STUDIES ON THE REACTIVITY OF SOME INDIAN FLY ASHES AND CEMENTS BLENDED WITH THEM AS INFLUENCED BY THEIR CHEMICAL AND PHYSICAL CHARACTERISTICS

By

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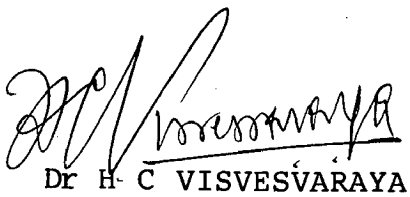
TO

MY FATHER

CERTIFICATE

This is to certify that thesis entitled "STUDIES ON THE REACTIVITY OF SOME INDIAN FLYASHES AND CEMENTS BLENDED WITH THEM AS INFLUENCED BY THEIR CHEMICAL AND PHYSICAL CHARACTERISTICS" being submitted by Mr. RAKESH CHANDRA SHARMA to the Indian Institute of Technology, New Delhi, India, for the award of the "DOCTOR OF PHYLOSOPHY IN MATERIAL SCIENCE", is a record of bonafide research work carried out by him under our guidance and supervision.

To the best of our knowledge the thesis has reached the requisite standard. The material presented in this thesis has not been submitted in part or full to any other university or institution for award of a degree or diploma.



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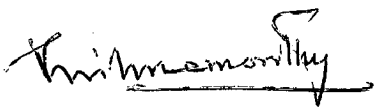

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ABSTRACT

The study under report involved physico-chemical and mineralogical evaluation of flyash samples collected from several Indian sources. The chemical constituents determined were : SiO_2, Al_2O_3, Fe_2O_3, free silica, soluble silica, CaO, MgO and alkalies. The physical characteristics were : specific gravity, fineness, particle size distribution and lime-reactivity. Mineral phases were studied using XRD; morphological features by scanning electron microscopy (SEM) and optical microscopy techniques. The degree of polymerization and effect of modifiers were evaluated using infra-red (IR) spectroscopy. Thermal studies were carried out by DTA and TGA.

A Comparative evaluation was made also of cements blended with some of these flyashes. Pores and porosity in the hardened samples were among the characteristics determined.

The principal conclusions from the study are :

(i) A negative correlation exists between loss on ignition and soluble silica content of flyashes.

(ii) Indian flyashes can be grouped into three categories based on significant parameters, such as glass content (or soluble silica content), loss on

ignition, fineness and lime-reactivity. It is also noted that highest lime-reactivities are associated with those flyashes which show the highest rating for each of these parameters.

(iii) Pores greater than 1000 Å in lime-flyash standard sand mortars is seen to be a significant or determinant factor in the loss of strength of lime-flyash mixes, where porosity is considered to influence the loss of strength of such mortars.

(iv) When flyash of "Highly reactive" group is used for blending with OPC, the pozzolanic reaction is evident even at 24 hours of mixing.

(v) For almost all categories of ashes, very early strength, such as 1-day strength, is relatively higher than what one would expect purely on the basis of replacement percentage. This is due to the "pore filling" effect of flyash, which, however, is not a significant factor in the long term strength of blended cements.

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ABBREVIATIONS

C_3S	-	Tricalcium Silicate (Alite)
C_2S	-	Dicalcium Silicate (Belite)
C_3A	-	Tricalcium Aluminate (Celite)
C_4AF	-	Tetra Calcium Alumino Ferrite
OPC	-	Ordinary Portland Cement
PFA	-	Pulverised Fuel Ash
SEM	-	Scanning Electron Microscope
XRD	-	X-ray Diffraction
IR	-	Infra-red Spectroscope
DTA	-	Differential Thermal Analysis
TGA	-	Thermo Gravimetric Analysis