Sub 100 nm particle upconcentration in flow using electrical forces

Dimaki, Maria; Olsen, Mark Holm; Svendsen, Winnie Edith; Rozlosnik, Noemi

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Congress Attendee	Maria Dimaki	
Contributing Author(s)	Maria Dimaki, Mark Holm Olsen, Winnie E. Svendsen and Noemi Rozlosnik	
Organisation	DTU Nanotech	
Email Address	maria.dimaki@nanotech.dtu.dk	Include your email address in poster abstract book? **Y** / N
Telephone	+45 45255829	

Poster Title	Sub 100 nm particle upconcentration in flow using electrical forces
Abstract (300 words approx.)	The detection of virus particles in water is imperative for reducing the risk for disease amongst the population. Especially enteroviruses are interesting as even a small amount of active viruses can lead to an epidemic. There is a need for continuous monitoring of the virus concentration at key points within the water supply network, but mainly before it reaches the water purification facilities. However, the small size of these viruses, generally under 100 nm, as well as their very low concentration in water (less than 10 viruses per 2 L of water, does not favour real time monitoring and especially not using microfluidic devices, as these generally have a very low throughput. Moreover a certain amount of viruses needs to be collected before detection can be achieved, making upconcentration of viruses a necessary step in the detection process. In this paper we will present a novel microfluidic system for sub 100 nm particle upconcentration in continuous flow. The system presented is designed to provide a 10x upconcentration of particles by using electrical forces to move the particles to the middle of the channel and by using balancing of the microfluidic channel hydraulic resistance to extract only 10% of the total flow to the outlet channel. The system is scalable so that the total flow through the system is in the range of 10-100 ml/h, even though the flow through a single channel is between 1-50 µl/h. COMSOL multiphysics combined with Matlab has been used in the design phase to optimise the electrode design and evaluate the chip performance. A prototype has been fabricated and tested with polystyrene particles down to 50 nm in diameter. The experimental results show that channel lengths of 2-5 cm are needed for particle upconcentration, which is better than the simulated results and suggests that other effects are also responsible for the particle movement than the simulated ones.

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