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Study on Manufacturing of Bricks by Using Waste Foundry Sand

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Abstract: *The main objective of this project is to utilize waste foundry sand (WFS) from foundry industry in manufacturing of bricks. The entire process of combining clay mixtures, forming of bricks, drying and firing was done with local conditions. With minimum process it was possible to introduce up to 30% WFS in clay bodies to produce bricks of desirable properties. The minimum average wet compression resistance of 5.54Mpa, and maximum average water absorption of 20.76% was obtained for bricks containing 30% WFS, when fired at 900 C. There was insignificant difference in apparent porosity, water absorption, and specific gravity of bricks containing WFS, when compared to commercial bricks. The addition of WFS reduced the bulk density of the bricks, which has also caused reduction in compressive strength. WFS bricks can be classified as class II bricks, based on recommendations of IS 1077 standard specification. These bricks can be used in single storied load bearing structures, and also in the construction of infill walls in multi-storied framed structures.*

Keywords: Red soil , Bagas, n foundry sand etc

I. INTRODUCTION

One of the preferred walling materials in India is clay fired bricks, that has a long and rich history of production dated back to Indus valley civilization (2500–1500 BCE). India is the second largest producer of bricks in the world, with over 240 billion bricks produced annually. The Indian economy is growing with a current target set to achieve an annual growth rate of 9%. The constant growth in economy and population, along with urbanization has resulted in increasing demand for buildings and infrastructure. In a published report 'Environmental and Energy Sustainability: An approach for India', it was estimated that the building construction sector in India would grow at a rate of 6.6% per year till the period of 2030, since 80% of India of 2030 is yet to be built. The constant growth in the construction sector will increase the demand on construction materials like bricks. At the same time major challenge faced in India is the use of agricultural clay for manufacturing of bricks, which is of great significance for farmers. To protect the agricultural land, government of India is prohibiting its use for brick manufacturing, and encouraging use of alternative materials. The use of industrial waste can address some of the issues faced by the construction industry, as well as find great means for waste disposal. Laboratory scale trials have shown that variety types of industrial waste can be used as raw materials for manufacturing bricks with acceptable quality. These include hematite tailings, fly ash, granite sawing waste, gold mill tailings, quarry residues and waste steel slag, paper processing residue, cigarette butts, rice husk ash, sawdust and marble residue, river sediment, sugarcane bagasse ash, waste tea, waste marble powder, PC and TV waste glass, Kraft pulp production residue, municipal solid waste incinerator fly ash slag, petroleum effluent treatment plant sludge, etc. Based on laboratory scale trials the technical feasibility of waste utilization in brick manufacturing provides a very viable option

Foundry industries are responsible for generation of huge solid waste like WFS. The disposal of waste sand in the environment, typically in landfill causes direct contamination of soil due to metals. It may also contaminate the groundwater resources and surrounding superficial environment.

Alaa. A.Shakir, Sivakumar Naganthan, Kamal Nasharuddin Bin Mustapha, Concluded in "Development Of bricks from waste material" the increase in the popularity of using environmental friendly, low cost and lightweight construction

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material n 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 the standard.

Alaa A. Shakir, Ali Ahmed Mohnmmed concluded in "Manufacturing of bricks in past, in the present and in the future" bricks is one of the most important material for the construction industry. The conventional method of bricks production has brought undeniable shortcomings. The consumption of earth-based materials as clay, shale and sand in bricks production resulted in resource depletion, environmental degradation, and energy consumption. The bricks was anciently produced by mixing the given the virgin resources, forming the bricks, drying them and then firing them.

Amit kumar D. Raval, Arti Pamnani, Alefiya I. Kachawala concluded in "Comparative study on fly ash bricks and normal clay bricks" studies partial replacements of fine aggregate with foundry sand. They analysed he compressive strength of concrete by Page 4 of 8 0%, 10%, 20%, 30%, 40%, 50%, at different curing period (7days, 14 days, and 28 days). The compressive strength of concrete increased along with the foundry sand replacement u to 30% replacement of fine aggregate with foundry sand, maximum strength was 33.65 mpa.

