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## RESEARCH ARTICLE

### Use of Human Hair as Natural Fiber for Fly Ash Bricks to Minimize Negative Environmental Impacts of this Waste.

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#### Abstract

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## INTRODUCTION

The *fly ash* is disposed off either in dry form or mixed with water and discharged as slurry into locations called ash ponds, lagoons or dykes. As we know, fly ash is generated in huge quantities by thermal industry. The quantity of fly ash produced worldwide in enormous and keeps increasing every passing year.

The coal reserves of India are estimated around 200 billion metric tons. Because of this wide availability, 90% of Indian thermal power stations have coal as their energy source.

Fly ash brick is made up of fly ash, sand, lime and gypsum. These bricks are lighter in weight and stronger than common clay bricks. As fly ash is being accumulated as waste in large quantities in thermal power plants, so its utilization as raw material in the manufacture of bricks

not only create opportunities for its proper and useful disposal but, also help to control environmental pollution to a greater extent in the surrounding areas of thermal power plants.

The protein substance in *human hair, nails* etc. are not always managed or utilized in a proper way. So these wastes can be recycled, when they will be integrated in the brick making. So by use of this natural fiber, we can will make the building material green.

**Aim:** - The aim of present study is to investigate the changes in the properties like *strength* by adding *human fiber* and *fly ash* to the bricks.

The fibers were added within the range of 0.20% to 1.00% by weight of fly ash. Then different mixes of fiber fly ash bricks may be tested for various parameters.

### ***Introduction to fiber fly ash brick***

1. **Size:** - a. 6" [230\*150\*80] mm  
b. 4" [230\*110\*75] mm
2. **Density:** - 1700 Kg/m<sup>3</sup>.
3. **Weight:** - a. [5-5.20] Kg  
b. [3.40-3.60] kg (as per size of brick.)
5. **Water absorption:** - (8-12) %
4. **Compressive strength:** - Average compressive strength of fly ash brick is 6N/sq.mm.  
Compressive strength of handmade fly ash brick is 3.5N/sq.mm.
6. **Efflorescence:** - Nil
7. **Composition:** - Cement, crushed sand, stone dust, chemicals.

### ***Advantages of fiber fly ash bricks***

1. Due to high strength, practically there is no breakage during transport and use.
2. Due to uniform size of bricks, mortar required for joints and plaster reduces about by 50%.
3. Seepage of water through bricks is considerably reduced.
4. Plaster of Paris/gypsum can be directly applied.
5. These do not require soaking of water for 24hours, but only sprinkling of water before use is enough.

### ***Disadvantages of fiber fly ash bricks***

1. Mechanical strength is weak.
2. Limitation of size.

### ***Environmental impacts of human hair***

Human hair is considered as a waste material in most parts of the world. Its accumulation in waste streams causes many environmental problems. It is found as municipal waste in almost all parts of the world. In rural areas with low population density, the hair is thrown away in nature, where it decomposes slowly over years, eventually returning the constituent elements namely *carbon, nitrogen, sulphur* and so forth, in their respective natural cycles. But in urban areas with high population density, the hair is thrown out and it accumulates in large amounts in the solid waste streams and chokes the drainage systems, posing a multifaceted problem. Due to

slow degradation, it stays in the dumps for longer period occupying large volumes of space. Over the leachate from these dumps, increases the nitrogen concentration in water bodies, causing problem of *eutrophication*. Burning of human hair or the waste piles containing them- a practice observed in many parts of the world, produces foul odour and toxic gases such as *ammonia*, *carbonyl sulphides*, *hydrogen sulphides*, *phenols*, *pyrroles* and *pyridines*.

Open dumps of hair generate hair dust which causes discomfort to people and if inhaled in large amount, can result in several respiratory problems. Sweat and other organic matter sticking to the hair become a source of foul odour and breeding ground for pathogens.

So the best way to address such problems is to develop systems which utilize this waste material. Besides reducing wastes, it contributes to the economy.

As a potential material resource, human hair has the advantage that it is completely renewable and available in every locality.

### **Experimental investigations:-**

**Table 1: Source of various raw materials for experimental work**

S.No.	Ingredients	Source
01.	Fly ash ( Class F)	A paddy product of Kashmir
02.	Sand	Jehlum river; Kakpora Pulwama Kashmir
03.	Quarry dust	Pantha Chowk Srinagar
04.	Sludge lime	Kathua, Ramban Jammu
05.	Human hair	From ordinary sources

**Table 2: Chemical composition of fly ash**

S.No.	Characteristic	Test results (%age by mass)
01.	Silicon dioxide (SiO <sub>2</sub> )	62.20
02.	Magnesium oxide (MgO)	06.09
03.	Sulphur trioxide (SO <sub>3</sub> )	03.00
04.	Calcium Oxide (CaO)	05.30
05.	Aluminium Oxide (Al <sub>2</sub> O <sub>3</sub> )	07.63
06.	Ferric oxide (Fe <sub>2</sub> O <sub>3</sub> )	07.63
07.	Loss on ignition	00.13

**Table 3:- Proportions of ingredients of fiber ash bricks of different samples**

Sample	No. of bricks	Fly ash (F) (%age)	Sand (%)	Quarry dust (%)	Sludge lime (%)	Human hair (%)	Total (%)
A.	6	70.00	10.00	10.00	10.00	-	100
B.	6	69.80	10.00	10.00	10.00	0.20	100
C.	6	69.60	10.00	10.00	10.00	0.40	100
D.	6	69.40	10.00	10.00	10.00	0.60	100
E.	6	69.20	10.00	10.00	10.00	0.80	100
F.	6	69.00	10.00	10.00	10.00	1.00	100

**Table 4:- Percentage of water absorption**

Sample	Water before absorption of water (Kg)	Percentage of water absorption
A.	2.718	7.82
B.	2.851	4.92
C.	2.991	5.07
D.	2.963	5.74
E.	2.892	6.00
F.	2.860	6.45

**Table 5:- Results for different mixes of human hair fiber fly ash bricks**

Sample No.	Average crushing strength (N/mm <sup>2</sup> )		
	7 Days	14 Days	21 Days
A.	2.456	3.062	4.386
B.	2.398	2.959	4.309
C.	2.872	3.387	4.594

D.	3.875	4.343	4.957
E.	4.789	5.895	6.765
F.	5.700	7.400	7.756

### ***Conclusion***

According to test performed, it is observed that there is increment in the properties of fly ash brick by adding a certain percentages of human hair fiber by weight. By adding human hair, we conclude that there is improvement in the various properties when fly ash is reduced from 0.20 to 1.00% and human hair fiber is increased from 0.20 to 1.00% and other ingredients remain same. In this case the weight of the brick is increased, but percentage of water absorption is decreased and crushing strength is increased compared to normal fly ash brick.

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