Thermal Processing of Ionic Solutions at Different Viscosities Using a Modular 2450 MHz Continuous Flow Microwave System

Morgan Caudill[1,2], George N. Stoforos[2], Josip Simunovic[2], Van-Den Truong[1], [1]USDA-ARS, SEA Food Science Research Unit and [2]Department of Food Bioprocessing and Nutrition Sciences. North Carolina State University, Raleigh, NC 27695

Continuous flow microwave technology operated at 915 MHz has been developed and implemented for commercial processing and aseptic packaging systems. Microwaves have been shown to heat products nearly three times as quickly as conventional heating methods. However, the current 915 MHz systems are more suitable for large scale manufacturing and require a considerable capital investment. Thus, the goal of this project is to implement a microwave system more suitable for research and for lower capacity processing. This study aimed to evaluate the heating performance of a modular 2450 MHz continuous flow microwave system and to determine the parameters required to reach pasteurization temperatures of ionic solutions at three viscosities. For the current prototype, thirteen 2450 MHz microwave units of 1200 W power each were assembled in three modular stacks. A microwave-transparent tube conveys materials being heated through the center of the microwave units during thermal processing. Salted water, 1% carboxymethyl cellulose (CMC**)** solution, and 1.5% CMC solution were processed at a flow rate of 2 L/min. The temperature gained in the system was calculated in order to predict the amount of additional microwave modules needed to reach a temperature of 100°C. It was determined that the current three modular system is capable of increasing the temperature of the product from room temperature (~20°C) to ~80°C. These results showed that an addition of 1 to 2 modules is needed in order to produce a functional system capable of reaching 100°C. This system has the potential to be a more cost effective heating system for small scale processes and R&D research on processing of food and pharmaceutical liquids.