composite Materials", International Conference (2011), ISSN 978-86-82343-14-1
[11] http://www.dec.ny.gov/chemical/8732.html

