Exploring the impact of molecular weight of fucoidan polysaccharides on the adsorption of protein to a PEM surface

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Wound care is an area of active research where surface and materials chemistry has the potential to improve healing outcomes for patients, through the creation of bioactive wound dressings. Polyelectrolyte multilayer (PEM) films have been shown to be an effective method of constructing surface coatings that can be applied to different surfaces to encourage tissue repair and growth. Naturally occurring biopolymers show great promise as biocompatible, bioactive components for PEM systems in wound care.

Fucoidan, a polysaccharide mainly extracted from seaweeds, has the ability to bind and protect biomolecules in wound fluids to promote healing. This work is focused on investigating two different molecular weight fractions of fucoidan in PEMs (in combination with chitosan, a well-studied biopolymer for biological applications) and their interactions with bovine serum albumin (BSA) as a model protein. The two fractions encompass low molecular weight fucoidan (peak MW 12.2 kDa) and unfractionated fucoidan (peak MW 61.7 kDa) from the seaweed species Fucus vesiculosus.

The layer-by-layer (LbL) build-up of the fucoidan-based PEMs, and their interactions with BSA, have been monitored using zeta-potential measurements, Quartz Crystal Microscopy with Dissipation monitoring (QCM-D), and Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR-FTIR). Similar build-up has been observed for both systems. However, protein adsorption is seen to be very different, with low molecular weight fucoidan PEMs giving rise to lower adsorption, and a degree of PEM degradation due to BSA-fucoidan complexation. The implications of these observations for the use of fucoidan PEMs in wound dressings will be discussed.