# COMPARATIVE STUDY REGARDING THE ANTIOXIDANT ACTIVITY OF SUBCRITICAL EXTRACTS FROM VITIS SEMEN, MUSTARD AND POLYGONUM CUSPIDATUM

**L. GACEU[1]**

[1)]*Transilvania University of Braşov, Departments of Engineering amd management in Food and Tourism, 29 Eroilor Bld., 500036 Brasov, Romania, E-mail: gaceul@unitbv.ro*

***Abstract:*** *Extraction at subcritical pressures of bioactive compounds from plants in soft extraction conditions represents an alternative to replace classical methods of extraction with different solvents, or on enzyme basis. The most important advantage that the HFC extractors with liquefied gas at subcritical pressure offer is that they may extract oils in pure estate, at room temperature and in the absence of air, which allows to create new categories of products with a wide range of bioactive substances as, for example, from the group of alimentary aromas and, respectively, from the series of parfumes, pharmaceutic products etc.*

*The paper presents a comparative study of antioxidant activity of different extracts (Vitis semen, Mustard (seeds) and Polygonum Cuspidatum (root parts)), measured through electrochemical detection by using a biosensor.*

***Keywords:*** *antioxidant activity, subcritical extraction, Vitis Semen, Mustard, Polygonum Cuspidatum*

## 1. Introduction

The scope of the project is to find the best extraction method for the bioactive compounds, such antioxidants, polyphenols, anthocyans, and to find certain utilization in food products. Part of them has to be extracted by using subcritical extraction with HFC 134a. Preliminary results show that the quality and total amount o bio-compounds is higher than classical extraction. Supercritical fluid extraction (SFE) technology has become an increasingly popular method for the recovery of food ingredients and products over the last 20 years, due to its unique advantages, including low temperature use, selective extraction, simpler and cleaner (solvent-free) product recovery.

SFE is also an environmentally benign technology since the process typically generates no waste. Supercritical fluid exhibits high density like liquids, which contributes to greater potential for solubilisation of materials, and low viscosity similar to gases, which enables its penetration into the solid [3].

Recent researches was done by combining the two methods. In the first stage lipids were extracted on HFC extractor (FC 100, Timatic, Italy), then second phase extracts hydrosoluble compunds in SLE extractor (MiniTimatic, Italy). In this case, extraction eficiency was higher 20-30%-and time was reduced between 32-35 %, also depending on temperature (which was varying between 30-40C degrees). Better results were obtained by applying ultrasound waves in extraction liquid in the second phase. Also, combinations of glycerin, propilen-glycol, alcohol has to be use. The main phases of the technological process that has to be optimized are: drying, sterilizing, chopping, liposoluble extraction, hydrosoluble extraction with variable pH, filtering and purification of extracts, packaging [1, 2, 4].

Various methods for characterization or analytical evaluation of preservatives and antioxidants have been explored and applied. Alongside chromatographic or spectrophotometric alternatives, knowledge of the redox and amperometric behaviour, the electrochemical assessment can be a basis to explain useful properties or a direct analytical pathway in dosage of the additives in mixture or individual systems. Electrochemistry of various natural antioxidants is the subject of a active research as is the electrochemical study of the phenolic compounds or their derivatives.

## 2. Materials and methods

The raw material studied was: Vitis semen, Mustard (seeds) and Polygonum Cuspidatum (root parts)). Extraction from raw materials was done with FC 100 extractor (Timatic, Italy) by using HFC 134a (1,1,1,2-tetrafloretan) at pressure 5-8 bar and temperature 5-35 C degrees. The extracts were diluted at 3 different concentration: 20, 40, 60 µl in pH7 ws. Biosensors are gaining an increasing role in food analysis; they can be defined as a sub-group of chemical systems,
in which the analytical device includes a biological sensor coupled with a chemical or physical transducer.

