Title Effect of atmosphere composition on quality of components of a ready-to-eat complex soup including fresh-cut vegetables and seeds

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Abstract

Fresh-cut vegetables (parsley, celery, carrot, onion, potato), cereals (barley and 'emmer' wheat) and legumes ('cannellini' and 'borlotti' beans, lentils) were mixed into a complex ready to cook soup. Before mixing, potatoes were dipped in a 2% citric acid + 1 % ascorbic acid solution for 6 minutes at 20 °C to prevent browning, lentils were rehydrated for 5 hours in water and beans for 14 hours in a 5% NaCl solution. Three experiments on the effect of controlled atmosphere on quality of the ready-to-eat soup were carried out. In the first experiment, the mix was stored at 5 °C in air (I), 5% O_2 in nitrogen (II), 15% CO_2 in air (III) and 5% O_2 + 15% CO_2 in nitrogen (IV). Initially and after 2, 5 and 10 days of storage, color and external appearance were measured. In addition, for samples stored in air and 5% O_2, respiration rate was monitored. Atmosphere with 15% CO_2 in air and in combination with low oxygen, showed the best results in maintaining quality attributes for most of the species; in particular, especially in the last days of storage, 'borlotti' beans, parsley, 'emmer' wheat and barley, lentils, potatoes and celery received an higher score value for external appearance than samples stored in air and low oxygen. High CO_2 also had positive effects on maintaining initial color parameters and in slowing down sprouting process on seeds. In the second experiment the mix was stored at 5 °C in air (I), 15% CO_2 in air (II) and 20% CO_2 in air (III), in order to test the effect of higher CO_2 concentration. At 0, 2, 5 and 9 days, in addition to the parameters evaluated in the first experiment, firmness for potatoes, beans and lentils, was also measured. Each species stored in CO_2 atmosphere was considered above the limit of marketability for all the storage duration. Onion, carrot and beans stored in 10% CO_2 showed the best external appearance, while for lentils and potatoes 20% CO_2 treatment was the most effective. In addition, averaged appearance score for the whole soup, calculated for each treatment was higher for product stored at 20% CO_2. Finally, in the last experiment microbiological aspects were evaluated, comparing soup stored in 20% CO_2 with the soup stored in air during 0, 2, 5 and 8 days of storage. 20% CO_2 atmosphere allowed to control mesophilic microorganism, yeasts and moulds, whose growth was well below the safety threshold for a fresh-cut product.