Biomass Fly Ash in Concrete 1

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Objective:

This investigation determines the effect of biomass fly ash and mingled biomass-coal ash in design mixes on concrete strength, flexure strength, freezing-thawing, setting time and rapid chloride permeability. The work intends to offer information to standardize biomass fly ash addition to concrete.

Project Investigation:

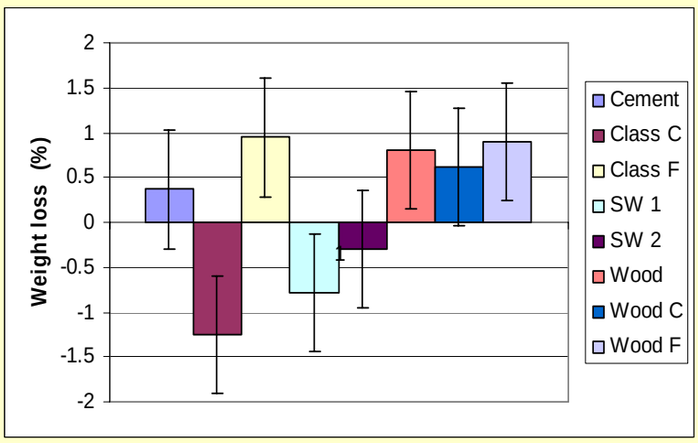
- water/ (cement + fly ash) ratio : 0.5
- 25% substitution of cement with fly ash and their combination
- air volume assumed as 5%
- Coarse aggregate sieved:1/2-1 in.:45%; 3/8-1/2in.:45%; No.4-3/8in. :9.5%; No.8-No.4: 0.50%
- 5 kinds of fly ashes and 2 of their combination are involved:
  1. class C 2. class F 3. wood (sieved with No 10 sieve)
  4 SW1 (co-fired 20%Switchgrass, 80% Galatia coal)
  5. SW2 (co-fired 10%Switchgrass, 90% Galatia coal)
  6.wood C (20% wood mingled with 80% class C)
  7 wood F (20% wood mingled with 80% class F)

Elemental Analysis and LOI of Fly Ash and Cement

Elemental analysis and LOI of fly ash and cement

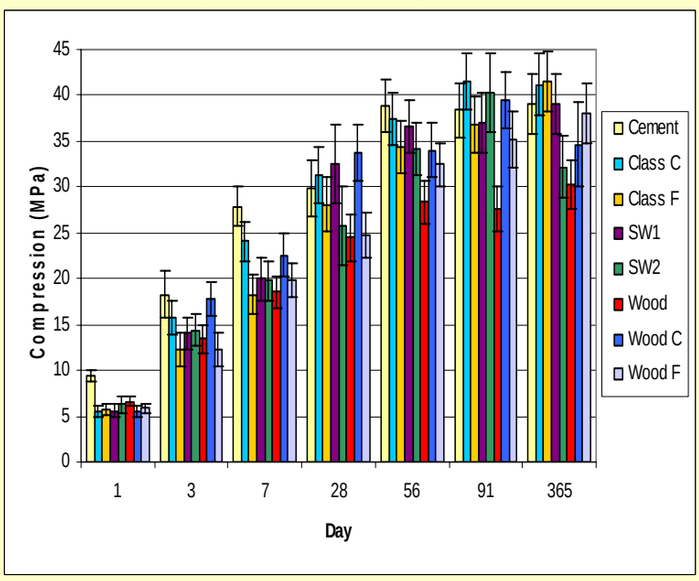
(W %)	Class C	Class F	SW1	SW2	Wood	Cement
TOTAL	100.65	99.04	100.63	99.6	99.82	99.5
SiO_2	37.26	54.91	52.16	53.02	48.94	21.5
Al_2O_3	19.62	27.79	23.55	25.78	12.47	4.2
Fe_2O_3	6.07	7.54	7.57	7.95	5.45	2.7
CaO	24.18	1.11	2.37	1.88	13.55	64.3
MgO	5.37	0.84	1.31	0.91	3.16	2.2
Na_2O	1.5	0.19	0.7	0.26	1.68	0.51
K_2O	0.43	2.4	4.01	2.14	3.37	
Cr_2O_3	0.01	0.02	0.02	0.02	0.03	0
TiO_2	1.52	1.63	1.45	1.65	0.78	0
MnO	0.01	0.02	0.04	0.02	0.12	0
P_2O_5	1.2	0.28	1.04	1.1	0.95	0
SrO	0.3	0.1	0.13	0.2	0.06	0
BaO	0.66	0.12	0.18	0.38	0.07	0
SO_3	1.82	0.37	2.25	1.23	1.3	2.6
LOI	0.7	1.72	3.85	3.06	7.89	1.3
Insoluble Residue	0	0	0	0	0	0.19

Freezing-thawing Test



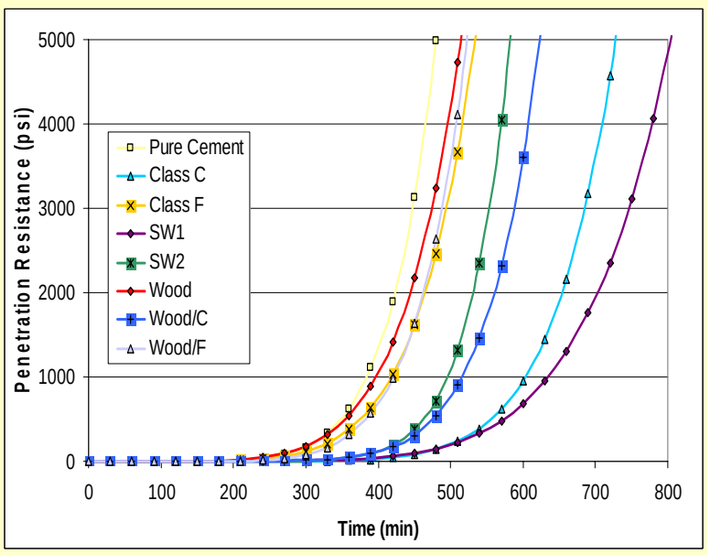
Error bars indicate a 95% confidence interval

Compressive Strength Test

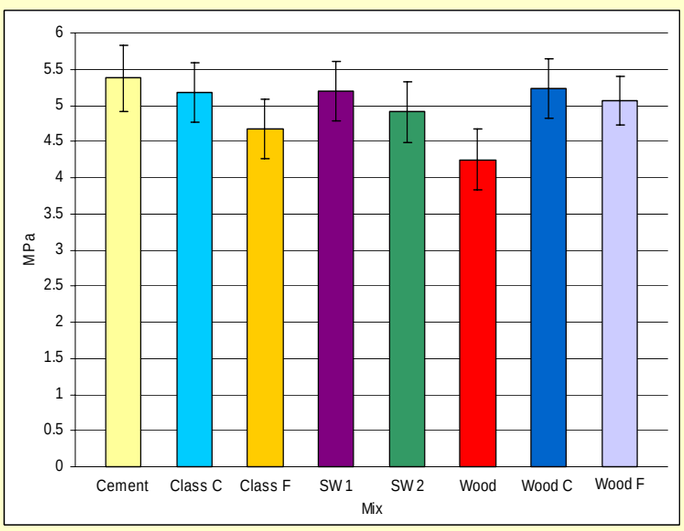


Error bars indicate a 95% confidence interval

Setting Time Test



Flexure Strength Test (56th day)



Error bars indicate a 95% confidence interval

Rapid Chloride Permeability Test