

The thermal stability of vitamin C (including L-ascorbic acid [L-AA] and dehydroascorbic acid [DHAA]) in crushed broccoli was evaluated in the temperature range of 30 to 90 °C whereas that of ascorbic acid oxidase (AAO) was evaluated in the temperature range of 20 to 95 °C. Thermal treatments (for 15 min) of crushed broccoli at 30 to 60 °C resulted in conversion of L-AA to DHAA whereas treatments at 70 to 90 °C retained vitamin C as L-AA. These observations indicated that enzymes (for example, AAO) could play a major role in the initial phase (that is, oxidation of L-AA to DHAA) of vitamin C degradation in broccoli. Consequently, a study to evaluate the temperature–time conditions that could result in AAO inactivation in broccoli was carried out. In this study, higher AAO activity was observed in broccoli florets than stalks. During thermal treatments for 10 min, AAO in broccoli florets and stalks was stable until around 50 °C. A 10-min thermal treatment at 80 °C almost completely inactivated AAO in broccoli.

AAO inactivation followed 1st order kinetics in the temperature range of 55 to 65 °C. Based on this study, a thermal treatment above 70 °C is recommended for crushed vegetable products to prevent oxidation of L-AA to DHAA, the onset of vitamin C degradation.

Practical Application: The results reported in this study are applicable for both domestic and industrial processing of vegetables into products such as juices, soups, and purees. In this report, we have demonstrated that processing crushed broccoli in a temperature range of 30 to 60 °C could result in the conversion of L-ascorbic acid to dehydroascorbic (DHAA), a very important reaction in regard to vitamin C degradation because DHAA could be easily converted to other compounds that do not have the biological activity of vitamin C.