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ХАРЧОВИХ ПРОДУКТІВ
FOOD QUALITY
AND SAFETY**

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Подано наукову інформацію у сфері систем менеджменту якості та безпечності харчової продукції, презентовані новаторські ідеї в галузі підвищення якості та безпечності харчових продуктів, які можуть привернути увагу широкого кола фахівців та стати предметом дискусії. Розглянуто аспекти технічного регулювання у Україні, а також актуальні питання у сфері lean-виробництва харчової продукції, підприємництва та торгівлі.

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20. EFFECTS OF TEMPERATURE ON THE QUALITY IN BAKED FOODS RICH IN POLYPHENOLS

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Cereals and cereal-based products being wheat and rice are the most used for human consumption products. From nutritionally point of view, cereal-based products are an important source of carbohydrates, protein, vitamin B and E, iron, trace minerals and fibers (Rosell, 2011). In order to increase the functional properties of these products, in recent years they have been enriched with polyphenols, because polyphenols are hot topic research. The phenolic compounds exert biological activities (antioxidant and anti-inflammatory effects) and prevent chronic diseases and other (Santhakumar et al., 2018; Syarifah-Noratiqah et al., 2018).

Polyphenols are classified as flavonoids and non-flavonoids (Serra et al., 2018). Flavonoids are mainly in the products such as vegetables, fruits and tea (Crozier et al., 2009). Phenolic compounds such as ferulic or coumaric acids are in cereals products (Ou and Kwok, 2004; Pei et al., 2016).

During the baking process, in bread, cookies or muffins, the amount of free phenolic acids are increasing, but the amount of bound phenolic acids are decreasing. It means that baking transform phenolic acids from bond to free ones (Abdel-Al and Rabalski, 2013).

Anthocyanins are the most sensitive polyphenols to thermal treatment. The research of bread with strawberry, black currant and raspberry showed that the most

of polyphenols are lost in those breads, by up to 50% during baking process (Górnaś et al., 2016). The same observation was in the bread incorporated with wild blueberry (Rodriguez-Mateos et al., 2014). Flavonoids are more stable during baking than anthocyanins. Vogrinčič et al. (2010) showed that in bread with Tatar buckwheat flour the content of rutin decreased about 50% after baking. Buchner et al. (2006) have studied quercetin during heating at 100°C. They found that quercetin is stable at this temperature, but in the higher temperature (at 200°C) quercetin forms many degradation products (Ravber et al., 2016).

The incorporation of products rich in polyphenols influence on the aroma of baked foods. Tańska et al. (2016) found that fruit pomace (from blackcurrant, rosehip or elderberry) decreased the aroma of shortbread cookies. According to Zain et al. (2018) green coffee bean powder decreased bread aroma as well.

Some polyphenols influence on the color and texture parameters of baked products. The mechanism for the effect of polyphenols on texture is unclear, but the presence of polyphenols in products mainly makes them harder. According to Zhang et al. (2014) some polyphenols such as epicatechin, quercetin, chlorogenic acid or rosmarinic acid, in cookies result in an increase in the hardness of cookies compared to the control. The same effect was observed in bread with quercetin where, in comparison with control, the hardness and chewiness increased (Lon and Zhou, 2018). It can be affected by wheat proteins and starch (Amoako and Awika, 2016). The color is formed in the oxidation process. The oxidized polyphenol products react with amino acids. Amino acids and proteins through the Maillard or Strecker reaction form brown pigments (Bittner, 2006). For example, polymerization of quinones produced from chlorogenic acid, form a green pigment in sunflower's products (Liang and Were, 2018).

Summarizing can be found that polyphenols influence the color, texture and flavor of baked foods. Most polyphenols are thermally sensitive. In polyphenol-incorporated bakery foods need to be investigated the chemical reactions of polyphenols and their oxidized products (quinones) with other food components.

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