Internal Report

Assessment of High-Rate Sedimentation Processes: Microcarrier Weighted Coagulation Jar Tests

by

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Disclaimer

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It has been subjected to the Agency’s technical peer review. Currently, the microcarrier weighted coagulation jar test procedure is being further evaluated. It does not necessarily reflect the views of the Agency, and no official endorsement should be inferred. Also, the mention of trade names or commercial products does not imply endorsement by the United States government.

Abstract

Past studies have identified that a significant amount of wet weather flow pollutants is associated with colloidal and larger particulate solids. These particles can play an important role in water treatment and pollutant transport due to their large specific surface area and high energies that facilitate the sorption of significant quantities of substances. Since the colloidal particles adsorb heavy metal and organic ions and water borne microorganisms, removal of these particles is of paramount importance in the water treatment process. In this process, colloidal particles, coagulated with microcarriers (MC), can be removed by a high-rate sedimentation process. The MC plays a crucial role in enhancing settling properties, and in particular, the removal of colloidal particles and associated contaminants.

A detailed testing procedure and a method of experimental analysis using a modified jar test for the MC process have been developed. A series of MC weighted jar tests were undertaken on parking lot storm runoff, synthetic samples, and combined sewer overflow mixed with a MC, coagulant (electrolyte) and coagulant aid (polyelectrolyte). Two particle analyzers with a range of 0.002 to 5 micrometers (μm) and 0.1 to 2,000 μm, respectively, were used to determine the full range of particle size distribution. Different materials were used as the MC in this study. The operational parameters being evaluated include coagulant dosage, coagulant aid type and dosage, mixing- and flocculation-induced hydraulic shear or velocity gradients and duration, and characteristics of the MC. The pH, turbidity, particle size distribution, total solids, total volatile solids, suspended solids, and zeta potential were determined. The experimental results reveal that the MC weighted coagulation dramatically reduced coagulation (< 3min.) and settling time (< 8 min) producing high settling velocity flocs and high quality supernatant (turbidity from > 80 to < 2 NTU).

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