INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume 4, Issue 2)

Available online at: www.ijariit.com

An Experiment of Concrete Partially Replacement of Brick Kiln Dust

Rahul Sharma
er.sharmarahul28@gmail.com
Lakshmi Narain College of Technology (LNCT), Bhopal, Madhya Pradesh

Ram Bharosh
ram.kumarnit9893@gmail.com
Lakshmi Narain College of Technology (LNCT), Bhopal, Madhya Pradesh

ABSTRACT

Sustainable resources management and development have been at the forefront of the important issue concerning the construction industry for the past several years. Specifically, the use of sustainable building materials and reuse waste materials is gaining importance and becoming common place in many areas. As one of the most commonly used construction materials in the world, concrete composed of natural aggregate, natural sand, cement, and water, out of this raw material for concrete, cement can be manufactured in industries but natural aggregates are nonrenewable resources and depleting at an alarming rate, results in scarcity of good quality natural occurring aggregates (coarse and finer one). In the present study the hardened properties like compressive strength, split tensile strength, and also durability properties like CSAT and UPV test were carried out on Brick kiln dust concrete. The percentage of bricks kiln dust that partially and fully replaced by fine aggregates by weights were 0%, 10%, 20%, 30%, 40% and 50%. Experiments were conducted for both Ordinary Concrete and bricks kiln dust Concrete with different percentages of BKD. It is observed from the experimental results and its analysis, that the compressive strength of concrete, splitting tensile strength of concrete increases with the addition of low Percentage of bricks kiln dust. The results show that the optimum replacement of recycled bricks kiln dust with fine aggregates was 30%. Up to 30% replacement, it is possible to gain the same strength as conventional concrete.

Keywords: *Bricks kiln dust, Workability, Compressive strength, Split tensile strength, Durability.*

1. INTRODUCTION

The present-day world is witnessing the construction of very challenging and difficult civil engineering structures. Quite often, concrete is the most important and widely used material is called upon to possess very high strength and sufficient workability properties. Efforts are being made in the field of concrete technology to develop such concretes with special characteristics. Researchers all over the world are attempting to develop high performance concretes by using bricks kiln dust in concrete up to certain proportions On the other hand Brick kiln dust (BKD) is a waste product obtained from different brick kilns and tile factories. There is numerous brick kiln which has grown over the decades in an unplanned way in different part of the country. Tons of waste products like brick dust or broken pieces or flakes of bricks (brickbat) come out from these kilns and factories. So far, such materials have been used just for filling low lying areas or are dumped as waste material causing land scarcity and Generally, it is important that fine aggregates should have good strength, durability and weather resistance i.e. surface of concrete should be free from impurities such as loam, silt and organic matter, durable particle free from absorbed chemicals in permissible amount that will not affect hydration of cement and water, and bond of cement paste. The most important factor that governs the selection criterion of bricks kiln dust as a construction material in concrete works is its availability. Often the field engineers have to produce concrete from the bricks kiln dust generally available and close to the construction sites.

2. MATERIALS USED

2.1 Cement

Ordinary Portland cement (OPC) from a single lot was used throughout the course of the investigation. The physical properties of the cement are determined from various tests, conforming to Indian Standard IS: 1489-1991(Part-1) are listed in Table 3.1. All the tests were carried out as per recommendations of IS: 4031-1988. Cement was carefully stored to prevent deterioration in its properties due to contact with the moisture.

2.2 Course aggregate

Crushed angular granite metal from a local source was used as coarse aggregate. The specific gravity was 2.67; the coarse aggregate is defined as that retained on 4.75 mm IS sieve. To increase the density of the resulting concrete mix, the coarse aggregate is frequently used in 20mm sizes

2.3 Fine Aggregate

IS 383-1970 defines the fine aggregate, as the one passing 4.75 mm IS sieve. The fine aggregate is often termed as a sand size aggregate. Locally available riverbed sand was used in the present study. The sand conforms to grading Zone – III as per IS: 383 – 1970 respectively. The specific gravity was 1.78.

2.4 Brick Kiln Dust

Brick dust is a waste product obtained from different brick kilns and tile factories. There is numerous brick kiln which has grown over the decades in an unplanned way in different part of the country. Tons of waste products like brick dust or broken pieces or flakes of bricks (brickbat) come out from these kilns and factories. So far, such materials have been used just for filling low lying areas or are dumped as waste material. The specific gravity was 2.50. The bricks kiln dust conforms to grading Zone – III as per IS: 383 – 1970 respectively.

