Challenges and Opportunities in Plant-based Protein Manufacturing

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The growing demand in plant-based beverages and foods, such as yogurt and cheese, drives food processors to seek innovative approaches to convert plant protein ingredients into novel food products with desired functionalities. The composition and characteristics of plant-based proteins, however, are different to proteins from animal sources (e.g., dairy and meat), presenting many challenges alongside the opportunities of plant-based product manufacturing. This presentation will showcase recent work within The Department of Chemical Engineering Food and Agribusiness Program and within Agriculture and Food at The University of Melbourne, highlighting how research is addressing some of these challenges, including:

(i) Membrane Processing of Plant-based Milk - Membrane systems are widely used for the fractionation and concentration of dairy proteins, to avoid the degradation of heat-sensitive compounds and the loss of their bioactive properties. Only a limited number of studies, however, have focused on membrane filtration of plant-based proteins. We investigate the filtration mechanism and fouling propensity for ultrafiltration of common plant-based milk (e.g., soy milk), in terms of critical flux and gelation concentration. We discuss how a fundamental understanding of protein filtration developed through studies of dairy systems can be applied to the ultrafiltration of plant-based proteins, and the strategies for mitigating membrane fouling in industrial operations.

(ii) Almond Protein Gelation - The development of plant-based products requires a better understanding of the response of plant-based proteins to process variables. Challenges are also introduced by the reduced protein content of these products compared to dairy products. We present the effect of pH and thermal treatment on the microstructure of almond proteins. Moderate heating (55°C and 75 °C) induces denaturation and partial aggregation, while a self-supporting weakly flocculated particulate gel structure can be formed at higher temperatures. Gels formed at pH 4 and 7 are similar in strength but differ in their textural properties, illustrating how almond processing can be tailored to obtain products with desired properties for enhanced consumer acceptability.