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CRITICAL REVIEW ON TYPES OF BRICKS TYPE 13: WOOD ASH BRICKS

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Abstract - Wood ash is the residue powder left after the combustion of wood, such as burning wood in a home fireplace or an industrial power plant. In this modern world, due to rise in technology day by day, on the other hand side we the humans were continuously spoiling the environment by polluting it. Wood ash is one of the most pollution causing factors, which was being produced by various industries. On the other side there is demand for clay bricks, due to the use of clay bricks the top layer of the soil is depleted which is too serious problem for the society that cannot be ignored. So to solve this both problems there is an idea to prepare a "Wood ash bricks". Wood ash is a by-product of combustion from wood-fired boilers, at a typical paper mills and other wood burning facilities. Approximately three million tons of wood ash is produced annually in the United States. Approximately 70% of the wood ash is being landfilled, around 20% is being used as soil supplement, and the remaining 10% is being used in miscellaneous applications. Wood ash is composed of both inorganic and organic compounds. The physical and chemical properties of wood ash vary significantly depending upon various factors such as type or species of trees/wood, method and manner of combustion, efficiency of the boiler, and other supplementary fuel used with wood. Continued use of clay bricks in construction industry will lead to extensive loss of fertile top soil. This could be a devastating environmental hazard. High demand for clay bricks would result in price hike of clay bricks. This paper deals with the manufacturing process of such bricks along with its process of manufacturing, method of testing as well as its advantages

Keywords - Wood ash brick, Process of manufacturing, Materials selection, Testing, Advantages

I. INTRODUCTION

Production of burnt clay bricks requires consumption of coal leading to greenhouse gas emissions. The primary raw material used for bricks is the soil, which is often taken from prime agricultural land, causing land degradation as well as economic loss due to diversion of agricultural land. Use of traditional technologies in firing the bricks results in significant local air pollution. The burnt clay brick industry in India produces over 180 billion clay bricks annually with a strong impact on soil erosion and unprocessed emissions. To address this situation attention has been made to develop the Eco friendly building material. Therefore we have taken wood chips which are largely generated as a waste. These bricks are comparatively lighter in weight and stronger than common claybricks. Since, they are being accumulated as waste material in large quantity and creating serious environmental pollution problems, its utilization as main raw material in the manufacture of bricks and useful disposal but also help in environmental pollution control to a greater extent in the surrounding areas. In view of superior quality and eco-friendly nature we have chosen these bricks. [2]Nowadays, environmental concerns and an interest in reducing construction costs have led to using some recycled materials instead of conventional materials for engineering projects, resulting in favorable outcomes in terms of both economical and technical aspects. For example, the engineering properties of coal fly ash Class C have been studied to examine the possibility of recycling for engineering projects including highway constructions [3],concrete mixtures [4]and soil stabilization [5,6]. Considering the fact that geotechnical projects generally require a large quantity of materials, reuse of biomass ashes as a new recycled material in geotechnical projects will surely be attractive. Biomasses, including plants, are organic materials that are derived from any living or recently-living structure. Biomass has been used as an agriculture, forest, and energy resource, such as for biofuels, as a source of industrial heat for the forestry and paper industries, and for ethanol and biodiesel [7]. Biomasses are mostly combusted and then typically discarded or disposed of without treatment. Thus, recycling or treatment of biomass ashes leads to the utilization of natural materials as an economical and environmental alternative. In 2012, about 474 million dry tons of biomass materials were estimated to be created in the United States from forest and agricultural residues [8]. Forests residues constitute approximately 231 million dry tons of this total, with wood as the most abundant biomass material in the United States. A remaining 243 million dry tons are divided into multiple agricultural crops including sugarcane bagasse [8]. Combustion of biomass produces biomass ashes. The total amount of biomass ashes obtained from combustion is variable depending on the type of material and combustion process. Total annual biomass ashes may range from 4.6–27 million dry tons [9]. Both wood ash and sugarcane bagasse ash account for the greater portion of the biomass ashes [8]. The use of wood ash and sugarcane bagasse ash as a pozzolanic material in concrete mixtures [10,11] and the use of wood ash as highway pavement and subgrade reinforcement material [12,13] have been studied in an attempt to

increase the strength and stiffness of the materials[14]. However, the utilization of wood ash in the brick industry will help in use of waste material in the construction work as well as the there will be advancement in technology will be beneficial for mankind as well as environment.

II. PROCESS OF MANUFACTURING OF WOOD ASH BRICKS

Sieving of material
The material are properly sieved in order to remove the course material so that fine powder can be used for the purpose of making bricks, any present of course material will directly effect the strength and property of the material

Mixing of materials
Ceramic wastes are finely powder by the process of grinding and it is kept ready to mix with wood ash. The already prepared wood ash is taken in a barrel and it mixed well with of ceramic waste. This well mixed powder is added with water. They are mixed well and made into paste

Moulding or shaping of bricks
The pasty material is then moulded by the general moulding techniques like machine pressing or slip casting.

