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Survival of Human Adenovirus 41 in Applied Manure and Biosolids

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Abstract:

Human adenovirus (Ads) 40 and 41 are important human enteric pathogens and they are second to rotaviruses as etiological agents of pediatric gastroenteritis. Ads are prevalent in environment and are shed in the feces of infected humans and have been found to accumulate in sludge at ~107 genomic copies/L. Human Ads were also found in sewage samples from animal slaughter houses, probably originating from human contamination. As a result, fresh fruits and vegetables may be contaminated by contact with Ad contaminated water and manures/biosolids. The objective of this study is to understand factors controlling the survival of Ads in agriculture systems.

One ml of human Ads 41 (~6.7x10⁵ viral particles (VP)/ml) was added into 2 g biosolids, or raw poultry litter (RPL), incubated at 20 or 4 °C and analyzed every 10 days. One-step quantitative real-time PCR (qPCR) was used to quantify Ad genomic copies in manure/biosolids. The Most Probable Number Method (MPN) based on one-step RT-PCR results of Ad infected cells was used to detect the infectivity of MNV in manure/biosolids. After 60 days incubation, there was no significant reduction of Ad genomic copies in either biosolids or RPL at 20 or 4 °C, showing that the virus was very stable in these environments. However, only 3 log infectious unit (IU)/ml Ads were detected after 10 days incubation at 20 °C, and after 20 days the infectious virus was below the detection limit (36 IU/ml); and at 4 °C, there was still 2 log IU/ml Ads infectious after 50 days, demonstrating that maintaining of infectivity in biosolids was temperature dependent. In RPL, there was ~3 log IU/ml infectious Ads after 60 days for both 20 and 4 °C. Thus the survival of Ads is dependent upon biosolid type, treatment, and storage conditions.

Impact Statement:

To the best of our knowledge, this is the first study to measure the survival of Ad41 in a variety of waste materials including important soil amendments. The drier solids are likely a greater risk compared to wetter soil amendments as they maintained higher infectivity of Ad41.

Category: Watershed Assessment and Restoration

Type of Presentation: Poster Presentation