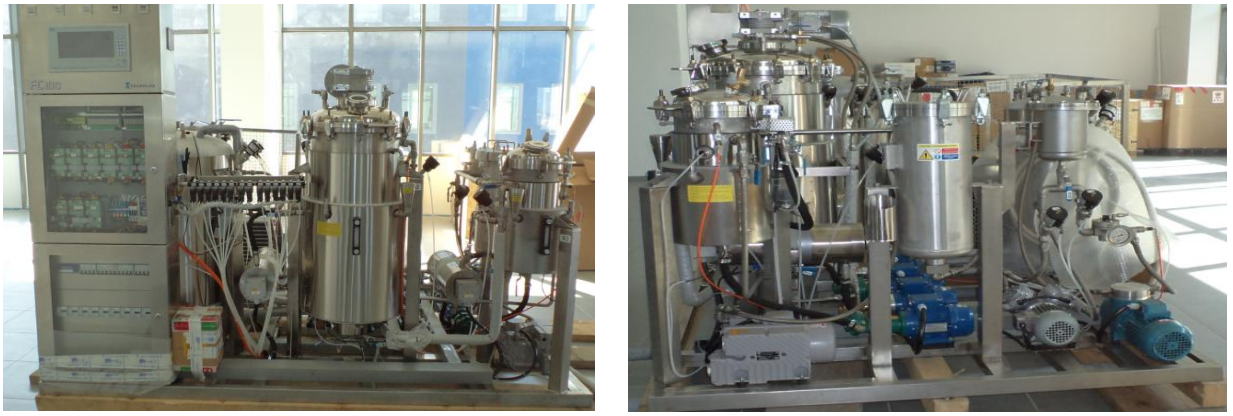

***Fig. 1*** *Extractor TIMATIC FC100*

The biosensor used in this study was based on the electrochemical measure of potential to determine concentration of analytes or to characterize the chemical reactivity of a compound. Differential Pulse Voltammetry (DPV) has been used for quantification, since it is suitable to measure the redox properties of chemical compounds having low molecular weights [7, 10].

Applying a potential, a redox reaction occurs on working electrode surface; electrons involved in the reaction modify the current applied in the cell, and this modification is elaborated by a signal transducer. Results obtained with biosensors were compared for 3 different extracts from different 3 raw materials.

## 3. Results and discussions

Antioxidant activity of samples was measured by an electrochemical biosensor, EDEL meter (Edel Therapeutics, Lausanne, Switzerland) . This is an analytical device, which includes a biological detector coupled with a chemical transducer and specific software. Gallic acid was used as a reference standard.

Each sample, standard solutions or diluted extract samples, was transferred in an aluminium-wrapped becker under magnetic stirring. Then, the electrode was inserted in the EDEL meter and immersed in the solutions. After 10 second, the software was launched and measurements, expressed in nA, were recorded each 30s.

For each sample, the measure was stopped when EDEL values were stable, reaching the plateau status. In figure 2, 3, 4 can be observed the comparative results of the antioxidant activity of *Vitis semen*, *Mustard*, *Polygonum Cuspidatum*, evaluated through the intensity of the current between electrodes [nA].