3. MIX PROPORTIONS

Table 3.1 Mix details for mortar and concrete

MIX	SAND (%)	BKD (%)
M1	100%	0%
M2	90%	10%
M3	80%	20%
M4	70%	30%
M5	60%	40%
M6	50%	50%

4. RESULT AND DISCUSSION ON EXPERIMENTAL TESTS

4.1 Workability of Concrete Mixes

The workability of concrete mixes was found out by slump test as per procedure is given in chapter 3. w/c ratio was kept constant 0.45 for all the concrete mixes. The workability results of different concrete mixes were shown in Table 4.1

Table 4.1 Workability values for different concrete mixes

Mix no.	Description	Slump (mm)
1	100%FA+0%BKD	120
2	90%FA+10%BKD	114
3	80%FA+20%BKD	105
4	70%FA+30%BKD	100
5	60%FA+40%BKD	100
6	50%FA+50%BKD	90

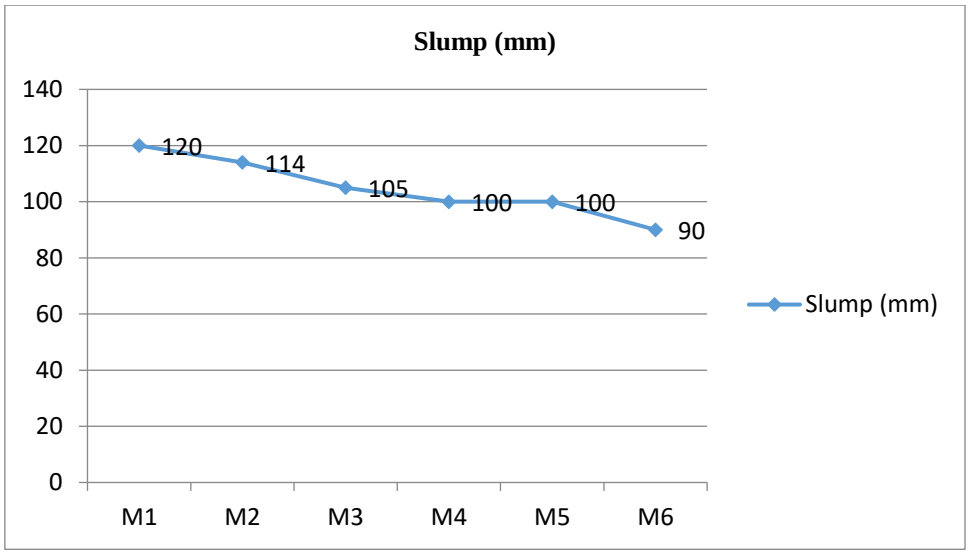

Fig. 4.1 workability of concrete different mixes

Table 4.1 shows that as the addition of bricks kiln dust to concrete mix increases, the workability of the concrete mix was found to decrease as compared to control mix. The addition of bricks kiln dust into the concrete mix further decreases the workability. The lowest value of slump was obtained with mix 0%FA+100%BKD and the highest value was obtained with 100%FA+0%BKD. The mix with the combination 90%FA+10%BKD show nearly equivalent workability compared to control mix.

4.2 Compressive Strength

The results of the compressive strength tests conducted on concrete specimens of different mixes cured at different ages are presented and discussed in this section. The compressive strength test was conducted at curing ages of 7, 14, 28, 56 and 90 days. The compressive strength test results of all the mixes at different curing ages are shown in Table 5.1. Variation of compressive strength of all the mixes cured at 7,14,28,56 and 90 days are also shown in Fig. 5.2

Table 4.2 Compressive strength (MPa) results of all mixes of concrete at different curing ages

Mix no.	Description	7 days	14 days	28 days	56 days	90 days
1	100%FA+0%BKD	19.00	22.00	25.00	28.00	39.40
2	90%FA+10%BKD	16.65	18.00	26.60	29.00	39.67
3	80%FA+20%BKD	17.82	19.2	25.70	24.40	31.80
4	70%FA+30%BKD	18.90	21.50	29.10	31.12	37.20
5	60%FA+40%BKD	22.50	22.80	27.50	32.30	38.30
6	50%FA+50%BKD	16.20	20.10	24.50	26.8	31.50

