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Czech J. Food Sci.

I. Van Bree, S. Samapundo, F.

Devlieghere, B. De Meulenaer: Modelling the Effect of Headspace Oxygen Level on the Degradation of Vitamin C in a Model Fruit Juice

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Fruit juices are a significant source of vitamin C in the human diet and therefore their nutritional value is mainly related to the amount vitamin C they contain (KABASAKALIS *et al*. 2000; MANSO *et al*. 2001; SHINODA *et al*2005; BERLINET *et al*2006). However, vitamin C (which also commonly known as ascorbic acid) is readily oxidised and degraded at different rates depending on storage conditions like temperature, the presence of oxygen or trace metals, light exposure etc. (KABASAKALIS *et al*. 2000). In the presence of oxygen, ascorbic acid (AA) is oxidised to

dehydroascorbic acid (DHA), which is itself then further hydrolysed into 2,3-diketogulonic acid (DKG). DKG is then decarboyxylated leading to the formation of reductones and furan compounds. Whereas AA and DHA have vitamin C activity, DKG does not exhibit any vitamin C activity. In this study, the influence of different headspace O_2 levels on the oxidation of AA and the formation and breakdown of DHA, was investigated at 22 ° C. Kinetic rate constants for each degradation step were estimated using a reversible consecutive model. Finally, the estimated kinetic parameters were linked to the headspace oxygen levels. The headspace oxygen level was observed to have a significant effect on the rate of oxidation of AA. A lower oxygen partial pressure in the headspace, resulted in a lower concentration of dissolved oxygen in the model fruit juice, and consequently in a slower rate of AA oxidation. At the high headspace O_2 levels (10 and 20.9%), AA was completely oxidised and below the LOD (32.55 mg/l of model fruit juice) after 20 days. Whereas under anaerobic conditions, 65% of the initial amount of AA was still present after the

same incubation period. With regards to DHA, a marked difference was noticed in the slopes of the curves and in the maximum DHA concentration attained. Namely, an increase in the initial headspace oxygen level corresponded not only to an increase in the maximum DHA concentration but also to a shorter time for the maximum DHA concentration to be attained. This indicates that a faster rate of formation of DHA occurred the higher the initial headspace oxygen level was. The estimated kinetic rate constants supported the observations made above. A positive linear correlation was been found between the oxidation rate of AA and the initial headspace oxygen level. This is very important as it provides for the first time an opportunity to model the rate of vitamin C degradation.

Keywords:
oxygen; permeability; vitamin C; fruit juice; ascorbic acid; dehydro ascorbic acid

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