Influence of Fe$^{2+}$-sodium persulfate on extracellular polymeric substances and dewaterability of sewage sludge

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ABSTRACT

Activated persulfate generated from Fe$^{2+}$-sodium persulfate (SPS) was used as a conditioner for dewatering of waste activated sludge. The effects of Fe$^{2+}$-SPS on dewaterability were investigated by specific resistance to filtration (SRF) and capillary suction time (CST), as well as further confirmed the results with diaphragm filter press dewatering process in laboratory. The amount of extracellular polymeric substances (EPS) and zeta potentials were analyzed. With 30 mg Fe$^{2+}$ per gram dry solid (DS) and 100 mg SPS per gram DS, 89.0% of SRF and 84.1% of CST reductions were achieved, respectively. Furthermore, the dewatered cake moisture content was as low as 52.6% in the diaphragm filter press dewatering. The EPS fractions and zeta potential of the sludge floc were found to have significantly changed during the Fe$^{2+}$-SPS conditioning. Proteins and polysaccharides contents in filtrate all increased with increase in the amount of Fe$^{2+}$-SPS, but decreased in tightly bound EPS (TB-EPS). The change of proteins content in loosely bound EPS (LB-EPS) was more significant than polysaccharides. Scanning electron microscope images further demonstrated that the Fe$^{2+}$-SPS pre-treatment ruptured the sludge floc resulting in the formation of permeable and incompressibility structure in filtration process.

Keywords: Sewage sludge; Dewatering; Sulfate radical; Persulfate activation; Extracellular polymeric substances

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