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Production of insulating brick using different waste materials- A Review

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ABSTRACT

Bricks are widely used construction and building material around the world. This paper attempts to develop bricks from waste materials that are present in the environment without causing any damages to the environment. The main objective of this paper is to prepare insulating bricks by using the waste materials and to conduct field and laboratory test on them. Traditional bricks are made of clay or cement. However, it has environmental deficiencies as causing high energy consumption and carbon dioxide emission. In addition, excessive and senseless use of non-renewable natural resources around the world causes social, economic and environmental damages. For these reasons, researchers have used several waste materials in brick production to contribute to sustainable development by optimizing environment-material economy. The bricks are prepared by using waste materials like {Textile waste}cotton waste..

KEYWORDS-Insulating Bricks, Waste Materials, Textile Waste,Cotton waste

1. INTRODUCTION

Brick is a building material used to make walls, pavements, and other elements in masonry construction. Since the large demand has been placed on building material, especially in the last decade, owing to the increasing population, which causes a chronic shortage of building materials, people have been challenged to convert the industrial wastes to useful materials such as building and construction materials. Accumulation of unmanaged wastes in developing countries increased environmental concern. The increase in the popularity of using environmentally friendly, low cost and light weight construction materials in building industry has brought about the need to investigate how this can be achieved by benefiting the environment as well as maintaining the material requirements affirmed in standards. Recycling of waste generated from industrial and agricultural activities as building material appears to be viable solution to such pollution problem but also to the problem but also to the problem of economic design of the building.Textile waste can be classified as pre-consumer and post-consumer waste. Pre-consumer waste is by-product materials originated from the textile industries; post-consumer residues are defined as any type of article made from manufactured textiles discarded because of damages or ageing. The purpose of this paper is to report a state of the art of feasible applications in building industry of the textile waste.

Textile fibers mainly could be used to realize insulation products. Moreover, the fabrics acted as reinforcement in the matrix of composites or as an alternative they are used in lightweight bricks. Textile threads can be also employed as a reinforcement fibers in cement based renders. The role of the residual textile fibers as sustainable and innovative raw materials is studied. The mechanical, hygrothermal, acoustic properties of innovative building composites are investigated.Huge amounts of cotton and textile ash waste are disposed of by countries all over the world. The majority of cotton wastes and textile ash wastes is expelled in such a way as to cause serious environmental problems. The present study involves experimental research investigating the potential use of cotton and textile ash wastes combination for producing a new and lightweight composite building material with good insulation properties. The results showed that the cotton and textile ash waste bricks fulfill the compressive strength and heat conductivity requirements of the ASTM and Turkish Standards. A cotton and textile ash waste brick house has been found to be superior to a concrete brick house for regulating indoor temperatures. The production process can be easily applied in conventional brick plants. The product is a light weight composite which can be used for making bricks and wall and ceiling panels with good insulation properties.

2. LITERATURE REVIEW

This passage describes about the journal which says about the various test results of various authors, a general idea of using a waste material in brick manufacture and various usage of waste materials & their properties. These are some of the various journals that describes about the former research of the authors.

ShikharShrimali et al.(2017) [1] describes about the conservation of environment from waste plastics that have been generated into useful materials. The usage of waste materials in the development process helps to produce eco-friendly structural elements. The project reviews one of the sustainable and effective ways of managing plastic waste in urban and rural parts of India in order to minimize their adverse environmental impacts. The requirement for such a research is validated as it is desirable to change the unsustainable arrangement of consumption, production and disposal associated with these materials.

Nivetha C et al.(2017) [2] describes about the strength and behaviour of red mud bricks. Disposal of large quantities of red mud poses increasing environmental problems This journal states that the compressive strength of the bricks will increase when the portions of red mud are limited to 5%, 10%, 15% when compared with conventional bricks. The usage of red mud is of great significance from the point of view of resource conservation and sustainability of the aluminium industry.