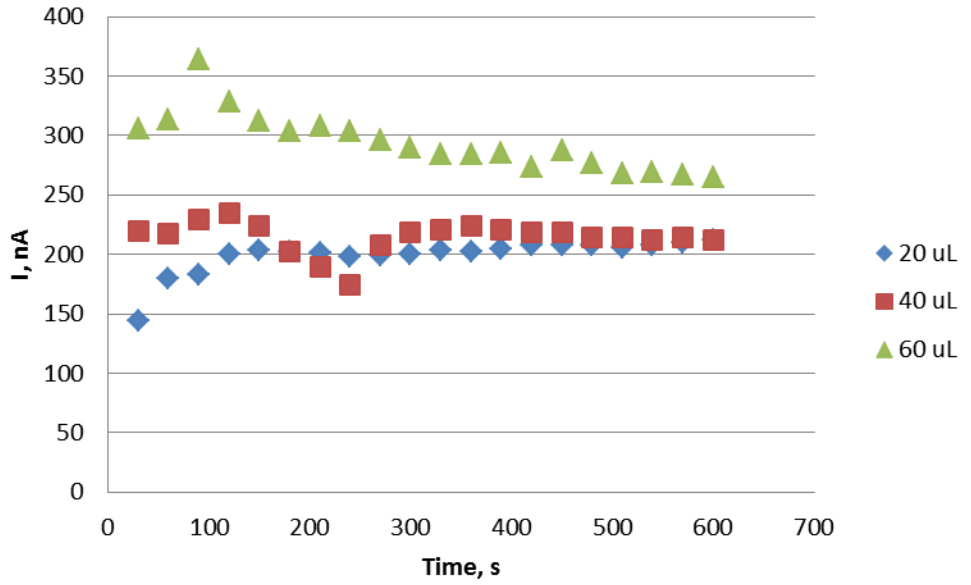


**Fig. 2** *Antioxidant activity of Vitis semen, evaluated through intensity of the current between electrodes [nA]*

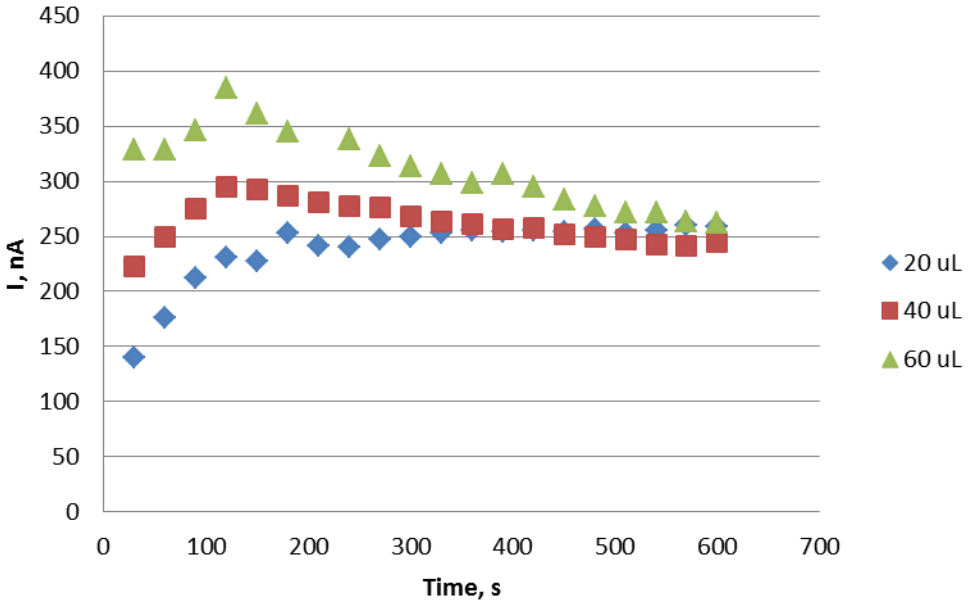


**Fig. 3** *Antioxidant activity of Mustard, evaluated through intensity of the current between electrodes [nA]*

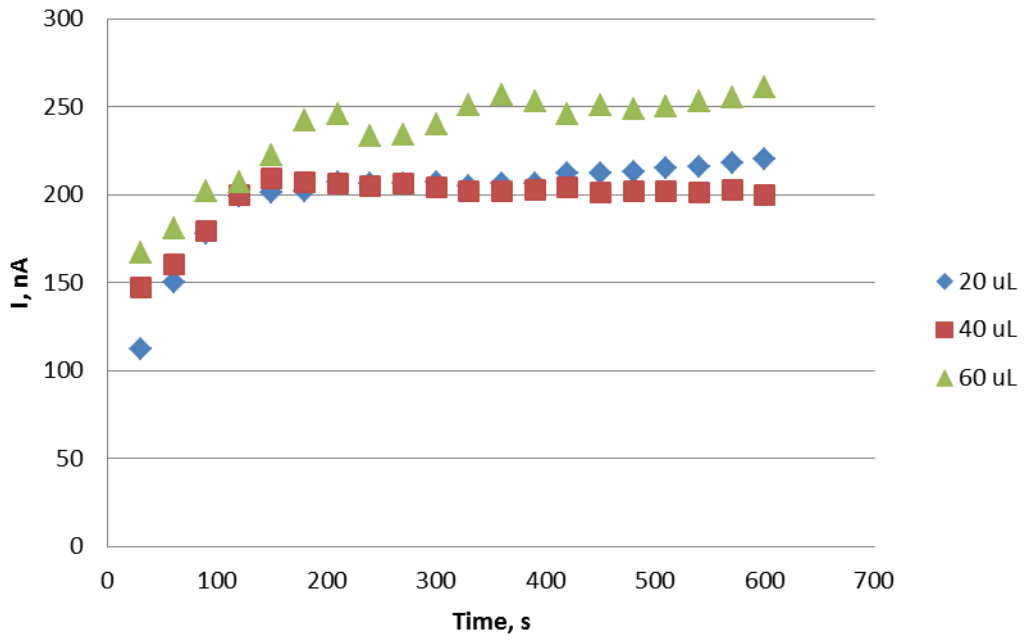


**Fig. 4** *Antioxidant activity of Polygonum Cuspidatum, evaluated through intensity of the current between electrodes [nA]*

## Conclusions

This contribution accentuates the role of electrochemical techniques in the determination of antioxidant activity/capacity in the biological samples of plant origin and in clinical samples. Electrochemical techniques represent due to selectivity and sensitivity suitable tool for the determination of antioxidant capacity in biological samples, where these method are sensitive under the low concentrations of antioxidants.

The preliminary data obtained with this method showed a high variability in the antioxidant activity of samples, in particular for *Polygonum Cuspidatum.*

The best results was observed in the case of *Mustard*, were after 10 -15 tests, corelation between the concentration of extract and the intensity of the current remain significant.

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