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Determination of pore size distributions of virus filtration membranes using gold nanoparticles and their correlation with virus retention

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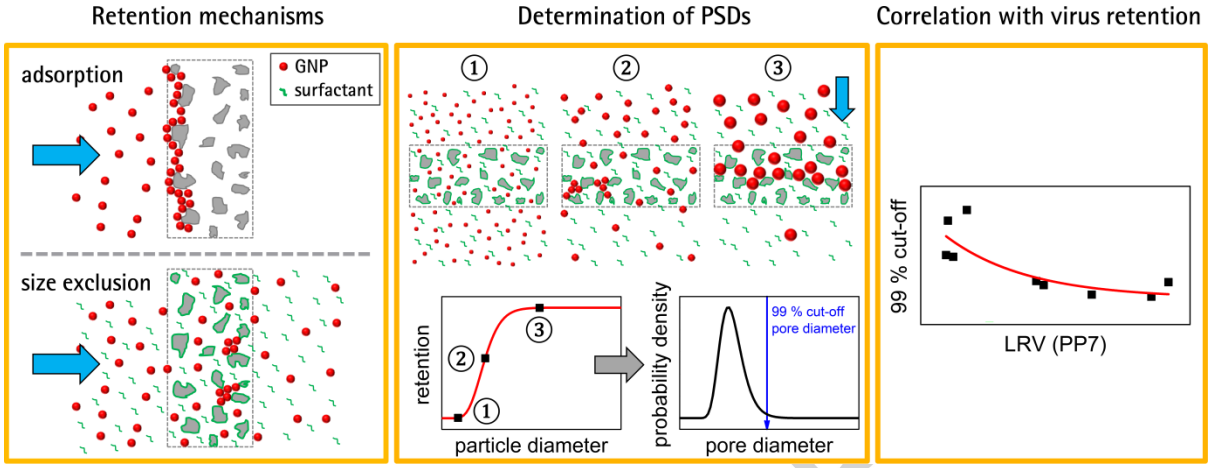

Virus filtration membranes contribute substantially to the virus safety of biopharmaceutical drugs due to their capability to retain viral particles mainly based by the size-exclusion mechanisms. In this work, virus filtration membranes were challenged with gold nanoparticles (GNPs) in order to determine pore size distributions (PSDs) for a wide range of different commercial and non-commercial parvovirus retentive membranes differing in structure, material and surface chemistry. The retention mechanism of GNPs was investigated and effectively shifted towards size-exclusion by using an anionic surfactant to suppress particle adsorption to the membrane surface. This allowed insights into the relevance of particle retention based on size-exclusion mechanisms of the respective membranes. Membrane PSDs investigated through GNP challenges were for some membranes compared with PSDs investigated by liquid-liquid displacement porometry (LLDP). In addition, virus retention performance using *Pseudomonas aeruginosa* bacteriophage PP7 as accepted model virus was determined for the entire set of membranes and correlated with the cut-off pore size obtained from experiments using GNPs. Exemplarily, retention was examined for one membrane type using a set of different sized viruses (PCV-2, PP7, MVM, HAV) ranging from 18–28 nm and compared to GNP retention.

Keywords: Gold nanoparticles, Membrane structure, Particle retention, Pore size distribution, Virus filtration, Virus retention