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The Impact of Surfactant on the Transport of Toxoplasma gondii Oocysts in Unsaturated Natural Soils

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Toxoplasma gondii exists in nearly the entire world because of its numerous intermediate hosts and the prevalence of its definitive host, felids. It is one of the most prevalent parasites affecting warm-blooded animals. In humans, it may cause damage to the brain, eyes and other organs in fetuses and pose a threat to immunocompromised population. In several studies, T. gondii has been linked to schizophrenia and suicide. T. gondii has been detected in soil, open water and animal feed in agricultural settings and elsewhere and may remain viable for months or even years in environmental settings as environmentally-resistant oocysts. It can be transmitted via the fecal-oral route, including by consuming unwashed produce contaminated with oocysts, or through the consumption of tissue cysts in infected and undercooked meats. The prevalence of T. gondii, the potential health risks and the environmental resilience necessitate a better understanding of the transport of T. gondii oocysts through soil, which to this point has not been well studied. Surfactants may be introduced to agricultural fields through the application of pesticides that include them, reused water or sludge and environmental remediation. They may influence soil hydrology properties and water flow thereby impacting the conveyance of pathogens in soil water. The goal of this study is to determine the impact of surfactants on the transport of T. gondii oocysts through natural, unsaturated soils. Vertical, gravity-driven flow of an artificial rain solution was allowed through soil columns that were packed in such a way to limit preferential flow. The rainfall solution used included KCl as a background electrolyte with Aerosol 22 surfactant in the rainfall of half of the columns. After flow through the columns reached steady state, a pulse containing about 2.5 million T. gondii oocysts and KBr as a conservative tracer was added. Leachate samples were collected from the bottom of each column while artificial rain was applied. Following the cessation of the rainfall, the columns were sliced into 1 to 2 cm sections and samples were taken to characterize the retention of T. gondii within the columns. T. gondii in both the leachate samples and soil samples was quantified using qPCR.