MICROWAVE PRECONDITIONING OF DRY NAVY BEANS

Shirazi, A., L.G. Occeña, and M.A. Uebersax
Dept. of Food Science and Human Nutrition
Michigan State University
East Lansing, MI 48824

Introduction: Conventional methods of legume processing and preparation are often too time consuming for current western lifestyles. Alternative methods of producing convenience legume foods are desirable. Application of microwave energy has gained wide acceptance even in many final home food preparations. This research was undertaken in an attempt to establish a rapid processing method for production of microwavable navy beans.

Method: Feasibility of using microwave energy for conditioning dry navy (Phaseolus vulgaris, 'C-20') beans was investigated. Dry seeds were soaked for various time periods and held refrigerated for 2-3 days for improved distribution of water throughout the seed tissues. Beans of different moisture contents (47 to 54%) were subjected to different microwave energy levels for 2 minutes prior to frozen storage. The frozen preconditioned samples were heated by microwaves for 30 seconds in a Nordicware microwave pressure cooker. Microwave heating time was established following a come-up time ranging from 3 to 7 minutes. Products were evaluated for changes in textural characteristics (Kramer Shear Press), color attributes (HunterLab Colorimeter Model D25-PC2) and starch microstructure (scanning electron microscopy).

Results: Moisture gain in dry beans leveled off after 5 hours of soaking at room temperature (Figure 1). Significant differences were found in bean texture after preconditioning (Figure 2). Softer texture was observed in preconditioned products of higher initial moisture content. Texture of the frozen preconditioned samples was significantly different after the 30-second cook (Figure 3). Lower microwave energy level was associated with longer come-up times and, therefore, resulted in higher weight gains during cooking due to longer contact between sample and water (Figure 4). The texture of the cooked sample approached that of the conventionally retorted navy beans (Figure 5). Thus, sufficient thermal energy is needed to produce a desirable and palatable texture. Desirable texture of cooked beans was associated with a weight gain of approximately 30% above the initial bean soak weight. Color (lightness, L*) of the final product was a function of both bean initial moisture content and microwave processing energy level (Figure 6).

Beans of softer texture, darker color and higher yield were produced using the pressure cooker at lower energy levels and subsequently longer cooking times. Potential for acceptable prepared frozen microwavable products were attained using these procedures. Results indicated that desirable quality following approximately 5 minutes in home preparation times may be achievable.
Figure 3. Maximum force required to shear frozen preconditioned navy beans after cooking at high (740 W) microwave energy level for 30 seconds.

Figure 4. Total increase (% above soak weight) in weight of navy beans subjected to microwave heating (preconditioning and cooking).

Figure 5. Maximum force required to shear navy beans cooked in a conventional retort (240°F, 45 minutes) or subjected to different microwave energy levels.

Figure 6. Color of final product as affected by post-soaking moisture content and microwave energy levels used for preconditioning.

References


