Valorisation of pomelo (Citrus maxima) peels and corn (Zea mays) cobs to be innovative gelators for oleogels, hydrogels and bigels

WANG H. (2), WANG P. (3), KASAPIS S. (2), TRUONG T. (1,2)
1 School of Science, Engineering and Technology, RMIT University, Ho Chi Minh City, Viet Nam
2 School of Science, STEM College, RMIT University, Melbourne, Australia
3 Key Laboratory of Meat Processing and Quality Control, College of Food Science and Technology, Nanjing Agricultural University, Nanjing, China

Valorising plant by-products is a feasible approach to reduce environmental risks and improve their values. Many plant by-products are fibre-rich and amphiphilic that can be utilised as health-promoting functional ingredients. This study presents a valorisation of pomelo (Citrus maxima) peels and corn (Zea mays) cobs into powder form with various particle sizes (125, 250 and 500 µm). They were mixed with either rice bran oil or water (60 – 90% w/w each) at room temperature for 2 mins to produce oleogels (OG) and hydrogels (HG), respectively. This suggests that the gelation process using the pomelo peel (PP) and corn cobs (CC) powders (10 - 40% w/w) was robust compared to other conventional gelators, which typically required excessive heating time and temperature. Analyses of the chemical composition indicated that fibres are abundant in both powders, providing structural entities for the gelation. Examination of the gelators' antioxidant profiles showed that PP had a higher antioxidant capacity than CC, implying PP gels can have a longer shelf-life than CC gels. The PP and CC powder particle size and concentration significantly impacted texture, rheology, microstructure and water/oil loss. Both HGs and OGs could not be formed with 500 µm particles. Stable HG & OG gels were produced with the smaller sizes (125 and 250 µm) of PP powder (10 – 35% w/w) and CC powder (20 – 40% w/w). Increased particle size and gelator concentration promoted hard and brittle gels and vice versa. However, large particle sizes and high gelator concentration decreased the oil/water loss. The microscopic images showed that the gelation was due to the interaction between gelator particles and the solvent droplets, and smaller particles promoted more uniform structures. Based on these results, bigels were developed from 125 ?m PP powder. Preparation of PP bigels included mixing preformed HG and OG at various ratios, and adding PP powder (15-25%) into water-in-oil emulsions. The bigels formed from the set HGs/OGs appeared to be more stable, harder and elastic than those produced from the water-in-oil emulsion template. The developed OG, HG and bigels can find applications in formulating low-fat products and encapsulation of bioactives.