

## UTILIZATION OF AGRO-INDUSTRIAL WASTE MATERIALS BY USING SEQUENTIAL SUPERCRITICAL FLUID AND ULTRASOUND EXTRACTION METHODS

M. Tsitsagi, M. Chkhaidze, M. Buzariashvili, N. Nonikashvili

*TSU, Petre Melikishvili Institute of Physical and Organic Chemistry, 31 A. Politkovskaia, Tbilisi, Georgia*

*[Mziatsitsagi@yahoo.com](mailto:Mziatsitsagi@yahoo.com)*

In recent years, there has been a growing interest in the so-called functional food additives. These ingredients are preferred by consumers to have a natural origin, being commonly extracted from natural sources such as plants or food by-product. Grape seeds and skin, orange and tangerine peel, tomato paste waste are the most abundant agro-industrial waste materials in Georgia. Extraction of natural food colorants and small scale high cost bioactive compounds from above mentioned waste materials is the main goal of our research.

The choice of the suitable technique for extraction of bioactive compounds from botanic matrix depends on: the desired class of compounds to be extracted, quality and yield required for extract; the process conditions and economic feasibility for scaling up the process. Sequential supercritical Fluid extraction and ultrasound assisted extraction, the environmentally friendly separation techniques has been used for extraction of target products.

Supercritical fluid extraction is an advanced separation technique based on the enhanced solvating power of gases above their critical point. One of the most frequently used supercritical fluids is carbon dioxide. Besides the advantages of having a low critical temperature and being neither toxic nor flammable, carbon dioxide is also available at low cost and high purity; On account of these characteristics, the fluid is an ideal solvent for in the food dye, pharmaceutical and cosmetic industries, where it is essential to obtain final products of a high degree of purity. Another modern technique we use is ultrasound-assisted extraction method. The application of ultrasound disrupts the cell wall structure and accelerates diffusion through membranes, allows cellular material release and improves mass transfer as well.

Ultrasound-assisted extraction is an upcoming extraction technique that can offer high reproducibility in shorter time, higher yields of bioactive compounds, simplified manipulation, decreased temperature during processing, reduced solvent consumption, and lower energy input. Sequential, stepwise supercritical and ultrasound extraction methods makes available selective and quantitative extraction of oils, phenolics, carotenoids, lycopene, pentacyclic triterpenes and pectins from different botanic matrixes. Selectivity, reproducibility was main challenge of our research. Thus, large range of pressure, temperature, extraction time and different solvent for sequential extraction of different class of compounds has been studied.

Essential oil, carotenoids, hesperidin and pectin has been extracted from tangerine and orange peel; quercetin and natural dyes from onion skin; lycopene and carotenoids from tomato peel, anthocyanins from "Saperavi" skin, phenolics and pentacyclic triterpenes from apple peel. Optimal extraction parameters and suitable extraction techniques have been selected for each target products. Main requirements were selectivity, reproducibility and feasibility for industrial means.

### References:

- [1] Helena Sovova; Roumania P. Stateva *Reviews in Chemical Engineering* 27(3-4) 2011, 79-156
- [2] M. Dent, V. Dragović-Uzelac, I. Elez Garofulić, T. Bosiljkov, D. Ježek, and M. Brnčić\* *Chem. Biochem. Eng. Q.*, 29 (3) 2015, 475-484