Relationship between biochemical constituents and production of odor causing compounds from anaerobically digested biosolids


ABSTRACT
The main objective of this research was to test the hypothesis that bioavailable protein, and, more specifically, the sulfur-containing amino acids within the protein, can be degraded by proteolytic enzymes to produce odor causing amino acids, mainly volatile sulfur compounds (VSCs), during biosolids storage. Another objective of this research was to examine the factors that affect protein and amino acid content from different full-scale treatment processes. To achieve these objectives, samples of digester effluent and cake solids were collected at 11 different wastewater treatment plants in North America and the samples were analyzed for protein and amino acid content as well as general protein degrading enzyme activity. Ten of the plants used mesophilic anaerobic digestion and one plant used thermophilic anaerobic digestion. At the same time, cake samples were stored using headspace bottles, and the concentration of VSCs were measured using GC/MS and olfactometry measurements were made by a trained odor panel. The results showed the bound cake protein content from the different sites was well correlated with VSC production as well as the detection threshold (DT) measured by the odor panel. In addition, the sulfur containing amino acid, methionine, was very well correlated with the VSC concentration and well correlated with DT. Protein degrading enzyme activity was not well correlated to odorant production. Operational parameters such as solids retention time generally did not correlate well with the biochemical constituents. However, the total iron content of a digester was negatively correlated with the bound protein concentration, suggesting greater amounts of Fe in the biosolids decreased the amount of protein that could be extracted from the cake.