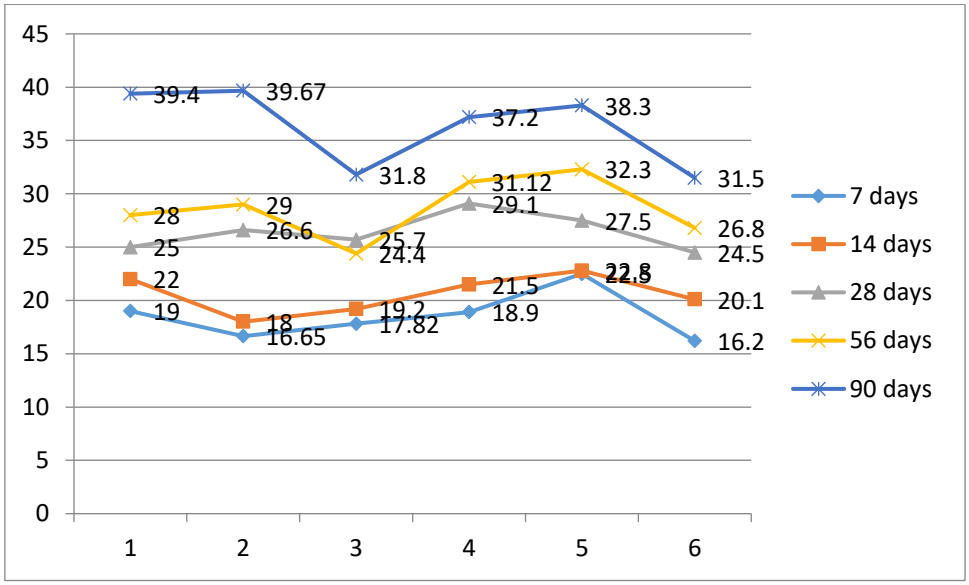

Fig. 4.2 Variation of compressive strength of concrete with age

Table 5.2 shows that addition of BKD 50% replacement by weight of fine aggregate shows a decrease in compressive strength at 28 days concrete compared with control mix of concrete. It can also be observed from the Fig 5.1 that the maximum compressive strength at 28 days of curing was obtained for a mix containing 70%FA+30%BKD. At 50% BKD addition, the compressive strength of concrete mix was found to decrease in 28, days of curing compared with control mix of concrete. The maximum value of compressive strength obtained for concrete mix with 70%FA+30%BKD was 29.10 at 28 days of curing respectively. The value of compressive strength obtained for concrete mix with 80%FA+40%BKD was 27.50 at 28 days of curing respectively.

4.3 Split Tensile Strength Test Results

The results of the splitting tensile strength tests conducted on concrete specimens of different mixes cured at different ages are presented and discussed in this section. The splitting tensile strength test was conducted at curing ages of 7, 14, 28, 56 and 90 days. The splitting tensile strength test results of all the mixes at different curing ages are shown in Table 4.3.Variation of splitting tensile strength of all the mixes cured at7, 14, 28, 56 and 90 days is also shown in Fig. 4.2. Shows the variation of splitting tensile strength of concrete mixes w.r.t control mix (50%FA+0%BKD) after 7, 14, 28, 56 and 90 days respectively.

Table 4.3 Splitting tensile strength (MPa) results of all mixes of concrete at different curing ages

Mix no.	Description	7 days	14 days	28 days	56 days	90 days
1	100%FA+0%BKD	3.50	3.18	4.48	5.23	5.28
2	90%FA+10%BKD	3.32	3.28	3.12	3.82	4.33
3	80%FA+20%BKD	3.12	3.13	3.24	3.69	4.14
4	70%FA+30%BKD	3.18	3.43	3.52	4.21	4.38

