RECYCLING OF FILTER TEA INDUSTRY BY-PRODUCTS: PRODUCTION OF *A. MILLEFOLIUM* EXTRACTS USING SUBCRITICAL WATER EXTRACTION

Jelena Vladić[1], Maja Molnar[2], Martina Jakovljevic[2], Senka Vidović[1], Stela Jokić[2], Kristian Pastor[1], Natasa Nastic[1]

[1]*Department of Inorganic and Analytical Chemistry, University of Szeged, H-6720 Szeged, Dóm tér 7, Hungary*
[2]*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology, Franje Kuhača 18, 31000, Osijek, Croatia*
e-mail: vladicjelena@gmail.com

Abstract

Medicinal plants are most commonly used in the form of herbal tea, individually or in a tea blend. In the process of production filter tea, "herbal dust" or very small particles are formed during grinding of the plant material. As the particles of herbal dust are smaller (<0.315 mm) with respect to the particle size of filter paper, this fraction cannot be used in form of filter tea and is considered as a by-product in the tea production process [1]. Considering the significant content of bioactive compounds in this type of material, it would be beneficial to develop an adequate way of additional exploitation of the by-product and its transformation into high-quality products.

A medicinal plant with pharmacological properties that are recognized worldwide is *Achillea millefolium* which is included in the national Pharmacopoeias of many countries. Many scientific researches confirmed the biological activity of *A. millefolium* preparations such as anti-inflammatory, antitumor, antioxidant, antimicrobial, liver protective activities, and gastroprotective activity [2].

Introduction

The aim of this study was to develop procedures for obtaining *A. millefolium* extracts with a high content of polyphenolics by applying innovative green technology - subcritical water extraction (SWE). During the extraction with subcritical water, Maillard and caramelization reactions take place and have formation of neoantioxidants as a consequence, which are the reason for the increased antioxidant activity. Hydroxymethylfurfural (HMF) is an indicator of the Maillard reaction [3]. Several studies show that HMF and related compounds induce the genotoxic and mutagenic effect in human cells and promote colon cancer in rats [3]. Therefore, the goal of this research was to establish the conditions of extraction that provide the highest quality of extracts in terms of content of antioxidant components with the lowest formation of HMF.

Experimental

SWE extraction was performed at different process parameters (temperature 120–200 °C, extraction time 10–30 min, and HCl concentration 0–1.5%). The content of polyphenols in obtained extracts was determined by applying spectrofotometric methods, and the content of individual components present in extracts was determined by HPLC analysis. Additionallz, HMF content in extracts was determined.

Results and discussion

There was no HMF present in extracts at the highest temperature of extraction (200°C; 20 min and without HCl) which provided the highest content of phenols (128.20 mg/GAE/g SE). HPLC analysis was used to determine the content of chlorogenic acid and its highest content was recorded in the extract obtained at 120°C, 20 min and without addition of HCl. The same

extract also possessed the highest content of flavonoids (79.19 mg CAT/g SE). The presence of chlorogenic acid was not detected at the highest temperature due to potential degradation, while at lower temperatures the content of chlorogenic acid was in range of 16.8-30.4 μg/mL of extract. In addition, HMF was detected in almost all samples except in those obtained at higher temperatures and it ranged between 5.8 and 39.3 μg/mL.

Conclusion

In the present study, SWE was successfully applied for valorization of *A. millefolium* "herbal dust" through the extraction of bioactive components and production of high quality extracts.

References

[1] M. Ramić, S. Vidović, Z. Zeković, J. Vladić, A. Cvejin, B. Pavlić, Ultrasonic. Sonochem. 23 (2015) 360-368.
[2] A.M. Cavalcanti, C.H. Baggio, C.S. Freitas, L. Rieck, R.S. De Sousa, J.E. Da Silva-Santos, M.C.A. Marques, J. Ethnopharmacol. 107 (2006) 277-284.
[3] M. Plaza, V. Abrahamsson, C. Turner, J. Agric. Food Chem. 61 (2013) 5500-5510.