OPTIMIZATION OF BEE POLLEN FERMENTATION CONDITIONS USING CHEMOMETRIC ANALYSIS

Vaida Adaškevičiūtė[1], Vilma Kaškonienė[1], Paulius Kaškonas[1,2], Audrius Maruška[1]

[1] Instrumental Analysis Open Access Centre, Vytautas Magnus University, Vileikos str. 8, LT – 44404 Kaunas, Lithuania
[2] Kaunas University of Technology, Studentų str. 50, LT – 51368, Kaunas, Lithuania
vaida.adaskeviciute@stud.vdu.lt

Bee pollen is one of the most valuable natural products produced by bees (lot. *Apis mellifera)*. Bees are the insects that help transfering pollen between plants and also bring them to beehive. Bees mix collected pollen with saliva, nectar and honey and then place this mixture in the honeycomb for storage. The mixture changes over time because of the fermentation becoming a new product, known as bee bread. The fermentation of bee pollen contribute to increase of bioactive compounds content, nutritional value and antioxidant activity, which helps to preserve products against spoiling [1, 2]. The aim of this study was to optimize bee pollen fermentation conditions using chemometric analysis methods. Spontaneous fermentation and fermentation with *L. rhamnosus* was applied on bee pollen keeping prepared samples for 2, 4, 8, 12, 16 and 20 days, respectively. Total phenolic compound content, total flavonoid content and antioxidant activity were determined in the fermented bee pollen extracts by spectrophotometric methods in order to optimize fermentation process conditions [2, 3, 4]. The total content of phenolic compounds was measured using Folin–Ciocalteu reagent. The total flavonoid content analysis was carried out performing colorimetric reaction with aluminum chloride. Antiradical activity, characterized by the total radical scavenging activity, was measured using 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical. Results were evaluated employing chemometric analysis methods, which included principal component analysis (PCA), multidimensional scaling (MDS) and hierarchical clustering analysis (HCA). The spectrophotometric analysis of different bee pollen extracts showed that total content of phenolic compounds increased by 1.11-1.67 times and antiradical activity – 1.56-2.26 times in all fermented samples, but total flavonoid content – by 1.13-1.35 times after 4 and more days of fermentation. The optimal duration of fermentation was determined finding the highest observed total phenolic content, total flavonoid content compounds and antioxidant activity in the samples. According to the results, the optimal duration of fermentation are 8 days using *L. rhamnosus* and 12 days for spontaneous fermentation.

Acknowledgements:
This project was financed by Research Council of Lithuania project No. 09.3.3-LMT-K-712-10-0232.

[1] A. Gendrolis. *Žiedadulkės ir bičių duonelė. Kaip ilgai ir sveikai gyventi* (Kaunas, 2012, ISBN 9786094082832).
[2] V. Kaškonienė, A. Katilevičiūtė, P. Kaškonas, A. Maruška (2018). The impact of solid state fermentation on bee pollen phenolic compounds and radical scavenging capacity, *Chemical Papers*, 1-6. ISSN 2585-7290, (2018).
[3] V. Kaškonienė, G. Ruočkuvienė, P. Kaškonas, I. Akuneca, A. Maruška, Chemometric analysis of bee pollen based on volatile and phenolic compound compositions and antioxidant properties, *Food Analytical Methods*, 8(5), 1150-1163 (2015).
[4] M. Stankevičius, I. Akuneca, I. Jakobsone, A. Maruška, Comparative analysis of radical scavenging and antioxidant activity of phenolic compounds present in everyday use spice plants by means of spectrophotometric and chromatographic methods, *Journal of Separation Science*, 34 (11), 1261-1267 (2011).