TEZA ABILITARE

CARACTERIZAREA CHIMICĂ A UNOR MATRICI VEGETALE NE- ȘI BIOPROCESATE

Domeniul: Biotehnologii

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ABSTRACT

The present habilitation thesis presents, in synthesis, my professional and scientific achievements in the domain of analysis of bioactive compounds from non- and bioprocessed vegetable matrices, starting after the PhD defense, as well as my plans for the development of the future academic and research activity. Entitled “Characterization of some non- and bioprocessed vegetable matrices”, the thesis summarizes the most relevant scientific achievements, describing the results of several representative studies for my domains of interest in the research activity. The main research domain is related to the chemistry and biochemistry of the volatile compounds and other biologically active compounds (mainly with antioxidant potential) from non- and bioprocessed vegetable matrices. After a short introduction, the second part of the thesis (Scientific and professional achievements) is focused the 2 main research directions: (1) Extraction and analysis of the volatile compounds from vegetable matrices; (2) The study of the bioactive compounds from non- and bioprocessed vegetable matrices and (3) The development of functional products.

The chapter 2.1. (Extraction and analysis of the volatile compounds from vegetable matrices) includes original studies aimed on the essential oils characterization by means of modern analysis techniques and their applications in biotechnologies’ field; the use of volatile profile and chemometry in the authentication of agri-food products and the dynamic of volatile compounds in non- and bioprocessed products. In the studies presented in this chapter one of the newest and modern extraction techniques for volatile compounds was used, namely “in-tube extraction” (ITEX) coupled with gas-chromatography and mass spectrometry (GC-MS). Thus, in the studies Socaci et al. (2011, 2012), Salanță et al. (2015, 2016), Şerban et al. (2012), the ITEX/GC-MS technique prove to be a simple and efficient way to analyse and characterize the volatile profile of hop and other vegetable matrices. The complexity of the volatile composition of essential oils is at the foundation of their manifold biological activities (eg. antibacterial, antifungal, antioxidant, antiinflammatory, sedative, etc.). In the study we have published in Molecules journal (Semeniuc et al., 2018) we were able to establish some correlation between the volatile constituents, phenolic content, antioxidant capacity and antimicrobial activity of essential oils extracted from parsley, basil, thyme and lovage, in order to use these essential oils at their maximal potential as preservatives in food products. The volatile profile is influenced by both extrinsic and intrinsic
factors, such as variety or cultivar. In this sense, a part of our research was focused on the applicability of the volatile fingerprint in the discrimination processes of different fruits and vegetables or derived products botanical origin (tomatoes, sea buckthorn, polen). The main articles published in this area and presented in the thesis are Socaci et al. (2013, 2014), Mărgăoan et al. (2014). The importance of these studies for the knowledge in the field is highlighted by their citations in prestigious journal such as Nature or Chemical Reviews.

In addition to the external aspect, the aroma and the taste of vegetable are increasingly important attributes for consumers. The volatile compounds have a significant contribution on the product flavor, and it is therefore necessary to know as thoroughly as possible the changes that occur during maturation, storage or processing of the raw materials in the formation of volatile aroma compounds with positive or negative attributes on product sensory properties. The dynamics of the transformation of volatile compounds in different vegetable matrices as well as the dynamics of their accumulation or degradation in different bioprocesses (eg fermentation) have been the subject of several studies published by our research team such as: metabolic conversion of carbohydrates into lactic acid and volatile compounds during fermentation in acid doughs, the traceability of volatile hops compounds in beer, the dynamics of the accumulation of volatile compounds during fruit maturation.

Chapter 2.2. (The study of bioactive compounds from non-and bio-processed vegetal matrices) includes the most representative studies published as first / co-author on topics related to the recovery and exploitation of bioactive compounds (mainly antioxidant potential compounds) from agri-food waste, the characterization of plant matrices (vegetables, fruits, spices and medicinal plants) as sources of biologically active compounds and the influence that some bioprocesses (eg fermentation, germination) may have on the content and bioavailability of bioactive compounds from vegetable matrices (Socaci et al., 2018; Farcas et al., 2015; Nagy et al., 2018; Frond et al., 2019, Vicaș et al., 2014, etc.).

Besides the fundamental component, the research activity, especially in the field of biotechnologies, must also contain an applicability component, the transfer of know-how to the economic environment and industry. For this reason, we have always considered the exploitation of the results obtained from fundamental research either in the development of optimized analytical techniques / methods or in the development of new, value-added, functional products. Some of the
published articles that include this component (in addition to those already presented in the previous chapters) are presented in Chapter 2.3. (Development of functional products).

The scientific and publishing research activity after the completion of the doctoral thesis can be quantified as follows: 4 chapters in international publishing houses, 1 chapter and 1 scientific book in national publishing houses, 2 teaching manuals and 3 practical book for students. I have published as first/co-author 49 ISI articles (of which 9 were awarded by UEFISCDI) and 51 BDI articles (cf. Web of Science H-index = 6). I also coordinated 3 research projects and I was member in 19 research projects. I am Associate Editor of BUASVM-FST Series and reviewer for DBI journals.

The third part of the thesis presents the plans for scientific, professional and academic development, having as a first objective the increase of the scientific quality, the visibility and the national and international recognition of our researches. My future research activity will be focused on two main directions: (1) exploitation of agro-food waste in an integrative way; (2) the extraction and characterization of bioactive compounds in plant matrices. The research activity will be permanently correlated with the educational activity and with the requirements of the socio-economic environment.