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Discussion

A discussion of the paper "Use of zeolite, coal bottom ash and fly ash as replacement materials in cement production" by F. Canpolat, K. Yılmaz, M.M. Köse, M. Sümer, M.A. Yurdusev [Cem. Concr. Res. 34(5)(2004) 731–735]

H. Ün*

Department of Civil Engineering, Faculty of Engineering, Dokuz Eylül University, Bornova, İzmir, Turkey

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Canpolat et al. have presented a detailed study about the use of pozzolanic materials in cement production. Unfortunately some of their interpretations about zeolite replacement are misleading due to the facts listed below:

The authors claim that "the inclusion of zeolite up to level of 15% had resulted in an increase in compressive strength at early ages". This interpretation seems to be true based on the data in Table 4 in their paper. According to the test results, mortars produced by 5%, 10%, 15%, 20%, 25%, 30%, and 35% zeolite replacement had compressive strength of 25.2, 23.5, 22.1, 17.8, 14.2, 13.4, and 11.7 MPa, respectively where the reference specimens had 21.2 MPa compressive strength at the age of 2 days. However, according to Table 2, the properties of cements those are used for production of mortars are not similar to each other with respect to fineness. The specific surface of normal Portland cement used in the experimental study is 285 m^2/kg, and the specific surfaces of the cement produced by 5%, 10%, 15%, 20%, 25%, 30%, and 35% zeolite replacement are 535, 552, 564, 570, 576, 588, and 613 m^2/kg, respectively.

It is well-known that an increase in of specific surface area of cement causes an increase in mechanical properties of mortars and concrete especially at early ages. Since hydration starts at the surface of the cement particles, it is the total surface area of cement that represents the material available for early hydration. Thus the rate of hydration depends on the fineness of cement particles, and for a rapid development, high fineness is necessary [1].

The fineness of cement affects its reactivity with water. Generally the finer a cement, the more rapidly it will react. It may be noted from (Fig. 1) that generally the high early strength of type III Portland cement is in part due to the higher specific surface approximately 500 m^2/kg Blaine, instead of 330 to 400 m^2/kg for type I Portland cement [2].

It can be seen (Fig. 1) that at the age of 2 days cement with fineness 300 m^2/kg gained approximately 20 MPa compressive strength, where the cements with fineness 400 and 500 m^2/kg gained 30 and 35 MPa, respectively. Moreover, at all ages, the finer cements had higher strengths. This case shows the increase of the compressive strength of zeolite-blended cement used in the experimental study. In other words, the cements used in the experimental study will have approximately the same compressive strength values even if zeolite was not added. Because the

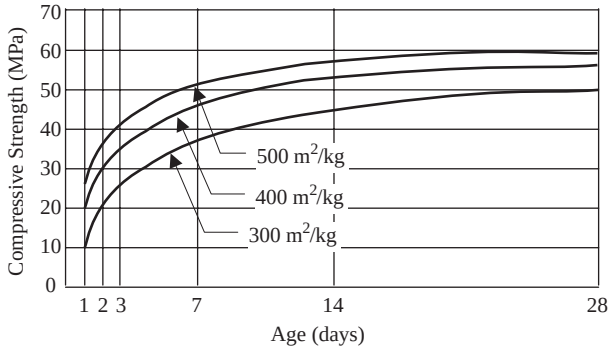

Fig. 1. Influence of cement fineness on strength [2].

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* Tel.: +90 232 4531008x1042; fax: +90 232 4531191.
E-mail address: hayri.un@deu.edu.tr.

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ratio of the fineness of blended cements to reference cement is approximately two.

Finally it must be concluded that the cements produced in this research are not proper for comparing the effect of zeolite on the initial strength of specimens. To investigate this effect of zeolite replacement, cements with the similar fineness have to be produced.

References

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[2] P.K. Mehta, P.J.M. Monteiro, Concrete (microstructure, properties and materials), İndian Concrete Institute, Chennia, 1997.