Abstract

The aim of this study was to develop a system for easy production of different veterinary chimeric vaccines based on stable mouse polyomavirus (MPyV) structures. The system is designed for antigens that are problematic in production or stability. First, universal vectors for baculovirus-directed production of chimeric MPyV VLPs or pentamers based on the major capsid protein VP1 were designed to be exploited as vaccines against other pathogens. The different strategies used in this study are based on: A) exposure of selected immunogenic epitopes on the surface of MPyV VLPs by inserting them into a surface loop of the VP1 protein, B) insertion of foreign protein molecules inside the VLPs, or C) fusion of a foreign protein or its part with the C-terminus of VP1 protein, thus forming giant pentamers of a chimeric protein.

Candidate vaccine antigens against porcine circovirus 2 (PCV2), the causative agent of porcine circovirus 2 systemic diseases (PCV2-SD) which causes significant economic losses in swine breeding, were prepared using the constructed vectors. All candidate vaccines induced the production of antibodies against the capsid protein of PCV2 after immunization of mice. The candidate vaccine Var C based on fusion of MPyV and PCV2 capsid proteins, is able to induce production of antibodies with the highest PCV2 neutralizing capacity. Its ability to induce production of neutralizing antibodies was verified after immunization of pigs. The advantage of this vaccine, along with its efficient production in insect cells and easy purification, is that it represents a DIVA (differentiating infected from vaccinated animals) vaccine, as it also induces an immune response against the MPyV VP1 protein and vaccinated and naturally infected animals can thus be distinguished.

Currently, papillomatoses caused by bovine papillomaviruses types 1 or 2 (BPV-1 and BPV-2) are spread throughout cattle farming in Europe including those in the Czech Republic. Therefore, a prophylactic candidate vaccine against BPV-1 based on VLPs formed by structure protein L1 of BPV-1 isolate from a Czech breeding was prepared in insect cells. The vaccine induces specific antibodies (including virus neutralizing ones) in both mice and cattle.

Both vaccines (against PCV2 and BPV-1) are currently being set up for large scale production by Dyntec company.

Key words: Porcine circovirus, bovine papillomavirus, mouse polyomavirus, VLPs, chimeric nanostructures, recombinant vaccine