Preparation and purification of a SARS-CoV-2 virus-like particle vaccine candidate

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A novel betacoronavirus SARS-CoV-2, which causes severe respiratory disease COVID-19, emerged as a global health threat in late 2019. In just one year, SARS-CoV-2 infected over 100.000.000 people worldwide and caused 2 million deaths. Clearly, a potent and safe vaccine that guarantees long-lasting protection against novel virus strains is desperately needed to curb and eliminate the pandemic. Here, we present preparation and purification of an advanced coronavirus-like particle (CoVLP) vaccine candidate based on essential SARS-CoV-2 structural proteins. We successfully assemble CoVLPs using the baculovirus expression system in insect cells. Highly pure and concentrated particles are obtained from the cell culture supernatant by sequential chromatography purification using hydrophobic and ion exchange monolithic columns. To further understand the up- and downstream bioprocessing, we monitor CoVLP characteristics by HPLC process analytical technology (PAT) system, ensuring robust development workflow. The purified nanoparticles closely mimic native coronavirus morphology and molecular composition, as determined by transmission electron microscopy and immunostaining. The presented CoVLPs, which cover a broad spectrum of viral antigens, are a promising next-generation COVID-19 vaccine candidate, particularly considering the increasing threat of immunity-evading mutations.