**The effect of polyvinyl alcohol (PVA) on swelling behaviour of chitosan (CS) aerogel**

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CS aerogels with their low density, high surface area, and high porosity, are suitable for food applications e.g. delivering nutrients to the gastrointestinal tract (GIT). To ensure their structural integrity and controlled nutrients release in the GIT, the swelling behaviour and structural changes during digestion must be understood. This study investigated the effect of polyvinyl alcohol (PVA) concentrations (0-5 wt.%) on the functionalities of CS aerogels as nutrient carriers. CS aerogels were characterized by shrinkage ratio after freeze-drying, mechanical properties, microstructure, and swelling ratio in water, HCl solutions (pH 1.5–4.5), and simulated digestive fluids (with or without pepsin, pancreatin, and bile salts). SEM images showed large pores and dense structures with 5 wt.% of PVA, caused by the coexistence of enriched and depleted precursor phases before gelation. This resulted in stress concentration during freeze-drying, leading to pores collapse and increased shrinkage (22.49%-65.99%). Bulk density increased from 0.09 to 0.24 g/cm³, and Young’s modulus significantly increased from 1.94 MPa to 10.5 MPa when adding 5 wt.% of PVA. Significant swelling of CS-PVA aerogels occurs within 1 hour in water, PVA addition decreased the swelling ratio of CS aerogels from 600% to 136% after 1 hour of soaking. At pH 1.5, pure CS and CS-PVA (0.5 wt.%) aerogels dissolved within 1 and 2 hours respectively, while higher PVA concentrations prevented dissolution. At pH ≥2.5, the swelling behaviour of aerogels was similar to that in water. During in-vitro digestion, metal cations were expected to form coordinate complexes with active unprotonated amino and hydroxyl groups of CS-PVA aerogels to strengthen crosslinking and decrease liquid uptake. Pepsin, pancreatin, and bile salts reduced the surface tension of the liquid media from 69.74 mN/m to 31.83 mN/m, affecting digestive fluids absorption. In conclusion, PVA improved the structural stability of CS-based aerogel in water and acidic solutions which is important for their role as a nutrient carrier. Future research will focus on in-vitro digestion of CS aerogels under more realistic conditions.