Microwave Pasteurization of Cooked Pasta Products:
Optimization of Texture and Quality in Ready to Eat Meals

Abstract

By Kari Elaine Jones, M.S.
Washington State University
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Chair: Barbara Rasco

The Microwave Assisted Pasteurization System (MAPS) developed by Washington State
University produces high quality foods with low risk due to the shorter come-up times needed to reach
critical temperatures in the heat treatment of pre-packaged foods. Pasta presents a new challenge to
MAPS due to its unique cooking requirements. In this study, the quality, texture and structure of MAP
pasta was assessed. Fettuccine pasta was boiled for 0, 3, 6, 9, or 12 minutes (M₀, M₃, M₆, M₉, M₁₂,
respectively), then pasteurized with MAPS at 90°C for 10 minutes in sealed plastic trays with calculated
amounts of water, and stored under refrigeration for 1 week. Treated pasta was evaluated by a trained
sensory panel, viewed under confocal and scanning electron microscopy, subjected to Large Amplitude
Oscillatory Shear (LAOS) rheometry, and analyzed chemically for protein solubility, disulfide (SS)
linkages, and degree of starch gelatinization. All formulations were successful in absorbing most of the
added water during pasteurization. Due to residual water in the M₁₂ treatment, a juxtaposition
between moisture absorption and moisture loss during pasteurization was hypothesized. The extremely
high clumping of strands observed in the M₀ treatment demonstrated the necessity of a parboil prior to
microwave pasteurization. Starch gelatinization (%Gelₐ) showed no differences between fresh cooked
treatments; however, after 1 week, M₀-M₆ had significantly higher %Gelₐ than other treatments,
suggesting a lower level of retrogradation in these treatments. $M_{6}$-$M_{12}$ had the lowest levels of SDS-soluble protein, while $M_{0}$ had the highest, indicating that protein polymerization increased with heat treatment. The pasta ultrastructure exhibited changes between the treatments that were not observable using chemical methods. Firmness and elongation increased with heat treatment; however elongation data indicated an overall weakening of pasta due to microwaves regardless of total heat. LAOS data showed nonlinear behavior as well as fluid like behavior in pasta at strains >1%, with little variation observed between the treatments. The sensory results suggested microwave pasteurization may intensify the attributes associated with aging pasta. A clear trend between magnitude of heat treatment and attribute intensity was not observed in all attributes. More work is needed to determine the precise effect parboil time has on quality of microwave pasteurized pasta.