VP17: "Experimental study of Human Adenoviruses interactions with TiO2 Nanoparticles"

M. Bellou[1], V. I Syngouna[2], A. Vantarakis[1] and C.V. Chrysikopoulos[3]
1 Environmental Microbiology Unit, Department of Public Health, University of Patras, Patras, Greece
2 Department of Civil Engineering, Environmental Engineering Laboratory, University of Patras, Patras, Greece
3 School of Environmental Engineering, Technical University of Crete, Chania, Greece
E-mail for communication mbellou@upatras.gr

Waterborne viral infection is one of the most important causes of human morbidity, and relates diseases continue to have public health and socioeconomic implications worldwide. Human Adenoviruses (HAdVs) is commonly found in environmental waters and is very resistant to water disinfection an environmental stressors. Among waterborne viruses, Human Adenoviruses are nowadays described as emerging pathogens and are considered to be highly resistant in water. High quantities of adenovirus DNA were recently detected in polluted surface waters, and this genetic marker seems to be a very long-lasting indicator of fecal pollution in surface waters. Titanium dioxide Nanoparticles (TiO2 NPs) are one group of the most widely used nanomaterials in consumer products including sunscreens, cosmetics, paints, and solar cell energy. Recently, they were increasingly applied for the photocatalytic degradation of pollutants in water, air, and soil matrices. With the rapid growth of the production, consumption and disposal of nanomaterials, they will inevitably and ultimately enter the environment. Accidental and/or deliberate introduction of TiO2 NPs into subsurface environments may lead to contamination of drinking water. Moreover, TiO2 NPs can act as colloidal carriers for the sorption of contaminants and then facilitate transport of these contaminants into subsurface and groundwater environments, which was regarded as "colloid-facilitated transport of contaminants". The objective of this study was to investigate the survival of HAdV in TiO2 NPs systems. The Nanoparticles used as a model were Titanium dioxide (TiO2). The survival of HAdVs onto these clays was characterized at 25 oC under the effect of visible light (VL) and the effect of dark. Control tubes, in the absence of clay, were used to monitor

virus inactivation due to factors other than adsorption to clays (e.g. inactivation or sorption onto the tubes walls). The batch equilibration method used consists of adding a virus stock solution into 15 ml centrifuge tube containing TiO2 NPs at a concentration of 1gr per liter. Controls containing only viruses and suspended NPs particls were used to monitor virus inactivation, virus sorption to the centrifuge tube and PCR inhibition due to suspended NPs particles. For both experiments (VL and Dark), samples were collected every 24 hours for a period of a month and centrifuged at 3000 xg for 30 minutes. To infer the presence of infectious HAdV particles, all samples were treated with Dnase and the extraction of viral nucleid acid was performed using a commercial viral RNA kit. All samples were analyzed by Real – Time PCR which was used to quantify viral particles in TiO2 NPs. Exposure time intervals in the range of a month resulted in a load reduction of 0.25 to 2.50 logs for VL experiments and a reduction of 0.15 to 2.85 for dark experiments. Furthermore, virus survival was higher under the effect of VL. The experimental results of this work indicate that viruses adsorption onto TiO2 NPs were systematically more persistent at dark. In comparing the survival rates of the Human Adenovirus under controlled conditions, they decrease with increasing time. The adsorption of HAdV onto both clays increase with increasing time and it is higher in dynamic experiments. The increased reduction of waterborne viruses by their contact with TiO2 NPs systems could play an important role in the prevention of viral waterborne diseases.