

Environmental virology and wastewater epidemiology: from plant viruses to SARS-CoV-2

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Viruses are abundant members of biosphere and some of them are very stable in environment, surviving prolonged periods outside of their hosts. Understanding the presence, diversity and survival of viruses in environmental samples, such as water, can help us to understand their spread, transmission pathways and their role in ecosystem cycles. We have been studying plant and human pathogenic viruses in surface waters and wastewaters. Recently, we have focused on the wastewater viromes, revealing a rich presence of plant viruses and confirming their infectivity even after their route through the tertiary wastewater treatment plant. For studying viruses in water, we have developed methods for efficient virus concentration, qPCR/ddPCR detection and quantification, and shotgun high-throughput sequencing (HTS). With the onset of current COVID-19 pandemic, in March 2020, we have extended our expertise to SARS-CoV-2 wastewater-based epidemiology, which enables the studies of the trends of viral epidemics in larger populations and in specified geographic regions. Using the developed and improved concentration and quantification approaches, we have established a monitoring of SARS-CoV-2 concentrations in wastewater from several Slovenian wastewater treatment plants as well as their variants of concern using high-throughput sequencing. The national wastewater monitoring, including different Slovenian wastewater treatment plants, school and retirement home, is currently helping us to follow the COVID-19 epidemics in Slovenia and support the governmental scientific advisory body. In this lecture, an overview of our environmental virology studies will be presented, leading to the efficient implementation of the ongoing SARS-CoV-2 monitoring in wastewater, which will finally be the focus of the talk.