Assessing the Effects of Toxic Organic Compounds on Activated Sludge Communities

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The influence of four selected synthetic organic compounds (SOCs) on activated sludge communities used in wastewater treatment was investigated using varied reactor configurations and operational strategies. The three major criteria for chemical selection included that the chemical is biodegradable with reported biodegradation pathways, that there is a significant potential for environmental impacts, and that there is a low potential for sorption or volatilization such that the primary mode of removal would be biodegradation. Chlorobenzene, acrylonitrile, methyl-tert-butyl-ether (MTBE), and phenol were selected based on the given selection criteria. Two laboratory scale activated sludge systems, a sequencing batch reactor (SBR) and a completely mixed activated sludge reactor (CMAS), were used. The reactors were operated in three distinct phases and allowed to acclimate for a minimum of five solids retention times (SRTs) between each variation in operational conditions. Phase 1 was a 5 d SRT with no SOCs, phase 2 was a 5 d SRT with SOCs incorporated into the waste stream, and phase 3 was a 10 d SRT with SOCs present. Microscopic image analysis of the activated sludge flocs, molecular analysis of the microbial population present, and typical operational performance parameters were all monitored throughout the project. Statistical analysis of the resulting data indicated that reactor performance, floc morphology, and community diversity w3re interrelated and varied as a result of the incorporation of SOCs and with variations in the SRT. The results of this study further indicated that the response to the changes in reactor operation is also dependent on the reactor type.

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