Journal of Data Acquisition and Processing
ISSN: 1004-9037
https://sjcjycl.cn/
DOI: 10.5281/zenodo.777593

EVOLUTION OF MICACEOUS BRICKS

Arvind Dewangan
Model Institute of Engineering & Technology, Jammu (J&K) India
e-mail arvinddewangan237@gmail.com

Abhishek Chandra
Model Institute of Engineering & Technology, Jammu (J&K) India
abhishekchandra123@gmail.com

Abstract
The sand deposited along the bed of rivers in the country generally contains mica particles in fair proportions. While there is general awareness with regard to the deleterious effect of using micaceous sand on the properties of concrete, the experimental evidence bearing on that aspect is lacking. This aspect in concrete mix design has been investigated as removal of mica in sand by simple washing, wind blowing omr density separation method is not practicable. The experimental investigations were carried out with sand containing mica content ranging from 2 percent to 12 percent and studied its effect on compressive strength, split strength, workability and unit weight of concrete.
Key Words : Mica, Muscovite, Biotite, Sub Area : Engineering Geology, Broad Area : Civil Engineering

GENERAL DESCRIPTION

Mica which is considered to be harmful for concrete may be present in almost all river sands although the proportion may vary from negligible to substantial amount. The mica being flaky and laminated in structure affects the strength and workability of concrete in the way other flaky and laminated particles do. fhe effect on durability will mostly results from the unsatisfactory workability of fresh concrete and leads to increased permeability. In addition, recently it is known that in the presence of active chemical agents produced during the hydration of cement conversion of mica to other forms may result.

The mica group includes silicates of aluminium and potassium (or rarely, sodium) with hydroxyl or fluorine, and usually with magnesium, iron or lithium. The members of the group are usually monoclinic and pseudohexagonal but may be hexagonal or triclinic. All micas have very perfect basal cleavage, giving thin elastic laminae, they are characterized by weak birefringence in cleavage flakes and basal sections combined with strong birefringence in transverse sections.

AIM & SCOPE OF PRESENT STUDY

During the past five to six decades lot of research work has been carried out to investigate the effect of deleterious substances present in sand on the properties of concrete. These investigations which also include the experimental work helped to identify various deleterious substances present in sand.

The earlier studies and research work were carried out on biolite variety of mica only. Hence in the present investigation an attempt has been made to study the harmful effects of muscovite mica present in Yamuna river sand on the strength of concrete. Firstly a mica separation technique is used for the assessment of mica already present in sand, so that excess of muscovite be added accurately corresponding to the required proportion and later on a total of ninety cubes and sixty cylinders containing varying proportion of mica were cast and tested for compression and split strength respectively. The mix and w/c ratio for all types were kept constant. The percentage of mica v;as only variable for the study. The effect on the properties of sand was studied.

In short the aim was to obtain the results which gave reduction in strength corresponding to percentage of mica present so as to make suitable allowances for the possible reduction in the strength of concrete.

PERMISSIBLE LIMITS FOR DELETERIOUS SUBSTANCES IN CONCRETE AGGREGATE

IS-383-1970

Sr. No.	Deleterious substance	Method of test	Fine Aggregate % by Wt, 1^ax		Coarse Agg:cegate % by Wt, Max.	
			Uncrushed	Crushed	Uncrushed	Crushed
(1)	(2)	(3.)	(4)	(5)	(6)	(7)
1.	Coal and lignite	IS 2386 (Pt.II)-1963	1.00	1.00	1.00	1.00
2.	Clay lumps	-do-	1.00	1.00	1.00	1.00
3.	Materials finer than 75 micron IS Sieve	IS:2386 (Part I) - 1963	3.00	15.00	3.00	3.00
4.	Soft fragments	IS:2386 (Part II)- 1963	^	"•	3.00	••
5.	Shale	-do-	1.00	-	-	-
6.	Total of percent of all deterious materials (except mica) Including sr. no.1 to 5		5.00	2.00	5.00	5.00

EXPERIMENTAL PROGRAMME

The aim of present investigation is to study the effect of muscovite mica present in fine aggregate on the strength of concrete. The sand sample was procured from the Yamuna River. Referring Table (1.1), it can be seen that the sample taken from Yamuna River, contains muscovite along with biotite, the mica content may be as high as 11 percent. The procedure was to add mica in a sand in definite proportion say 2,3,5,8 & 10 percent by weight of sand and then prepared a concrete mix for each proportion of mica. The main problem faced was that the excess of mica could be added only if the ^mica originally present in sand was estimated. For the

separation or assessment of quantity of natural mica in sand, various experimental methods tried were :

(a) Wind Blowing Method
(b) Floatation or Density Separation Method

A trial was made with one kilogram micaceous sand sample. Air was blown against a thin column of sand dropped from a funnel into a channel. This resulted in the more flaky mica particles being carried to a greater distance than the sand particles, resulting in the elimination of a certain percentage of mica in the original sand. Angular velocity of fan corresponding to (180 rpm) gave the maximum removal of mica. The mica separated was recovered and weighed.

