Reducing emerging contaminants in ground and surface waters: Optimizing contaminant removal in animal waste prior to land application

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Abstract. Land application is a widely used method of disposal for animal wastes (such as manure and treated wastewater) that additionally helps to minimize the environmental burden of agriculture by recycling nutrients. However, this practice can potentially lead to exposure of soils and surrounding ground and surface water to emerging contaminants including endocrine disrupting compounds (EDCs), antibiotics, and other pharmaceutical compounds which have been found in relatively high concentrations in manure and recycled water. The negative impacts of EDCs that migrate into terrestrial and aquatic systems have been widely reported and antibiotics in the environment have been linked with increases in quantities of antibiotic resistant bacteria posing human health risks. One solution involves biological treatment of waste materials and recycled water prior to field application. Recent studies have proven that a broad range of emerging contaminants are biodegradable through technologies such as anaerobic digestion or composting; however, few studies have attempted to determine degradation rates as a function of operational conditions. Specific microbes responsible for the degradation of the contaminants are also unknown. Thus, it is not currently possible to rationally design waste management technologies that efficiently remove emerging contaminants. The focus of this research is to identify operational conditions that will lead to the development of microbial communities that efficiently remove contaminants from a variety of pharmaceutical classes. Analytical chemistry methods have been developed to analyze target compounds in composting systems. Experiments to test the impact of composting temperature, pH, carbon content, and ammonia levels are currently ongoing.