Comparison of Microwave and Hot Water Pasteurization of Green Beans (Phaseolus vulgaris L.)

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INTRODUCTION

- Novel thermal processing technologies have been developed to reduce quality losses in production of pasteurized foods. Storage temperatures play a vital role in maintaining safety and quality of pasteurized food.
- Microwave technology has shown advantages over hot water heating:
  - Volumetric heating
  - Improved heating uniformity
  - High energy conversion rate
- 915 MHz semi-continuous Microwave-Assisted Pasteurization System (MAPS) developed at Washington State University for thermal processing.

METHODS

- 226 g green beans sealed in trays.
- Thermal processing target lethality: F10 = 10 min (a 6-log reduction of non-proteolytic Clostridium botulinum).

RESULTS AND DISCUSSION

- **Thermal processing**
  - Heating rate: 1.6 vs 8.4 °C/min (HW vs MAPS)
  - **Quality after thermal processing**
    - Significant less quality loss after MAPS processing

- **Quality degradation during storage**
  - **Aerobic mesophilic bacteria count**
    - Spoilage bacteria: Paenibacillus spp., Bacillus spp.
    - Time to spoilage (table) 10°C 7°C 2°C
      - MAPS 21 d 42 d 100 d
      - HW 17 d 35 d 80 d

- **Chlorophyll and greenness (a*) (e.g. 10°C storage)**
  - Degradation rate (MAPS vs HW): chlorophyll a: 0.123 vs 0.137
  - a*: 0.149 vs 0.173
  - Correlation: r=-0.958, p<0.01

- **Ascorbic acid**
  - Microwave processed samples have higher ascorbic acid retention

CONCLUSIONS

- Microwave processing caused less degradation in chlorophyll a, greenness, and ascorbic acid;
- Lower storage temperature could delay spoilage and quality losses;
- Microwave processed green beans showed slower spoilage and better preservation of quality attributes during storage;
- This study suggests that microwave pasteurization is a potential alternative to produce safe, high-quality vegetable products that preserve their quality during storage.

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