Density Separation or Floatation Method :

Mica particles of muscovite and biotite varieties differs from other constituents of sand, such as clay, silt, silica etc. with respect to their specific gravity. The specific gravities of silica and clay are 2.2-2.65 and 2.4-2.82 respectively, while that of mica varies from 2.8-3.0. This difference in physical property can therefore be taken advantage of to separate out the mica particles in sand by density separation method.

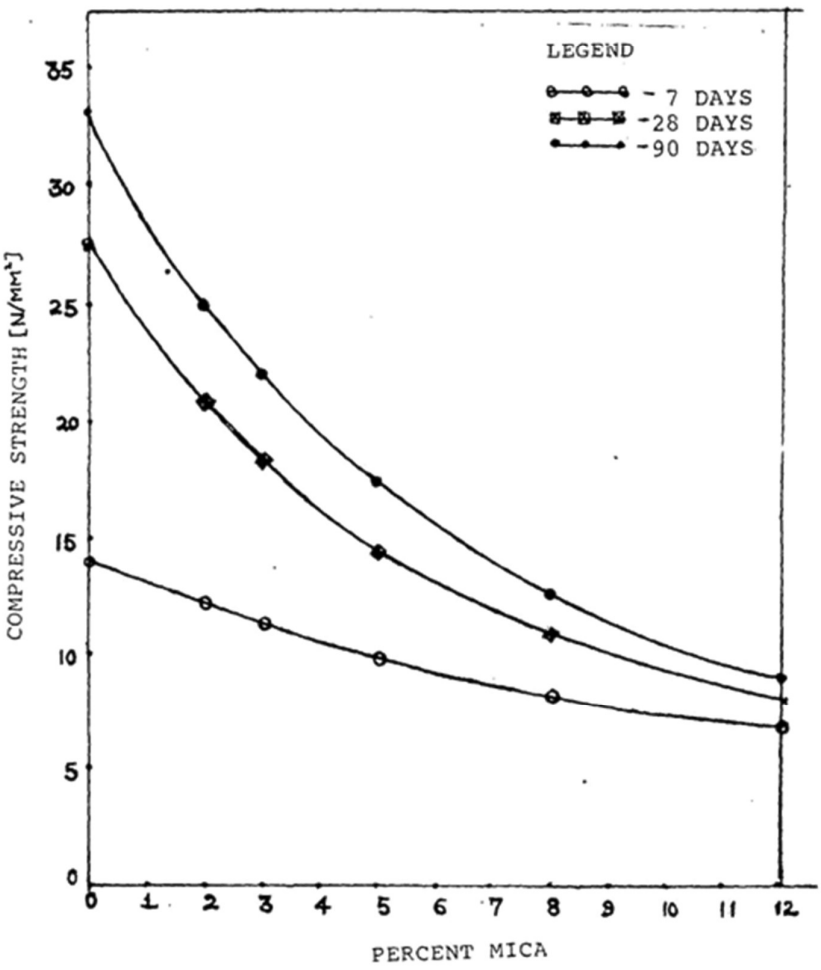

FIG.3.6.1 CURVES SHOWING VARIATION IN COMPRESSIVE STRENGTH CHARACTERISTICS OF CONCRETE WITH VARIATIONS IN THE MICA CONTENT OF SAND FRACTIONS.

