



Applications of Rice Husk Ash: A Review

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Abstract : The rice husk ash is a green supplementary material that has applications in small to large scale. It can be used for waterproofing. It is also used as the admixture to make the concrete resistant against chemical penetration.

The main applications of rice husk ash in the construction are:

- High-performance Concrete
- Insulator
- Green concrete
- Bathroom floors
- Industrial factory floorings
- Concreting the foundation
- Swimming pools
- Waterproofing and rehabilitation



Application of husk:

Suitability of RH to be used for different applications depends upon the physical and chemical properties of the husk such as ash content, silica content etc. Direct use of rice husk as fuel has been seen in power plants. Apart from its use as fuel, RH finds its use as source raw material for synthesis and development of new phases and compounds. A detailed description related to application of rice husk in industrial sectors as well as other fields has been given below.

A. As a Fuel in Power Plant:

Rice husk is mostly used as fuel in boilers for processing paddy and generation of process steam. Heat energy is produced through direct combustion. Small sector process industries use fixed low capacity boilers, which are manually fired using rice husk as a fuel. Partial and uneven fuel combustion leads to smoke emission and decrease the fuel efficiency. As husks are available virtually for free, the boiler efficiency and the degree of combustion were the issues of receiving the latest attention. Plants with capacity 2-10 MW range can become commercially viable and this biomass resource can be utilized to a much greater extent than at present. It has been seen that to produce 1MWh, approximately 1 tons of rice husk is required. So, the technical and economic factors decide the effective use of rice husk as fuel for power generation. Also, rice husk has been used as a useful and alternative fuel for household energy. RH is also used The increasing need for stronger and durable building materials has been to some extent fulfilled by a new concept i.e, blended cement. Blending of reactive rice husk ash in cement has become a common recommendation almost in all the international building codes. Extensive research has been carried out on application of RHA as mineral additive to improve performance of concrete. Reports indicated RHA as a highly reactive pozzolan RHA is mainly used a replacement of silica fume.



B. Use in Ceramic and refractory industry:

Rice husk ash is used in the manufacture of refractory bricks because of its insulating properties. It has been used in the manufacture of low-cost, lightweight insulating boards. RHA has been used as silica source for cordierite production. Replacement of kaolinite with rice husk silica in the mixture composition, yields higher cordierites with a lower crystallize temperature and decrease in activation energy of crystallization.

C. Insulating fire brick using RH:

Bricks made using rice husk develop plenty of pores during heat treatment due to burning out of organic material. The more the percentage of rice husk in a brick, the more porous would be the brick and better thermal insulation. Presences of entrapped air in pores have thermal insulating characteristics and thus make the porous fire brick structure suitable for back up insulation.

D. Other uses:

RH is used as a raw material for production of xylitol, furfural, ethanol, acetic acid, lingo sulphonic acids. It is used as cleaning or polishing agent in metal and machine industry, in manufacturing of building materials etc. RH has been used as an industrial raw material e.g. as an insulating board material, fillers in plastics, filling material, building materials, for making panel board, activated carbon etc. Little effort has been made to manufacture composite products based on two surface structure of rice husk. Despite so many well established uses, little portion of rice husk produced is utilized in a meaningful way, remaining part is allowed to burn in open piles or dumped as a solid waste. Rice Husk ash finds large number of industrial applications which are described below.

Applications of rice husk ash:

Rice husk ash has been widely used in various industrial applications such as processing of steel, cement, refractory industry etc. Suitability of RHA mainly depends on the chemical composition of ash, predominantly silica content in it. RHA is found to be superior to other supplementary materials like slag, silica fume and fly ash.

RHA in Steel industry:

RHA is used during the production of high quality flat steel. The ash also finds application as an excellent insulator, having fine insulating properties including low thermal conductivity, a high melting point, low bulk density and high porosity. It is used as "tundish powder" to insulate the tundish container, prevent rapid cooling of steel and ensure uniform solidification in casting process. RHA is also used as a coating over the molten metal in the tundish and in ladle which acts as a very good insulator and does not allow quick cooling of metal.

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Use of RHA as Silica Source:

Due to presence of large silica content in ash, extraction of silica is economical. Silica is also precipitated in customized forms to meet the requirements of various uses. Some of the uses of silica are in rubber industry as reinforcing agent, in cosmetics, in toothpastes as a cleansing agent and in the food industry as an anti-caking agent there is a growing demand for fine amorphous silica in the production of high performance cement and concrete, use in bridges, marine environments. RHA in cement and construction industries The increasing need for stronger and durable building materials has been to some extent fulfilled by a new concept i.e., blended cement. Blending of reactive rice husk ash in cement has become a common recommendation almost in all the international building codes. Extensive research has been carried out on application of RHA as mineral additive to improve performance of concrete. Reports indicated RHA as a highly reactive pozzolana RHA is mainly used a replacement of silica fume or as an admixture in manufacturing of low cost concrete block. Lower values of compressive strength at early ages for up to 7 days except for the mixture where the compressive strength was higher due to the increased reactivity and the filler effect of RHA. Based on that, it can be noticed that the amount of RHA present when 5% replacement used is not adequate to enhance the strength significantly. The available silica from the addition of 5% RHA reacted with only a small portion of C-H released from the hydration process and thus, the C-S-H released from the pozzolanic reaction was relatively limited. However, this was overcome by the age of 28 days where the strength achieved higher values than the control. The strength increased with RHA for up to 10% which resulted in achieving the maximum value. The strength values when RHA was replaced by 15% were found to be similar to 5% replacement except that at the age of 7 days, the strength was higher than the control for all RHA mixtures, in this case, the amount of silica available in the hydrated blended cement matrix is probably too high and the amount of the produced CH is most likely insufficient to react with all the available silica and as a result of that, some amount of silica was left without any chemical reaction.

Other applications:

The possibilities of improving residual soil properties by mixing RHA and cement in suitable proportions as stabilizing agents. Indian Space Research Organization has successfully developed a technology for producing high purity silica from RHA that can be used in manufacturing of silicon chip in industry ref. the possibility of using RHA in water purification use of Rice Husk to synthesize High-Performance Phosphors. Other uses of RH are in control of insect pests in Stored Food Stuffs, in the water purification, in vulcanizing rubber, as flue gas desulphurization absorbents. RHA has been found to be effective as an oil spill absorbent, and for use in waterproofing chemicals, flame retardants, and as a carrier for pesticides and insecticides. Its absorbent and insulating properties are useful to many industrial applications.

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