

RADIATION INDUCED MAILLARD REACTIONS (THE KINETIC OF COLOUR FORMATION DURING HEATING)

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The reactions of non enzymatic browning called Maillard reactions include a series of chemical reactions taking place in food preservation, preparation and processing at higher temperatures. The final effect of proceeding Maillard reactions is mainly a change in the flavour and colour of food products.

The products of these reactions have an essential effect on food organoleptic quality and their acceptance by consumers. They are characterized by strong antioxidant properties. Preliminary studies were mainly conducted on model system containing of selected compounds, simulating food, to allow the interpretation of the results in terms of the food (reducing sugars and amino acids). The products of these reactions have a critical influence on the quality of food products and their acceptance by consumers.

There are prospects that in near future the radiation method will be accepted by joint FAO/WHO/IAEA (UNO-Organizations) and introduced on a commercial scale into international practice).

In this communication the results are presented the investigations of the effect of ionizing radiation from ^{60}Co on the acceleration of Maillard reactions in model system containing an aqueous solution of fructose $F-0.03 \text{ mol/dm}^3$ and alanine $\text{Ala } 0.01 \text{ mol/dm}^3$. Solutions F/Ala irradiated in the range of doses 5 to 30 kGy at a dose rate 1.4 Gy/s, were then heated for some hours at different temperatures: 40°, 60°, 80°, and 100°C. To asses the colour intensity of the solutions under investigation, the value of absorbance at 450 nm in 10 mm cuvettes was measured. These spectrophotometric studies showed that the colour intensity of irradiated solutions was dependent on the dose of radiation, the temperature and the heating time. The reaction constants estimated for the system studied increased with the increase of radiation dose and temperature. The activation energy of colour development determined for the range of temperatures from 60°C to 100°C decreased with dose from 70.6 kJ/mole for 5 kGy to 60.7 kJ/mole for 30 kGy.

The results of spectrophotometric and chromatographic studies confirmed the formation of carbonyl products from fructose radiolysis and their participation in the acceleration of non-enzymatic browning reactions. The aldehyde products formed from the amino acids as a result of the Strecker degradation are responsible for the formation of odour characteristic for Maillard during heating.

The changes in the concentration of fructose and alanine during irradiation of the solutions under study were proportional to the dose of radiation. The radiation yield of fructose decomposition was equal to $G = 2,6$ and that for alanine $G = 0.22$. In the irradiated solutions of F/Ala, serine has been found, which so far has not been mentioned as a product of alanine radiolysis.

In conclusion it may be stated that the studies performed demonstrate the influence of radiation and acceleration of Maillard reaction during subsequent heating at 40°C up to 100°C of systems containing reducing sugars and amino acids. It should be taken under consideration in the studies on introducing radiation technology of food products preservation connected with further thermal treatment.



CZ9928615