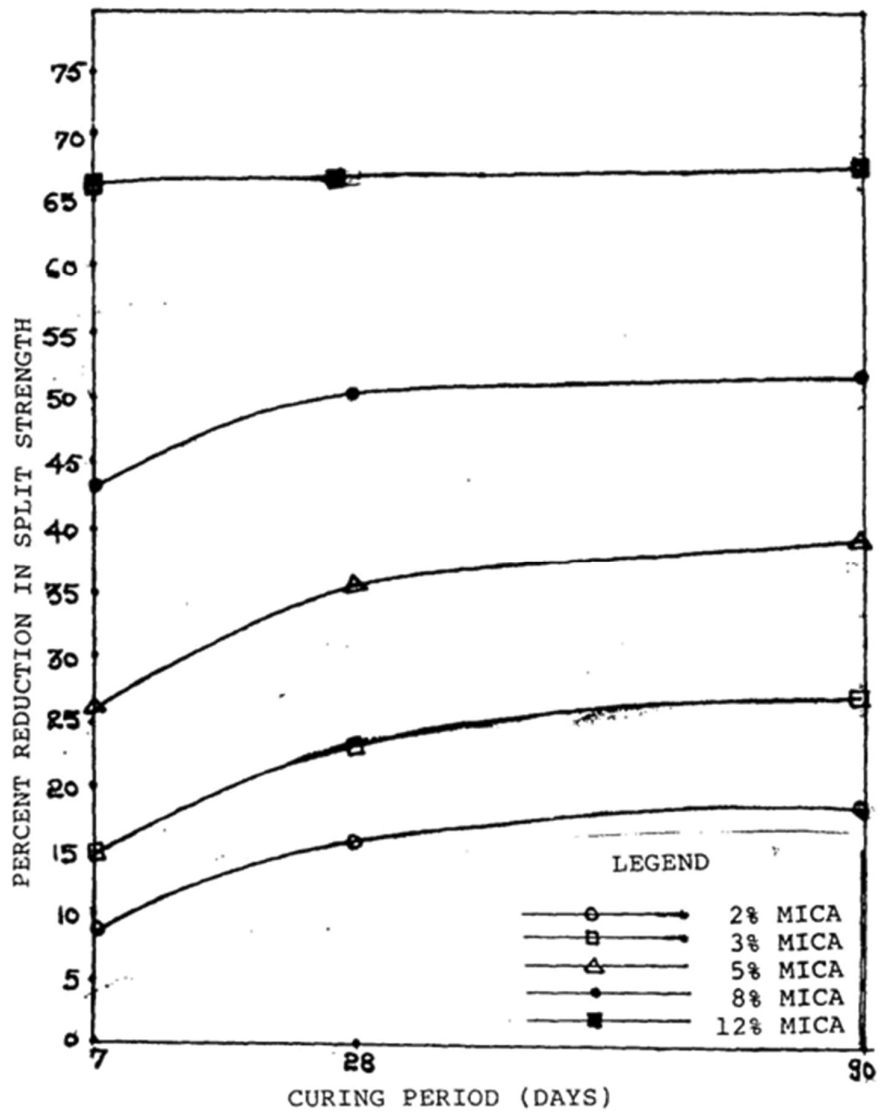

FIG. 3.6.6 CURVES SHOWING REDUCTION IN SPLIT STRENGTH CHARACTERISTICS OF CONCRETE (EXPRESSED AS PERCENT OF NO MICA MIX) WITH VARIATION IN CURING PERIODS

DISCUSSION OF RESULTS

Materials required for sample 1 and 2 (Three mould each of size 150×150×150$\boldsymbol{mm3}$):-

	Cement (kg)	Fine Aggregate (kg)	Course Aggregate(kg)	Mica (kg)
Sample A	1.443×6= 8.658	2.21×6= 13.26	4.416×6=26.496	0.0367×6=0.2202 (2.5 Percent of cement replace by mica)
Sample B	1.400×6= 8.4			0.0736×6=0.4416 (5 percent of cement replace by mica)

Validation:-

	Compressive strength ($^{N}/_{mm2}$)		Gain strength (%) as compare to M20 PCC	
	After 7 Days	After 28 Days	After 7 Days	After 28 Days
PCC	13.5	20		
Sample 1(2.5 Percent of cement replace by mica)	14.32	22.84	5.90	14
Sample 2 (5 percent of cement replace by mica)	15.03	24.72	11.12	23.54

The split strengths as found by extroploting the curve. , corresponds to no mica were 1.14, 2.1 & 2 2.46 N/mm at 7, 28, & 90 days respectively.

- The strengths at 2 percent of mica were 1.04, 1.77 and 2.0 at 7, 28 and 90 days respectively.
- The strengths at 3 percent of mica were 0.97, 1.61, 2 and 1.79 N/mm at 7, 28, & 90 days respectively.
- The strength corresponding to 5 percent of mica at 7,28 & 90 days were 10.0, 14.5 and 17 N/mm respectively.
- The strengths corresponding to 8 percent of mica at 7, 28 & 90 days were 8.4, 11.0 and 12.75 N/mm^ respectively.

