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Paper Title: Silk Fibroin-based Hydrogel as Injectable Carrier for Prolonged Immunization of Plant-based COVID-19 Subunit Vaccine

Authors: Juthamas Ratanavaraporn, Nopparuj Soomherun and Saran Keeratihattayakorn (Chulalongkorn University, Thailand)

Email: juthamas.r@chula.ac.th

Abstract

This study investigates the potential of silk fibroin (SF) hydrogel-based vaccine formulations as a delivery system for the receptor-binding domain-fusion protein (RBD-Fc) vaccine against SARS-CoV-2. The SF hydrogel was utilized to control the release of the RBD-Fc vaccine, leading to prolonged and consistent immunization effects compared to formulations without the hydrogel. The presence of aluminum hydroxide (alum) as an adjuvant significantly affected the protein release, resulting in a gradual release profile regardless of its presence or absence. Immunization experiments were conducted in mice, demonstrating that SF hydrogel-based vaccine formulations induced higher immunogenic responses than the RBD-Fc vaccine alone, with and without alum adjuvant. Both SF hydrogel-based formulations showed long-lasting immune responses, outperforming the RBD-Fc adjuvanted alum vaccine. These findings suggest that the slow delivery of plant-produced RBD-Fc with SF hydrogel-based vaccine formulations significantly enhances RBD immunogenicity, leading to robust humoral immunity. These results demonstrate the potential of SF hydrogel-based vaccine formulations as a promising delivery platform for RBD-Fc vaccines. However, further studies are required to assess whether the induced antibodies can effectively neutralize SARS-CoV-2 and its variants.