

## **Low-Fouling Plate-and-Frame Ultrafiltration for Juice Clarification: Part 2—Module Design and Application**

### **ABSTRACT**

The purification and concentration of orange juice are crucial to remove undesirable materials, such as pectin, which is responsible for juice clouds; or limonene, which is responsible for bitter taste. Membrane-based juice clarification is preferred due to its capability to separate specific targeted molecules, while still maintaining the clarified juice's nutritional content. In this study, a novel designed bench-scale plate-and-frame membrane module composed of low fouling cellulose acetate membrane sheets was manufactured to facilitate orange juice clarification. The experimental results demonstrated the effectiveness of the developed module to be used for juice clarification. After incorporating the functional and structural design parameters, the final module had the following specifications: dimensions of 125 × 168 mm, an effective volume of 0.9–9.4 L, a total active membrane area of 1088 cm<sup>2</sup>, and a transmembrane pressure of 0.3–0.55 MPa. The results of the juice clarification show no difference in the value of pH, viscosity, total acid, water content, color L\* (brightness), and color a\* (reddish) of the feed, the permeate, and the retentate streams. The clarified juice had slightly higher total dissolved solids (°Brix), ash content, vitamin C, and color (b\* yellowish). Overall, our findings demonstrated that the developed plate-and-frame module could effectively be used to clarify orange juice without altering the quality, i.e., reducing the nutritional contents.