R.Nithiya et al.(2016) [3] describes about the development of bricks from various recyclable waste materials like coconut fibre, granite waste and egg shell. The usage of granite waste and eggshell as an alternative raw material in the production of clay-based products leads to relief on waste disposal concerns. It was found out that he bricks are sufficiently hard in 4%,8% and 12% replacement of granite waste. The compressive strength increases up to 6% of granite waste and beyond that it gradually decreases. It was concluded that the when the percentage of granite waste increases the hardness of the bricks gradually increases.

R.Sumathi et al.(2016) [4] states the various techniques adopted for utilization of sludge in production of bricks produced by various industries. This study investigates the potential for reusing sugarcane sludge by suing it as a partial replacement material in clay bricks. The water absorption property of all sugarcane sludge brick is lesser than the water absorption of normal good quality burnt clay brick (20%) except 30% sludge bricks. The compressive strength of all mix proportions of sugarcane sludge bricks is lesser than 140 kg/cm^2. Hence it is concluded as weaker than the conventional bricks.

Sandeep Sharma et al.(2016) [5] describes the development of unburnt bricks, non-structural bricks using various industrial waste materials. This investigation deals with the development of bricks from fly ash. Utilization of fly ash can reduce the solid waste disposal problem and minimization of pollution. The study deals with the utilization of fly ashes for making lime activated fly ash bricks and their different property characterisation. Lime activated unfired fly ash bricks can be made by utilizing industrial wastes such as well as less power consumption. Usage of fly ash in the production process produced higher compressive strength than the conventional bricks.

Prashant Gupta et al.(2015) [6] describes the effect of processed tea waste(PWT) and water treatment plant(WTP) sludge addition on the physical, mechanical and thermal properties of the clay bricks. The compressive strength of the brick sample consisting of WTP sludge increased significantly while the compressive strength of brick samples consisting PWT decreased slightly. The addition of PWT will increase the porosity of the bricks which ultimately embraces the thermal insulation property of the burnt bricks. The addition of PWT in the manufacturing of bricks not only increases the thermal insulation, but it also increases the water absorption property of the bricks.

H.N.Rajendra Prasad et al.(2014) [7] describes about the various industrial waste materials like fly ash, granite dust and sludge lime that can be used as an alternative in manufacturing of clay bricks. Usage of fly ash in manufacturing process of bricks produces comparatively higher compressive strength than the conventional bricks. Usage of granite dust increases the thermal insulation of the bricks, as the addition of granite dust increases the porosity of the bricks which ultimately increases the thermal insulation property.

Ravikumar et al.(2014) [8] have studied the behaviour of fly ash bricks by taking different proportions of fly ash and clay. The proportions of fly ash has been varied to determine various compressive strengths for different compositions. Usage of fly ash in manufacturing process of bricks produces comparatively higher compressive strength than the conventional bricks. From the compressive strength values obtained the compressive strength of bricks is high when the content of fly ash is limited to 20%. Usage of fly ash in production protects the environment by reducing the amount of top soil required for the manufacturing of bricks.

Mohammad Shahid Arshad et al.(2014) [9] describes about reuse of recycled paper mill waste in production of light weight bricks. The main objective of this study is to reduce the quantity of clay with the natural waste material. Natural wastes like coconut fibre, orange peel are used as a replacement of clay. The usage of orange peels and coconut fibre reduced the quantity of clay up to 10%-40% and 10%-60% respectively. The brick becomes lighter when the clay content is reduced. It is concluded that the orange peel does not make a good bond with paper mill, and it gets crumbled when they are completely dried and hence it cannot be used as an ingredient for construction purpose.

Alaa.A.Shakir et al.(2013) [10] describes the feasibility study of using bricks made from municipal Solid waste incinerator fly ash slag. Study has been made on how to handle the municipal solid waste incinerator fly ash in the manufacturing of clay bricks. The usage of municipal solid waste incinerator ash slag in manufacturing increases the thermal insulation of the bricks. The thermal insulation property increases due to the increase in the porosity of the bricks. It is concluded that further studies should be conducted in the usage of municipal solid waste in the production of bricks, as there are no standards for the usage of solid waste in manufacturing process.