5	60%FA+40%BKD	3.28	3.21	3.51	4.29	4.19
6	50%FA+50%BKD	2.92	3.47	3.24	3.88	4.00

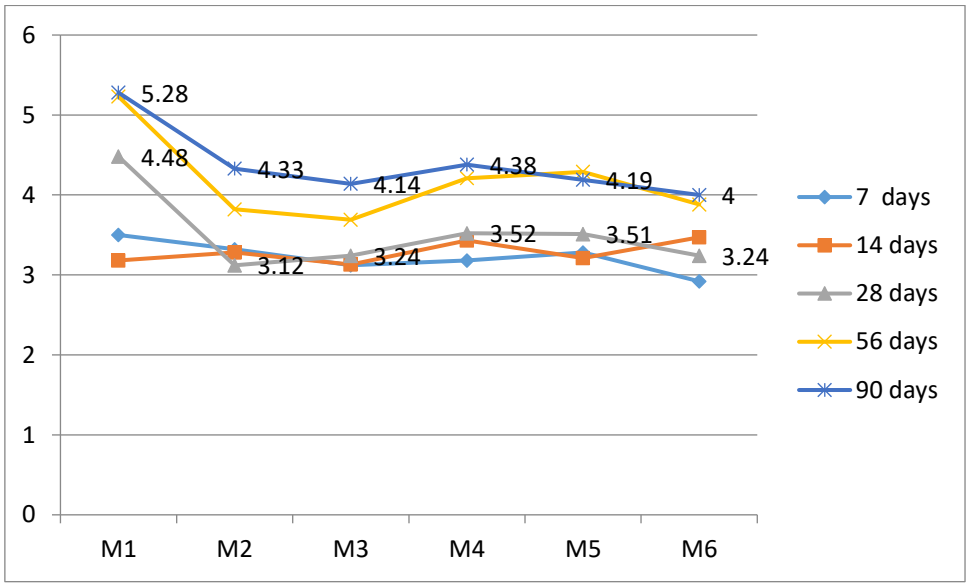

Fig. 4.3 Variation of split tensile strength of concrete with age

Fig.4.3 shows that the splitting tensile strength test results of bricks kiln dust concrete show The maximum value of splitting tensile strength obtained for content 70%FA+30%BKD mix was 3.52MPa and 4.38MPa at 28 and 90 days respectively. The lowest split tensile strength was obtained by 50%BKD, mix which is 3.24 and 4.00MPa at 28 and 90 days respectively.

5. DURABILITY

5.1 Ultrasonic pulse velocity (UPV) Test Results

The results of the UPV tests conducted on concrete specimens of different mixes cured at different ages are presented and discussed in this section. The UPV test was conducted at curing ages of 56 and 90 days. The UPV test results of all the mixes at different curing ages are shown in Table 4.7 and 4.8.

Table 5.1 UPV values at 56 days of curing

Description	Distance (mm)	Transit time (µ sec)	Average pulse velocity (km/sec)	Quality of concrete
100%FA+0%BKD	150	30.80	4.00	Good
90%FA+10%BKD	150	36.60	4.13	Good
80%FA+20%BKD	150	31.90	4.71	Excellent
70%FA+30%BKD	150	37.50	4.01	Good
60%FA+40%BKD	150	31.80	4.71	Excellent
50%FA+50%BKD	150	33.2	4.51	Good

Table 5.2 UPV values at 90 days of curing

Description	Distance (mm)	Transit time (µ sec)	Average pulse velocity (km/sec)	Quality of concrete
100%FA+0%BKD	150	33.70	4.45	Good
90%FA+10%BKD	150	36.70	4.08	Good
80%FA+20%BKD	150	36.10	4.15	Good
70%FA+30%BKD	150	36.30	4.13	Good
60%FA+40%BKD	150	37.70	3.97	Good
50%FA+50%BKD	150	38.40	3.91	Good

