

A Comparative Study of Simple and Pre-polymerized Fe Coagulants for Surface Water Treatment

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Abstract : This study investigates the use of original and pre-polymerized iron (Fe) reagents compared to the commonly applied polyaluminum chloride (PACl) coagulant for surface water treatment. Applicable coagulants included both ferric chloride (FeCl_3) and ferric sulfate ($\text{Fe}_2(\text{SO}_4)_3$) and their pre-polymerized Fe reagents, such as polyferric sulfate (PFS) and polyferric chloride (PFCl). The efficiency of coagulants was evaluated by the removal of natural organic matter (NOM) and suspended solids (SS), which were determined in terms of reducing the UV absorption at 254 nm and turbidity, respectively. The residual metal concentration (Fe and Al) was also measured. Coagulants were added at five concentrations (1, 2, 3, 4 and 5 mg/L) and three pH values (7.0, 7.3 and 7.6). Experiments were conducted in a jar-test device, with two types of synthetic surface water (i.e., of high and low organic strength) which consisted of humic acid (HA) and kaolin at different concentrations (5 mg/L and 50 mg/L). After the coagulation/flocculation process, clean water was separated with filters of pore size 0.45 μm . Filtration was also conducted before the addition of coagulants in order to compare the 'net' effect of the coagulation/flocculation process on the examined parameters (UV at 254 nm, turbidity, and residual metal concentration). Results showed that the use of PACl resulted in the highest removal of humics for both types of surface water. For the surface water of high organic strength (humic acid-kaolin, 50 mg/L-50 mg/L), the highest removal of humics was observed at the highest coagulant dosage of 5 mg/L and at pH=7. On the contrary, turbidity was not significantly affected by the coagulant dosage. However, the use of PACl decreased turbidity the most, especially when the surface water of high organic strength was employed. As expected, the application of coagulation/flocculation prior to filtration improved NOM removal but slightly affected turbidity. Finally, the residual Fe concentration (0.01-0.1 mg/L) was much lower than the residual Al concentration (0.1-0.25 mg/L).

Keywords : coagulation/flocculation, iron and aluminum coagulants, metal salts, pre-polymerized coagulants, surface water treatment

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