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# ASSESSING THE SCOPE OF UTILIZING WASTE FROM BRICK PRODUCTION FOR BUILDING MATERIALS

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## ABSTRACT

*The recent increase in infrastructure sector is resulting in increased production of bricks. The brick industry of India is managed by unskilled labour resulting in high amount of waste generation, the waste generated is a cause of environmental concern.*

*Published research reports have indicated it as a viable material to be utilised in concrete industry. This paper presents an overview of the work done in earlier studies depicting the effect of brick dust on the properties of concrete*

***Keywords: Brick Dust, Compressive Strength, Durability***

## I. INTRODUCTION

In developing countries bricks are still one of the most popular construction materials. India is the second largest producer of fired clay bricks after china. India is estimated to have more than 100,000 brick kilns, producing about 150-200 billion bricks annually, employing about 10 million workers and consuming about 25 million tons of coal annually [8]. For brick making availability of good soil is crucial. Recently number of additives are added or are replaced with clay to increase the performance of bricks including fly ash, bagasse ash, rice husk ash etc. The utilisation of waste from different industrial sector is appreciable for the environment and for the economy of the state also. The waste from the brick production facilities is also a cause of concern as the brick sector of India is unmanaged and have poor worker skill which causes high waste generation.The waste generated from the brick production can be broadly classified as

- Brick dust or Surkhi
- Deformed bricks
- Over burnt bricks
- Broken bricks
- Fly ash

The fly ash generated is being utilised by various other industries and have sufficient recycling values. The rest of the waste is being dumped on the roadside or in land filling causing environmental concerns.The presence of water bodies near the brick kilns also adds the high risk of water contamination and poses a threat to water ecology.

With increasing restrictions on the landfills and increased concerns about environmental quality, effective waste management is being desired. The current study is aimed to review the published literature on building materials with brick dust waste as raw material.

## II. CHARACTERISTICS OF BRICK POWDER

Table 1 presents the chemical composition of brick powder waste from different studies. Table 2 presents the physical properties of brick powder waste.

**Table 1: Chemical Composition of Brick Powder Waste**

| Author | $SiO_2$ (%) | CaO(%) | $Al_2O_3$(%) | $Fe_2O_3$(%) | MgO(%) | $Na_2O$(%) | Loi |
|---|---|---|---|---|---|---|---|
| Kamal uddin (2004) [1] | 67.43 | 2.12 | 1.99 | 7.99 | 2.46 | 0.08 | 1.10 |
| Aliabdo et al. (2013) [6] | 54.2 | 6.8 | 15.4 | 7.6 | 2.5 | - | 6.2 |
| Demir and Orhan (2003) [9] | 55.91 | 7.20 | 16.68 | 8.29 | 2.32 | 1.09 | 2.28 |

**Table 2: Physical Properties of Brick Powder Waste**

| Authors | Specific gravity | Fineness Modulus | Water absorption (%) |
|---|---|---|---|
| Aliabdo et al. (2013) [6] | 2.43 | 2.44 | 20.00 |
| Sharma et al. (2014) [3] | 2.35 | 3.73 | - |
| Kamal uddin (2004) [1] | 2.6 | 2.11 | - |

## III. PROPERTIES of HARDENED CONCRETE

### 3.1 Compressive Strength

Kamal Uddin (2004)[1] investigated the use of brick dust as mineral admixture replacing cement. The cement was replaced till 60%, the compressive strength values till 20 to 30% replacement were slightly higher than

control concrete at curing ages of 45 days.Singh et al. (2013 [2]examine the use of brick dust as fine aggregate in production of self-compacting concrete. The brick dust substituted natural aggregates by 25 and 50%. The cube compressive strength achieved at 7 days was 23% lower and at 28 days it was lower by 19% when 25% brick dust was utilised as fine aggregate. The strength kept on decreasing at higher substitution levels. Sharma et al. (2014)[3]demonstrated the use of brick dustas partial substitute of cement in manufacture of concrete paver blocks. The replacement levels were kept from 5 to 30%. It was observed that compressive strength improved when brick dust was utilised till 15% at all curing ages of 7, 14 and 28 days.Sharif et al. (2013)[4]utilised brick powder as mineral admixture replacing cement by 5, 10 and 15%. The binder content used was of three different series having different water cement ratios. They concluded that 5% brick dust powder can achieve higher strength than traditional concrete. At higher replacement levels a decrease in compressive strength was observed.Khan et al. (2013) [5]studied the brick dust as 10, 20 and 30% fine aggregate replacement in concrete. At the ages of 28 days and 56 days the concrete containing 20% brick dust achieved 12.2% and 25% higher strength than conventional concrete.Aliabdo et al. (2014)[6] studied the effect of 25 to100% replacement of fine sand by brick dust on properties of cellular concrete. They observed that the compressive strength increased by 12.92 and 20.22% till 50% replacement of natural sand and at higher percentages a decrease of 24.16 and 25.84% was observed. Bharti and Patel et al. (2014)[7]utilised brick dust as fine aggregate replacement till 15% replacement. They observed that highest compressive strength of concrete was achieved at 15% presence of brick dust.

### 3.2 Split tensile strength

Bharti and Patel et al. (2014)[7] utilised brick dust as fine aggregate replacement till 15% replacement. They observed that highest split tensile strength of concrete was achieved at 10% presence of brick dust.Aliabdo et al. (2014)[6] studied the effect of 25 to 100% replacement of fine sand by brick dust on properties of cellular concrete. They observed that the split tensile strength increased at all levels of replacements. The increase in split tensile strength after 90 days was 10, 1, 22 and 33% at 25, 50, 75 and 100% replacement levels compared to control mix respectively.

## IV. DURABILITY PROPERTIES OF CONCRETE

### 4.1 Water Absorption

Sharma et al. (2014)[3]demonstrated the use of brick dustas partial substitute of cement in manufacture of concrete paver blocks. The replacement levels were kept from 5 to 30%. It was observed that water absorption increased when brick dust was utilised till 15% at all curing ages of 7, 14 and 28 days.One of the major reason is the water absorption of brick powder in itself is very high which in turns causes an increase in water absorption of concrete.

### 4.2 Sulfate Attack

Sharif et al. (2013)[4] utilised brick powder as mineral admixture replacing cement by 5, 10 and 15%. The binder content used was of three different series having different water cement ratios. They concluded that brick dust powder causes higher expansion than traditional concrete. Although at lower replacement levelsexpansion was within permissible limits.

## V. OBSERVATIONS AND CONCLUSIONS

The review of different published literature results that brick dust or powder has potential to be utilised as lower aggregate replacement in concrete. The strength development pattern of brick dust concrete is similar to that of conventional concrete but there is increase in strength at all the curing ages. The utilisation of mineral admixtures can be used to increase compressive strength at higher substitution levels. From the published research work it is concluded that:-

1. Brick dust is the potential viable material to be used as fine aggregate to produce durable concrete.
2. Its use as fine aggregate in concrete will help in alleviating the potential problem of dwindling natural resources.
3. Its use will also help in protecting the environment surroundings.

Till date a very limited research work on brick dust as aggregate in concrete has been carried out. Therefore further investigations to study the ways in which brick dust as aggregate replacement in concrete affects the rheological properties of fresh concrete, mechanical and durability properties of hardened mass are needed.

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