Plant virus-derived nano-cages as delivery vehicle for DNA/RNA vaccination against spring viraemia of carp virus.

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Common carp (*Cyprinus carpio*) is one of the most cultured fish species worldwide. The increase in production, together with global intensification of aquaculture have led to infectious disease outbreaks. Disease prevention is therefore essential to prevent substantial economic losses and vaccination is currently the most efficient method for pathogen control. Common carp is susceptible to the highly contagious spring viraemia of carp virus (SVCV) and mortality can reach up to 70-90% in juvenile carp. Our laboratory successfully developed a DNA vaccine based on the SVCV glycoprotein. A single dose of 0.1µg DNA/g of fish led to up to 100% protection when injected intramuscularly. Unfortunately, the same vaccine did not confer protection when administered orally. In this project we investigated whether plant virus-derived virus-like particles (VLPs) can be used as a vehicle to deliver the DNA/RNA vaccine by immersion. Capsid proteins (CPs) of the plant virus cowpea chlorotic mottle virus (CCMV) were used to assemble VLPs containing our DNA/RNA vaccine. CCMV-VLPs are naturally not pathogenic to fish and are safe for the environment. CCMV-CPs have the unique ability to reversibly disassemble and assemble by changing the pH, allowing us to replace the viral RNA for our DNA/RNA vaccine (cargo). We were able to successfully assemble VLPs with plasmid DNA and the VLPs were able to protect the plasmid DNA against DNase. Furthermore, VLPs were able to deliver the plasmid DNA to fish cells *in vitro*. Further studies will be performed on zebrafish to assess the uptake *in vivo*. The preliminary assessment of the suitability of CCMV-based VLPs as nucleic acids vaccine vehicle will be presented and discussed.