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## Adsorption/desorption properties of chitosan-based passive samplers for the analysis of norovirus in water

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**Abstract:** Human noroviruses are the main cause of gastroenteritis worldwide; monitoring their occurrence would help to prevent epidemics. Passive samplers containing chitosan-based adsorbents were developed for the monitoring of noroviruses in various aqueous environments. The technology involves the concentration of the viruses by adsorption and their desorption by elution before their quantification through RNA analysis by RT-qPCR.

Two types of hydrogel beads were synthesized: chitosan (CS) and copper-imprinted chitosan porous beads (CS-IMP). They were characterized by zetametry, N<sub>2</sub>-sorption (77 K), and after freeze-drying by scanning electron microscopy. Beads were tested for the adsorption of noroviruses in different types of water i) NaCl saline water spiked with MNV-1, a non-pathogenic model virus for human norovirus, ii) spiked tap water, iii) spiked wastewater from the outlet of a WWTP and iv) water from a cave located in an agricultural and wine-growing region. The amount of viruses adsorbed was shown to be dependant on the BET surface area of the beads. In spiked saline solutions, the adsorption kinetic studies on hydrogels revealed a quasi-equilibrium after 6 h, with up to ~ 80% of MNV-1 adsorbed. The elution of the MNV-1 adsorbed was studied under different conditions of ionic strength, pH, surfactant concentration, temperature, time and adsorbent mass. Desorption was shown to be facilitated by pore sizes in the meso/macro scale. In the real waters, the adsorption efficiencies were lower, indicating a strong interaction of the noroviruses with the other components of the matrix.

Synthesized beads were incorporated into different sampling devices and tested for the monitoring of water for a given period of time. As for example, an automatic sampler developed in our laboratory was tested for the daily monitoring of an outlet municipal WWTP water. A correlation could be established between the daily concentrations of autochthonous viruses directly measured at the outlet of the WWTP and those determined by automatic passive sampling.

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