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EFFECT OF CHANGES IN POLYUNSATURATED FATTY ACIDS ON THE QUALITY OF WALNUT OIL

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The walnut oil obtained by the cold pressing of *Juglans regia* L. kernels is a food of high quality because of dominated content of polyunsaturated essential fatty acids: linolenic, linoleic, docosahexaenoic, eicosapentaenoic (ω-6, ω-3). The quality and shelf life of walnut oil depend on several factors, among which the physicochemical changes in polyunsaturated fatty acids play an important role. The processes of polyunsaturated fatty acids auto-oxidation under the action of enzymes, atmospheric oxygen and light have a strong influence on the quality decreasing of walnut oil.

The purpose of this investigation was to study the dynamics and kinetics of the polyunsaturated fatty acid oxidation processes; and analysis of the formation of primary and secondary oxidation compounds. Experimental researches were carried out during 2014–2018 years using walnuts of Cogalniceanu variety, harvested in Calarasi area (Republic of Moldova). Walnut oil was obtained by cold pressing of the walnut kernels and oil yields were determined. The analysis of walnut lipids, reactions kinetic of polyunsaturated fatty acids oxidation, and accumulation of primary and secondary oxidation compounds was studied. Changes in physicochemical and sensory quality of the walnut oil were determined. Freshly obtained walnut oil had the followed indexes of quality: acidity – 0.38±0.07mg KOH/g; iodine value – 148.0±0.6g per100 g of lipids; saponification index – 188.0±1.3mg KOH/g; water content – 0.1 %. The content of polyunsaturated fatty acids (ω-6, ω-3) in walnut oil ranged from 8.0 to 13.0 % of total fatty acids. During storage, the walnut oil changed permanently with losses of nutritional quality. The reaction of hydroperoxides formation as the primary oxidation compounds had zero order, but the rate of reaction was variable. Take into account that the molecular mechanism of lipid oxidation-reduction reactions is complex; the kinetic model of the lipid oxidation process was developed.

During storage, the variability of constant (K, $days^{-1}$) of reaction rate for hydroperoxides formation was evaluated depending on temperature and storage duration. At the initial stage of storage, an increase in storage temperature from 3 to 60 °C led to a rise in reaction rate constant by 17.8–35.0 times (from 0.052 to 1.821 $days^{-1}$). At the second stage, the process of hydroperoxides decomposition began, but the rate of this process was 2.15 times less than the reaction of their formation. After 180 days of storage, the concentrations of hydroperoxides stabilized at values of 1.7–3.0μmol/kg. It was shown that the changes in the acidity of walnut oil were significantly slower and ranged from 0.38 to 0.53mg KOH/g.

Keywords: walnut oil, polyunsaturated fatty acid, hydroperoxides, acidity.

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