

Morphology Analysis of Apple-Carrot Juice Treated by Manothermosonication (MTS) and High Temperature Short Time (HTST) Processes

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Abstract : Manothermosonication (MTS), which consists of the simultaneous application of heat and ultrasound under moderate pressure (100-700 kPa), is one of the technologies which destroy microorganisms and inactivates enzymes. Transmission electron microscopy (TEM) is a microscopy technique in which a beam of electrons is transmitted through an ultra-thin specimen, interacting with the specimen as it passes through it. The environmental scanning electron microscope or ESEM is a scanning electron microscope (SEM) that allows for the option of collecting electron micrographs of specimens that are "wet," uncoated. These microscopy techniques allow us to observe the processing effects on the samples. This study was conducted to investigate the effects of MTS and HTST treatments on the morphology of apple-carrot juices by using TEM and ESEM microscopy. Apple-carrot juices treated with HTST (72 °C, 15 s), MTS 50 °C (60 s, 200 kPa), and MTS 60 °C (30 s, 200 kPa) were observed in both ESEM and TEM microscopy. For TEM analysis, a drop of the solution dispersed in fixative solution was put onto a Parafilm ® sheet. The copper coated side of the TEM sample holder grid was gently laid on top of the droplet and incubated for 15 min. A drop of a 7% uranyl acetate solution was added and held for 2 min. The grid was then removed from the droplet and allowed to dry at room temperature and presented into the TEM. For ESEM analysis, a critical point drying of the filters was performed using a critical point dryer (CPD) (Samdri PVT- 3D, Tousimis Research Corp., Rockville, MD, USA). After the CPD, each filter was mounted onto a stub and coated with gold/palladium with a sputter coater (Desk II TSC Denton Vacuum, Moorestown, NJ, USA). E.Coli O157:H7 cells on the filters were observed with an ESEM (Philips XL30 ESEM-FEG, FEI Co., Eindhoven, The Netherland). ESEM (Environmental Scanning Electron Microscopy) and TEM (Transmission Electron Microscopy) images showed extensive damage for the samples treated with MTS at 50 and 60 °C such as ruptured cells and breakage on cell membranes. The damage was increasing with increasing exposure time.

Keywords : MTS, HTST, ESEM, TEM, E.COLI O157:H7

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