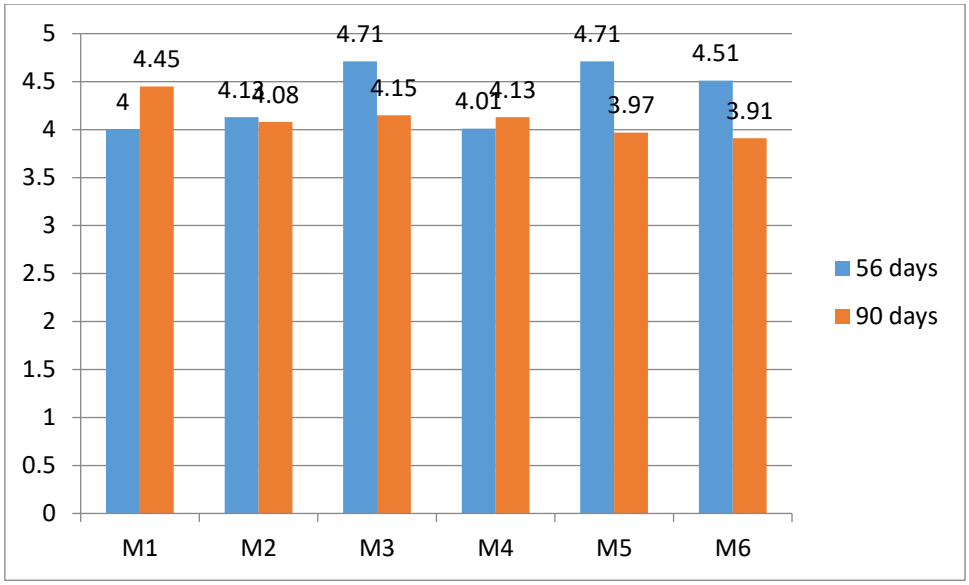

Fig.5.1 Variation of UPV value 56, and 90 days

Table 4.7 and 4.8 shows the UPV values at 56 and 90 days of curing. It was observed that concrete mix containing 60FA%+40%BKD and 80%FA+20%BKD showed highest value of UPV than all the values i.e. 4.71(km/sec) at 56 days of curing respectively and highest value of UPV 4.45(km/sec) at 90 days Concrete mix containing 100%FA+0%BKD, showed lowest UPV value i.e. 4.00(km/sec) at 56 days and lowest value UPV 3.91(km/sec) at 90 days respectively

6. CONCLUSIONS

6.1 Introduction

In the current investigation, bricks kiln dust (BKD) were used to examine the strength and water absorption characteristics using Capillary Suction test as per C 1585 – 04, and UPV test. The experimental data obtained has been analyzed and discussed in Chapter-4, to fulfill to the best of ability, the objectives set forth for the present investigation. This chapter gives the broad conclusions that are drawn from the investigation.

Based on the scope of work carried out in this investigation, following conclusions are drawn.

6.2 Conclusions

a. Brick kiln dust can be efficiently used to produce good quality concrete and mortar with the satisfactory slump and setting times. The test results show that results are within the permissible limits prescribed by the IS Standards.

b. All concrete mixes using brick kiln dust fulfilled the performance criteria for fresh and hardened properties.

c. Under certain conditions, replacement of fine aggregate by brick kiln dust appears to increase the strength of concrete and mortar.

d. Good hardened properties were achieved for the concretes with 30 up to% bricks kiln dust which can be considered as the optimum content for high compressive strength.

e. The compressive strength of a concrete increase in containing 70%FA+30%BKD.

f. the splitting tensile strength test results of bricks kiln dust concrete show The maximum value of splitting tensile strength obtained for content 70%FA+30%BKD mix was 3.52MPa and 4.38MPa at 28 and 90 days respectively.

g. the variation in IRA value of concrete mixes at different curing ages. The lowest IRA value was obtained with a mix containing 70FA%+30%BKD for all curing ages, whereas mix containing 50%FA+50%BKD give the maximum value at all curing ages

7. REFERENCES

[1] Ali, S., Harthy, A., Taha, A., Faisal, M., (2003) Effect of cement kiln dust (CKD) on the mortar and concrete mixtures. Construction and Building Materials 17 (2003) 353–36.
[2] ASTM C 1585 -04 (2007) Standard test method for measurement of the rate of absorption of water by hydraulic-cement concretes.
[3] Brahim, I., rkmen, T., (2003) Influence of different curing conditions on the physical and mechanical properties of concretes with admixtures of silica fume and blast furnace slag. Materials Letters 57 (2003) 4560–4569 Indian Standard IS: 516-1959, bureau of India standards, Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
[4] Corinaldesi, V.,Moriconi, G., Tarun Naik, R., (2010). Characterization of marble powder for its use in mortar and concrete. Construction and Building Materials 24 (2010) 113–117.
[5] Cachim, B., (2009) Mechanical properties of brick aggregate concrete. Construction and Building Materials 23 (2009) 1292–1297.

[6] Ghrici, S., Kenai, M., Mansour, S., (2007) Mechanical properties and durability of mortar and concrete containing natural pozzolana and limestone blended cements. Cement & Concrete Composites 29 (2007) 542–549.
[7] Indian Standard IS 383-1970, Bureau of India Standards, Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
[8] Indian Standard IS 383-1970, Bureau of India Standards, Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
[9] Indian Standard IS: 10262-2009, Bureau of India Standards, Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
[10] Indian Standard IS: 4031-1988, Bureau of India Standards, Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
[11] Indian Standard IS: 1489-1991(Part-1), Bureau of India Standards, Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
[12] Indian Standard IS 456-2000, Bureau of India Standards, Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
[13] Indian Standard IS : 269-1976, Bureau of India Standards, Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
[14] Konstantinos, G., Trezos, a., Michael, F., (2013). Durability of similar self-compacting concrete batches produced in two different EU laboratories. Construction and Building Materials 40 (2013) 207–216.
[15] Khalid, B., Zaher, N., Mahmod, S., Khaliq, A., (2014) Experimental investigation on using Cement Kiln Dust (CKD) as a cement replacement material in producing modified cement mortar. Construction and Building Materials 55 (2014) 5–12.