* 27.66, 47.80, 49.01 percent corresponding to 5 percent mica at above specified days.

* 40.43, 60.40, 61.75 percent corresponding to 8 percent mica at above specified days.

Methodology –

(a.) Calculation for Material (For one block)

Density of PCC= 2400 (As Per IS Code)

M20 concrete – 1:1.5:3= cement: Fine Aggregate: Course Aggregate Volume of mould = 150*150*150= 3375000 $mm3$

= 0.003375 $m3$

Wt. of concrete = 2200*0.003375= 8.1kg

Wt. of course aggregate =

$\frac{8.1 \times 3}{5.5} = 4.416 kg$

Wt. of fine Aggregate =

$\frac{8.1 \times 1.5}{5.5}$ = 2.21kg

Wt. of cement =

$\frac{8.1 \times 1}{5.5} = 1.47\ kg$

(b.) Introducing Mica

Sample 01-

2.5 percent of cement replace by mica by weight Wt. of mica = 1.47× 0.025 = 0.037

Remaining Wt. of cement = 1.47-0.037= 1.433kg

Sample 02-

5 Percent of the cement replace by the mica by weight- Wt. of mica 1.472× .05 = 0.073 kg

Remaining Wt. of cement = 1.47-0.073= 1.40kg

(c.) Water cement ratio - Ratio of the weight of water to weight of cement in the concrete mix is water-cement ratio. It is the important consideration in concrete mix design to make the concrete workable.

Water content = 1.47*0.5= 0.735 lit

= 735 ml for one block.

(d.) Sieve analysis – Sieve analysis is an analytical technique used to determine the particle size distribution of a granular material with macroscopic granular sizes. The sieve analysis technique involves the layering of sieves with different grades of sieve opening sizes.

We sieved the course aggregate as following size –

Aggregate passed by 20mm sieve and retained by 10mm sieve.

Validation report -

Mica is widely distributed and occurs in igneous, metamorphic and sedimentary regimes. According to the study, the Nellore district of Andhra Pradesh is famous for its mica (crude)

production. The current study aims to analyze the strength of concrete by replacement of the cement
with mica in appropriate proportion. We have performed the compressive test in the lab and validate the possibility of the mica in civil engineering work. For validation, we prepared 18 numbers of M20 concrete named S1, S2, and S3 in the same number of quantities (six each). The S1 and S2 samples of M20 concretes having 2.5% and 5% mica with the replacement of cement and S3 sample of M20 concrete is the plain concrete cement having ratio 1:1.5:3 of cement, fine aggregate, and coarse aggregate respectively. All these three samples (S1, S2, and S3) having performed on 7days and 28 days respectively. Three quantities of each sample having performed after 7days and the rest three sample having performed after 28days by the compressive testing machine. The result showing that the mica mixed (Replacement with cement) given high compressive strength as compared to the PCC. This validation result gives us the idea about future research on the same project and provides proof that the cement can be replaced by the mica in appropriate proportion but the complete future research will reveal the detailed information about that and further work is continuing.

CONCLUSION

The observations with regard to such properties of concrete as workability, unit weight, compressive and split strength, point to the detrimental effect of mica contained in sand incorporated in the mixes. They are of special significance in so far as they indicate that the presence of mica even to the extend of 1 to 2 percent affects those properties of concrete appreciably. On the other hand in case of clayey impurity, there is evidence that upto certain percentage proportion of clay, its effect may not be detrimental and even in some cases results in some improvement in strength characteristics of concretes.

REFERENCES:

[1]. IS:8112-1989, Indian Standard 43 grade ordinary portland cement specification, BIS, New Delhi.
[2]. IS:269-1989, Indian Standard Specification for ordinary or low heat portland cement, BIS, New Delhi.
[3]. Gogte (BS) An Evaluation of some common Indian rockswith special reference of alkali-aggregate reactions,Engg. Geology 7,2, 1973, p.135-153.
[4].J. Chand, D.P.Gupta Arvind Dewangan “How Does Mica Contents in Sand Affects Characteristics ofConcrete” International Journal of Applied and Engineering Research,
[5.]8 2010 Pp 1325-133
[6.] Arvind Dewangan , R. K. Manchiryal "MICACEOUS BRICKS : A Formulative and Strategic Study" NOVYI MIR Research Journal Vol. 6 ,Issue 3 2021, Pp 60-66