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A review on possibility of bricks with municipal solid waste

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Abstract
Since ages, bricks have been used and made majorly from clay. To save excessive usage of clay, one might think of possibility of usage of various types of waste products in the production of bricks with partial replacement of clay in the manufacturing process. Waste products may vary from place to place and may include plastic, glass, rubber, fly ash, construction material, sewage sludge and MSW. From past studies, it was found that wastes of various types such as municipal MSW incineration fly ash, paper sludge, agricultural waste, industrial waste (sewage, sludge, bagasse), sawdust wastes and limestone dustwastes and coconut shell powder have been generated and increasing day by day. As such they can be used for the production of bricks by replacing clay partially.

Keywords: Sewage, Clay, Bricks, Pollution.

Introduction
In the present century, as technology is updated very rapidly, the usage of natural materials like clay for the construction in bricks is also increased very fast. Since ages, bricks have been made from clay. These are used for building and pavement all throughout the world. As per the statistics of world bankon Solid waste (SW) assessment for disposal, the major cities in the world is presently producing approximately 1.3billion tones of SW per annum. Further the same is forecasted to rise to the tune of 2.3 billion tones by the year 2025 Also, this type of solid waste production may get double over the next twenty years in under developed or the developing countries. Disposal of Municipal Solid Waste (MSW) is the main problem. Dumping of MSW is very difficult due to lack of land available. New buildings, roadways, bridges, etc is constructed over the land available. Due to this land is not available to use for the purpose of dumping of MSW especially in urban areas. So for the solution of this problem, MSW treatment plants are organized. MSWs from nearer areas or from urban areas are collected. In these plants MSW can be divided into different parts according to different raw materials, which can be further processed into valuable products by related machines. In a world, the plant can not only remove waste pollution and improve the environment, but also create great profits and drive the economy. These MSWs can be thought of to be used as an ingredient in bricks. The same has been reviewed into this paper.

Appraisal
Various researches has been conducted the studies regarding the replacement of small quantity of clay with solid waste in making Brick. There are several studies conducted by many researchers and engineers regarding the effect on properties of brick by small replacement of clay using solid waste.
Datar and Shinde (2017) [8] had done an experimental study regarding the potential of coconut shell powder as an aggregate material for making construction bricks. The bricks are made using coconut shell powder with soil in a ratio 5% (Sample 1), 10 % (Sample 2), 15% (Sample 3), 20% (Sample 4), 25% (Sample 5) and 30% (Sample 6) by volume. Result showed that Sample-1(5% CSP and 95% Soil) bricks fulfill the criteria for compression test and water absorption as mentioned in IS 3495(1 to 4) – 1992. Thus it is proved from the experimentation that coconut shell has a capability to be used as an aggregate in construction bricks. Thus this

can be a new way of solid waste disposal of coconut shell.

Chin *et al*. (1998) [2] evolved new methodology involving the process of treatment of paper sludge along with the roughage extracted in the paper industry for the production of bricks. The raw bricks so prepared were fused in an oven at a temperature of 1000°C. The materials so produced had good a water absorption rate much lower than 14 %, besides having good compressive strength to the tune of 150 kg/cm^2. The bricks of this type might be used as non-load bearing or as in spacing erection parts.

Weng Chin-Huang *et al*., (2003) [10] suggested a space where we may use dried sludge as an ingredient with replacement of clay to improve the brick quality in an engineered way. The proportion of sludge in the mixture and the right temperature govern the end quality of brick. The proportion of sludge in brick if kept about 10% at 24% OMC when dried at a temperature varying from 800-960 degree Celsius will give the best quality brick.

Kae Long Lin, (2006) [4] tried the mixing of municipal solid waste slag procured from the incineration for the production of fired clay bricks. These bricks were shot at about a temperature of more than 950°C. Outcomes showed that the mechanical properties met the Chinese National Standard (CNS) for construction purposes as far as production of second-class brick is concerned. Further, the bricks so produced have less water absorption and greater compressive strength of the sintered bricks.

Cheng *et al*., (2006) [1] examined qualities of porous bricks constituted of solid waste excavated from the treatment plant along with ash excluding any special treatment. It was found that about 20 % replacement by weight content at a temperature of 1150°C could supply a brick with a compressive strength of 256 kg/cm^2, It had a better water absorption ratio and a permeability. Bricks formed will prove a nice eco-friendly product as pavement brick in non-rural areas.

Ismail Demir (2006) [3] examined the implementation prospective of treated tea residueas an ingredient of brick. The resilience and instinctive part was explored. Due to the carbon based properties, pore –forming and binding ability in clay were also investigated.it was inferred that waste tea addition increased the water content and thus the plasticity. As per test outcome, a mixture containing about 5% processed waste tea will help in the brick when prepared at 900 C.

Turgutpakiet (2007) [9] explored the physical and instinctive properties of brick samples with wood sawdust wastes and limestone dust wastes. They observed the effect of 10% - 30% wood sawdust waste replacements in wood sawdust waste. Even beyond the endurance limits limestone dust waste matrix does not reveal sudden brittle breakage.

Safiuddin *et al.* (2010) [6] represented a paper "utilization of solid wastes in construction materials. In this paper they are discussed about different types of solid waste like fly ash and bottom ash, waste steel slag, granulated blast furnace slag, rice husk ash, palm oil fuel ash, waste glass, organic fibers, rubber tires etc they concluded that the use of solid wastes is multipurpose.

Kanthe and Chavan (2012) [5] represented a paper "solid waste used as construction material". In this paper they are saying that, they prepared bricks having different amount of solid waste and compare them. Firstly brick is prepared having 100% clay. Then bricks having 60% clay and 40% solid waste were designed. After that bricks having 30% amount of clay, 40% solid waste and 30% fly ash were prepared. Each brick series were fired at same temperature. Compressive strength of bricks was 0.3508 N/mm^2, 0.5263N/mm^2, and 2.80N/mm^{2}respectively.Thesebricks so prepared have higher strength and are light in weight when compared to nominal brick used for construction.

Niklesh (2017) [7] represented a paper "using waste material for making light weight bricks". In this paper they are using waste materials like foundry products, paper production and residues, waste tea, sugar cane bagasse ash waste, organic sludge, recycle paper mill waste etc. to produce bricks.

Conclusion

From past studies, It was concluded that wastes of various types such as municipal solid waste incineration fly ash, paper sludge, agricultural waste, industrial waste (sewage, sludge, bagasse), sawdust wastes and limestone dust wastes and coconut shell powder are used for the production of bricks by replacing clay. Bricks made from these wastes give satisfactory results. To examine the effect of solid waste (powder form) in bricks we used solid waste from waste treatment plant in this present study.

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