Mechanisms for the production of odorous volatile aromatic compounds in wastewater biosolids


ABSTRACT

Six odorous volatile aromatic compounds (OVACs) were identified through GC-MS analysis of headspace samples from stored biosolids, including toluene, ethylbenzene, styrene, ρ-cresol, indole, and skatole. These OVACs were recovered even after 49 days of storage. The gas production profiles indicate that these compounds decreased as volatile organic sulfur compounds (VOSCs) increased, and started to accumulate after VOSCs depleted. Reasons for this observation remain unknown and are currently under investigation. Based on the chemical structures of these OVACs and past research, they are likely to be the degradation products of protein, and more specifically the aromatic amino acids tryptophan, tyrosine, and phenylalanine. Tryptophan addition was tested and an elevated concentration of indole was observed immediately after 1 day of storage. Unlike the immediate formation of indole, skatole appeared to have a lag-period before accumulation. This suggests the importance of available tryptophan in biosolids to indole and skatole production. In addition, ρ-cresol accumulated immediately after the addition of tyrosine. Phenylalanine, which was expected to be the precursor for toluene, ethylbenzene, and styrene formation, did not show any influence on their production except at day 1. Previous research indicated that methanogens are responsible for the degradation of VOSCs, and VOSCs accumulate when methanogens are inhibited. However, no apparent concentration change of OVACs was observed when 2-bromoethanesulfonic acid was incorporated into biosolids for methanogen inhibition. The observed OVAC profiles indicated a slow and low level production of OVACs during biosolids storage. The slow production results in a long-term production of OVACs and with the low odor detection threshold of these 6 compounds, they may be the major causes for the malodor in biosolids during long-term storage.