3. MATERIALS AND METHODOLOGY

3.1 MATERIALS

The materials used in this study for brick production are cotton waste (CW), textile ash waste (TAW) and cement. Huge amounts of textile ash and cotton wastes are disposed of by the textile industry in Nagpur.

3.2 METHODOLOGY ADOPTED

- The compressive strength values of the cotton and textile ash waste bricks tested in the present study.
- Water absorption and unit weight.
- The use of thermal insulation materials, particularly wall materials, has been the major issue in today's construction industry aiming to save energy. The energy crisis experienced in the past has shifted the focus of economic gain to energy saving. The solution of the problem of energy saving, in the construction sector, could be achieved through prudently chosen materials and wisely designed thermal insulation units. The present study demonstrated the use of cotton and textile ash waste bricks for this purpose.

Mix preparation: for this specific study, the required amount of raw materials and additives was measured by using a 24 cm × 12 cm × 6 cm volume box with different ratios. 'e amounts of materials were prepared according to ASTM mixing that means 1 : 2 : 3 and 1 : 2 : 2, where mix ratio 1 : 2 : 3 means one part cement to two parts sand and three parts gravel.

In the beginning, the aforementioned raw materials were mixed with water and homogenized with each other in proportion before sample brick preparation. The

raw materials have been mixed with enough amount of water to obtain homogeneous and smooth mixture for molding operation. In the mixing process of samples, the clay was mixed till it is observed that CW is uniformly scattered within the mixes. In order to obtain more homogeneous mixes, the water was sprayed by using a water pump onto the mixes while the mixing was carried out. If mixing was performed effectively, it reduces cracking during drying. Afterward, the fresh mixes were fed into the wood molds.

Moulding process: the size of a mold for brick making was selected by considering the shrinkage effect of the clay. Produced brick shrinks during drying, so the chosen mold size was larger than the intended finished brick. For hand molding, the tempered clay was forced in the mold in such a way that it fills all the corners of the mold. Extra clay was removed by using a wooden strike.'e mould was then lifted up, and raw brick was left on ground for the drying process.

Drying process: drying was carried out by placing the bricks in sheds with open sides so as to ensure free circulation of air and protection from bad weather and rains. Molded bricks have been allowed to dry for 7 to 14 days in such a way that there is no direct contact with sun light.

Burning of bricks: before the firing process, all the moulded brick samples were sun-dried as per the conventional method for 7–14 days, and most of the water present in the brick samples is evaporated in this process aiming to prevent cracking. Then, the dried brick samples were placed in a burning house for 14 days. All the burnt bricks were allowed to cool down and transferred for characterization to assess and compare the quality of brick produced using cotton waste with the controlled bricks.

4. CONCLUSION

Collect textile waste without recycle can become a serious problem for the health of the environment. The reuse of these leftover materials in new building materials is a solution to the problem of pollution and allows to preserve natural resources for future generation. The different type of textile construction materials and their properties have been examined in this work. Textile fibers can be used to produce sustainable thermal and acoustic insulators in the form of mats or panels, energy efficient bricks, innovative concrete or plaster mortar. Textile materials are comparatively acoustically efficient, with higher thermal performances than conventional building materials. Textile fibers increase the mechanical properties of plaster mortars. The application of textile waste as a secondary raw material is an interesting practice for developing environmental friendly composite materials as substitutes for conventional one. In summary, textile materials are promising materials for buildings, although there is still a lot of work to do. This work can help to have a global idea on the topic and can be a starting point for future research developments.

Scope for future study

1. Further research and development is needed to promote wide production and application of insulating bricks from waste materials.
2. Appropriate research should be conducted to define relevant standards for the development ofinsulating bricks from waste materials.

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Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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