Transport of SARS-CoV-2 on particulate aerosols

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Microhabitats within dust and *in situ* sediment particles have been shown to enhance the survival of pathogens, including viruses, extending their range of influence. SARS-CoV-2 is known to be transmitted via aerosolized droplets and is persistent in the environment for unusually long periods, for example, surviving for up to several days on plastics and in water. It is hypothesized that airborne particulates enhance survival by sheltering the virus from UV radiation and providing sufficient moisture potentially extending the virus viability and detection lifetimes beyond several days. Here we examine the presence of SARS-CoV-2 on aerosols that have undergone short and medium-range transport through the atmosphere. We examined liquid aerosols generated within wastewater treatment facilities (WWTP) that had known concentrations of SARS-CoV-2 virus RNA in the treatment water. In addition, we collected particulates in rainwater from cities around the US and one remote locations. We found no detectable virus RNA in the liquid droplets collected above WWTP anerobic or aerobic treatment tanks. In contrast, approximately 30% of the particulate and liquid aerosols collected in cities and one remote location (Niwot Ridge Colorado) contained SARS-CoV-2 virus RNA. Samples were more likely to contain RNA if samples were analyzed shortly after collection, however, we detected virus up to 20 days post collection. High wind speeds and higher city case rates were also significantly related to whether a sample tested positive for the virus ($p<0.001$).