P.P. Gadling Dr. M.B Varma concluded in "Experimental study on manufacturing bricks by using marble sludge powder for resistance test" during the India days the growth of development is increased that required of electricity from generated thermal power plant and this plant gives residues in the for Flay Ash in major quantity. The rate of generation of Fly Ash far exceeds the increasing growth rate of its user.

R.Nithiya concluded in "utilization of waste materials in burnt clay Bricks" hybrid material are material form two or more constituent material with significantly different physical or chemical properties, that when combined, produce a material with characteristics different from the individual component In this study, a new alternative concept for bricks manufacturing is introduced. Bricks made by shaping a plastic mass of clay and water, which is then hardened by drying and firing, are among the oldest and most enduring of mankind's building material. Units comparatively recent times the clay was dug, the bricks were made and the kilns set or drawn by manual labor with help from animal power.

Study on environmental toxicity of WFS indicates that there is significant difference among WFS in their compositions and concentrations of metal and organic pollutants. The concentration of Fe in leachates of iron and steel casting exceeded the maximum allowable concentrations specified by the National Standard of Drinking Water Quality. Disposal of WFS in environment possess threat to the groundwater and soil. Elements detected in groundwater can be in concentrations.

above the limits established by regulatory bodies and can be of concern. Research studies have been conducted on the utilization of WFS in different civil engineering applications like embankments, pavement sub-base, hot mix asphalt, flow-able fills, cement and concrete products. Also, field studies show that WFS performs well in certain applications without compromise on the required quality. But there is limited research and field implementation on use of WFS in brick manufacturing. Studies show that WFS can be used in manufacturing of clay bricks. Recycling of foundry sand residuals as aggregates in the manufacture of red clay bricks and tiles was studied. Clay bricks were prepared with 5%, 10%, 20%, and 30% of WFS. It was reported that best properties were obtained in samples with 30% and 40% WFS. The resulting brick specimen were put through a series of leaching tests to determine the compliance with the quality requirements for commercial clay bricks in different stages of their life cycle, accordingly it was concluded that foundry sand can be used in clay bricks. In another study, feasibility of recycling spent foundry sand in clay bricks showed that spent foundry sand can be introduced in clay bodies in variable amounts, depending on the clay and the plasticity of spent foundry sand, accordingly the recyclable amount was 30% by weight. The percentage of recyclable sand is reported to be influenced by the characteristics of the raw materials and the brick making process. The current study focuses on utilization of WFS in manufacturing of bricks at large scale with minimal process. The study wants to delve the practical feasibility of manufacturing WFS bricks with local conditions.

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II. METHODOLOGY

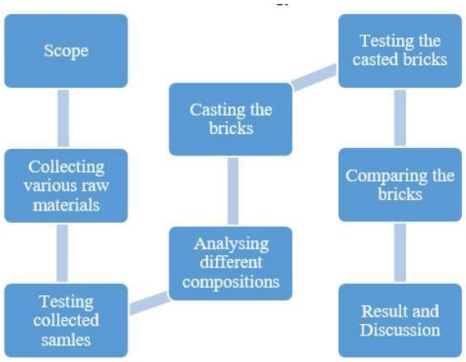

Fig. 1. Methodology

III. CONCLUSIONS

1. With minimum material processing and adopting local conditions, it was possible to introduce WFS as a raw material in production of bricks.
2. The maximum desirable replacement proportion of WFS is 30%.
3. The addition of WFS reduced the bulk density of the bricks, which has also caused reduction in compressive strength. The reduction in bulk density can be attributed to the poor packing ability of bricks containing higher content of WFS.
4.The average compressive strength of 30%WFS replacement is 5.54N/mm^2 and water absorption is 20.75% of dry weight, when fired at 900°c.this brick can be classified as a class lll brick, based on recommendation of is 1077-1957 standard specification. These bricks can be used in single storied load bearing structures, and also in the construction of infill walls in multi- storied framed structures.

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