Studies of the pickling technology of low-salt pickled cucumbers

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ABSTRACT

The pretreatments, pickling conditions and storage methods were examined for the production of high quality, appetizing and healthy pickles from cucumber by low-salt pickling technology. Pretreatments included hot water blanching, hot brine and/or hot NH3 solution blanching, and salt scrubbing and salt soaking. Pretreated cucumber was then pickled in a 2% brine solution at 4 °C, 15 °C or room temperature with the inoculation of different lactic acid bacteria and/or addition of 0-300 ppm of NaHSO3, 0.1-0.3 M citric acid/0.2-0.6 M Na2HPO4 buffers, 0-0.1% glucose and/or 0-0.5% yeast extract. The storage methods include different packaging/pasteurization condition and storage temperature. The pH value, microbial growth (OD660), polyphenol oxidase (PPO) activity, color values, hardness, organic acid concentration, titratable acidity, total count, total lactics, yeast and mold count, coliform count were analyzed during the pretreatment, pickling and storage periods. The result indicated that hot water blanching alone could not preserve the green color of cucumbers. The green color was better preserved by hot brine blanching due to the inactivation of PPO and thus the inhibition of enzymatic browning by salt, but different levels of hot brine blanching appeared to have similar results. Besides, the addition of 50, 100, or 300 ppm of NaHSO3 could slow down the increasing in color value "a" and delay the disappearing of green color. The effect was more obvious when salt scrubbing and salt soaking and the additi on of NaHSO3 were combined. However, the pH without control rapidly decreased to 3.7 or lower during pickling. Consequently, the Mg++ of chlorophyll was substituted by H+ in pheophytinization to form pheophytin or pheophorbide and the color of cucumber turned dark brown. When pH was buffered with citric acid/Na2HPO4, the color value "a" of cucumbers was kept negative. Controlling pH was most effective in preserving the green color of pickling cucumbers. Overall, the multitreatment described as follow can pr eserve both the texture and green color of cucumber after 3-days light pickling with 1: 1 Lactobacillus acidophilus CCRC 10695 and Leuconostoc mesenteroides CCRC 12580: the cucumber was 1) salt scrubbing for 1 min and then salt soaking for 30 min; 2) blanched at 70 °C in 0.05% ammonia / 5% brine for 1 min; and 3) pickled in a solution containing 50 ppm of NaHSO3 with its pH buffered with 0.1 M Citric acid / 0.2 M Na2HPO4. When the cucumber was pretreated with the above optimal methods, inoculated with Lactobacillus plantarum CCRC 10069 and fermented at 4 °C, the yeast and mold and coliforms did not grow. However, the growth of lactics and production of acid at 4 °C was slow even if 1% glucose and/or 0.5% yeast extract were added. Without substrate addition, the pickling of optimally pretreated cucumbers at 15 °C for 2 days could not only control the microflora, but also yield a better pickle product in terms of the quality of the green color, pulp perfectness, flavor, brittleness and acidity. The green color of pickling cucumbers can be preserved after 12-weeks storage, if the cucumber was pickled at 15 °C for 2 days, pasteurized at 70 °C for 10 min after vacuum packaging with the O-Ny/CPP laminated film and stored at 4 °C. The pH of the pickle products was 4.1-4.5, titratable acidity was 0.06%-0.12%, total counts was lower than 1,000 CFU/ml during storage. The green color disappeared rapidly if the pickle products were pasteurized or stored at higher temperatures and packed under nitrogen or atmosphere. The low-salt pickling process described above, however, could encounter the problems such as the increasing cost of equipments or refrigeration, the necessity in improving pickling sanitation and the impossibility of pickling at once a great quantity of raw materials. Thus, the feasibility of using minimal processing to produce low-salt cucumber sliced pickles to overcome these problems was investigated. Pickling brine was prepared from cucumber juice inoculated with Lactobacillus plantarum CCRC 10069 at room temperature for 3days. The texture and color of the cucumber slices were well preserved 4 weeks after minimal processing if the slices were pretreated, pickled in fermented, steriled and pH-adjusted (4.5) cucumber juice with/without preservatives, then pasteurized, packed and stored under the previously- observed optimal conditions. On the other hand, the texture, color and overall acceptance of cucumber slices deteriorated rapidlly if the slices were pickled in fermented brine without pH adjustment or without sterilization, or were inadequately pasteurized after packaging.

Keywords : pheophytinization ; pheophytin

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