Removal of Chromium (VI) in Cements and Effects of Additives on Properties of Cements

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Soluble Cr(VI) observes as chromate and dichromate in cements and causes allergic reactions and eczema diseases specially at skin[1,2] . According to directive 2003/53/EC of the Europen Parliament and the Council, the amounts of Cr(VI) contents in cements that used in AB countries must be maximume 2 ppm[3]. This is a serious problem for Turkey which is an important cement manufacturer and exporter country. The cements produced in Turkey have an amount of 50-60ppm Cr(VI) according to the kind of raw materials. The FeSO\textsubscript{4}.7H\textsubscript{2}O (HH) is added in cements with high ratio causes some problems as green color and hydrate water in composition of. This decreases the shelf life of cements.

It was used for reducing Cr(VI) content of kind of Portland Cement (OPC), Portland Puzzolanic (PPC) and Puzzolanic (PC) cement was used HH, monohydrates(MH and MH*), solid lignin (KL), KL/MH mixtures, Na\textsubscript{2}S\textsubscript{2}O\textsubscript{4}, NaHSO\textsubscript{3}, SnCl\textsubscript{2}.2H\textsubscript{2}O, NiH\textsubscript{2}H\textsubscript{2}O and FeS. The KL is prepared waste lignin liquor from the paper industry. The monohydrates was obtained by calcining HH in inert atmosphere (MH), and air atmosphere (MH*) at 130\degree C for 20 minutes.

The compound reduces 2 ppm Cr(VI) that the optimum mixing ratios were found for OPC, PPC, and PC; (KL: 0.44-0.40-0.16%), (MH: %0.14 -0.26-0.05), (HH: 0.16-0.08-0.04%), (MH*: 0.23-0.38-0.09%), (KL/MH:3/1: 0.24-0.24-0.04%), (KL/MH:1/3:0.27-0.28-0.05%), (SnCl\textsubscript{2}.2H\textsubscript{2}O: 0.036-0.025-0.010%), (Na\textsubscript{2}S\textsubscript{2}O\textsubscript{4}: 0.10-0.07-0.04%), (NaHSO\textsubscript{3}: 0.28-0.27-0.12%), (NiH\textsubscript{2}H\textsubscript{2}O: 0.24-0.16-0.09%), respectively. It was observed that FeS has no activity in Cr(VI) reduction.

The effects of additives on the hydration were investigated by physical tests (setting time, strengths and volume expansions), DTA-TG, XRD, SEM and FTIR techniques. MH, MH* and MH/KL: 3/1 mixtures successfully reduced Cr(VI) contents of the cements. On the other hand KL and MH/KL:1/3 mixtures are proper for the cements are contain low Cr(VI) contents but when this additives are used in cements must be take into consideration for setting time and water/cement ratio.

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References