Drying of bricks
Drying is carried out in normal temperature for removal of moisture

Firing of bricks
Firing is carried out in kiln at 1500ºC for 8 hours [1]

Testing of bricks
After the above process the bricks are passed through the recommended tests as explained

III. MATERIALS SELECTION OF INGREDIENTS OF WOOD ASH BRICKS

Wood ash
Wood ash is a by-product created during the combustion of wood products for energy production at pulp and paper mills, sawmills and wood- product manufacturing facilities. Wood ash is composed of both organic and inorganic compounds. The physical and chemical properties of wood ash, which determines its beneficial uses, are influenced by species of the wood and the combustion method. Due to high strength, practically no breakage during transport & use and to uniform size of bricks mortar required for joints & plaster reduces almost by 50%. Due to lower water penetration seepage of water through bricks is considerably reduced. These bricks do not require soaking in water for 24 hours only sprinkling of water before use is enough [2].

Characteristics of wood ash
Chemical properties [1]

S.no	Components	Percentage
1	Silicon-di-oxide (SiO_2)	65.3
2	Aluminium oxide(Al_2O_3)	4.25
3	Iron III oxide(Fe_2O_3)	2.24
4	Sodium oxide(Na_2O)	2.6
5	Potassium oxide(K_2O)	1.9
6	Calcium oxide(CaO)	9.98
7	Magnesium oxide(Mgo)	5.32

Physical properties [1]

S.no	Components	Percentage
1	Specific gravity	2.16
2	Mean size	170 µm
3	Bulk density	720 kg/m^3

Ceramic waste - The principle waste coming into the ceramic industry is the ceramic powder, specifically in the powder forms. Ceramic wastes are generated as a waste during the process of dressing and polishing. It is estimated that 15 to 30% waste are produced of total raw material used, and although a portion of this waste may be utilized on-site, such as for excavation pit refill, The disposals of these waste materials acquire large land areas and remain scattered all around, spoiling the aesthetic of the entire region. It is very difficult to find a use of ceramic waste produced [18]

Water - Water is an important ingredient of bricks as it actually participates in the chemical reaction with materials. Since it helps to mix the materials properly, the quantity and quality of water are required to be looked into very carefully.

IV. TESTING OF WOOD ASH BRICKS

4.1. Weight of Dry Block
Weight of the block has to taken to calculate the moisture content. As per the construction norms the brick should show the 10% moisture content of its weight. If the moisture content satisfies this test it will undergoes the next test [17].

4.2. Size of Block
Sizes of brick were checked for the slump test & to calculate the compressive strength of brick. Also through this test the uniformity of the brick was checked in six samples [17].

4.3. Compressive strength
Compressive strength of the specimen brick was calculated after 7, 14 & 28 days of curing using the formula as follows,

Compressive strength = Applied Max load x 1000 (N)/Cross sectional Area (mm^2) [15].

The compressive strength of brick is three times greater than the normal clay brick. The universal testing machine is used for testing the compressive strength of bricks. After the curing period gets over bricks are kept for testing. To test the specimens, the bricks are placed in the calibrated compression testing machine of capacity 3000 KN (Kilo Newton) and applied a load uniform at the rate of 2.9 kN/min. The load at failure is the maximum load at which specimen fails to produce any further increase in the indicator reading on the testing machine [16].

4.4. Water absorption

Fly ash Bricks should not absorb water more than 12% by its weight. The bricks to be tested should be dried in an oven at a temperature of 105^{o}C to 115^o C till attains constant weight cool the bricks to room temperature and weight (W_1). Immerse completely dried and weighed (W_1) brick in clean water for 24 hrs at a temperature of 27±20^{o}C. Remove the bricks and wipe out any traces of water and weigh immediately (W_2). Water absorption in % by weight = ($W_2 – W_1/W_1$) x 100 [16].

4.5. Efflorescence test

For this test, brick has to be placed vertically in water with one end immersed. The depth of immersion in water being 2.5 cm, then the whole arrangement should be kept in a warm-well-ventilated room temperature of 20-30^o C until all evaporates. When the water in the dish is absorbed by the brick and surplus water evaporates. When the water is completely absorbed and evaporated place similar quantity of water in dish and allows it to absorb and evaporate as before. Examine the brick after this and find out the percentage of white spots to the surface area of brick. If any difference is observed because of presence of any salt deposit, then the rating is reported as' 'effloresced". If no difference is noted, the rating is reported as not ''effloresced" [16]-[17]

V. ADVANTAGE OF WOOD ASH BRICKS

1. An average house of 10 squares will need approximately 22,000 clay bricks (conventional) of 230mm x75mm x100mm size. If wood ash bricks are used, you will need only 2750 of them. They come in sizes 400mm x 200mm x 150mm.
2. The bricks are lighter in weight by 10 per cent compared to clay bricks. It is said that fly ash bricks absorb less water compared to clay bricks (10 to 12 per cent as against to 15 to 20).
3. Wood ash can be manufactured in different sizes and colors with ash content being 35 per cent. They are strong and less susceptible to scratches. They can be used for courtyards, pathways and are most suitable for footpaths.
4. They are made using the combination of fly ash, cement and coarse sand. As you know, wood ash which is an industrial waste, can be utilised for various purposes such as making of bricks, blocks, concrete, tiles, kerb stones, paving slabs, survey pillars, door and window frames, inter-locking bricks and flowerpots.
5. Due to the presence of ceramics in it, they give high mechanical strength when compared to normal clay bricks.
6. They are cost efficient [1]

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