

Recovery of bioactive compounds from the wine lees by membrane technology, and their application in wine industry

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1. Curriculum

Born on June 30th 1993 in Armenia, Region of Quindio, Colombia. Master Degree in Bioprocess with emphasizes on the microencapsulation of bioactive compounds by spray drying of a particular fruit cultivated in semi-arid regions (2015-2017) at National Polytechnic Institute, Mexico. During the Master I did a research internship at the Institute on Membrane Technology, National Research Council (ITM-CNR), Italy, on the topic treatment of agro-food products by membrane operations. Bachelor Degree in Food Engineering (2010-2015) at University of Quindio, Colombia.

2. State of art

The grape crops are one of the most widespread crops today with around 77 million tons of grapes produced in 2013 accordance with FAOSTAT. Where the 80% of the whole grape production is utilized for the production of the winemaking (Zhu *et al.*, 2015) with a global production of wine around 27 billion liters per year (Amienyo, Camilleri, & Azapagic, 2014) where Italy leading world producer with 48.8 mhl, followed by France with 41.9 mhl and Spain with 37.8 mhl. An approximate 20%-30% of the grape utilized by winemaking is residues such as the grape pomace where the amount of the grape pomace is depends of the grape cultivation, pressing process and the different steps of fermentation (Dwyer *et al.*, 2003). For a long time the grape pomace of the wine process has been wasted due to the unexplored field of application with economic benefits (Garcia and González, 2017) despite the fact that every year there is a large amount of the wine industry wastes of 5-9 million that can be exploited (Meyer *et al.*, 1998; Schieber *et al.*, 2001) turning this to consider the environmental impact and the waste management issue as well (Fontana *et al.*, 2013; Louli *et al.*, 2004). In the wine process, the grapes are crushed and pressed, which does not represent an alteration in their chemical composition, although in the process of elaboration of red wine, the fermentation is the only significant step that occurs before the grape pomace is generated which promotes alterations in the composition of the carbohydrates but this does not represent a large chemical changes. However, in the grape pomace of both red and white grapes a significant amount of the bioactive compounds are retained (Arvanitoyannis *et al.*, 2006).

Due resources are becoming more restricted and the demand for functional foods grows, the use of the filtrations process and microencapsulation process can be very useful as profitable options for the recovery of valuable compounds from a kind of residue called wine lees from the winemaking process.

3. Ph.D. Thesis Objectives and Milestones

The general objective of this project is to recover the bioactive compounds of one of the waste from the winemaking and reduce the environmental impact of the wine sector, through a filtration system and the encapsulation of these biocompounds by mean the technology of the microencapsulation. The innovation of this project is to take advantage of a waste of the line of the wine process by means of a non-invasive technology that is the membrane process in order to recover valuable bioactive compounds that can be add at the vinification process and wine.

Within the overall PhD objective mentioned above the activities planned can be grouped into the following groups according to the Gantt diagram given in Table 1:

A1) Survey of sample and research

Litrature review about lates researches related with the techniques of recovery of compounds, biocompounds available in wine residues and evaluation of methods of determination of bioactive compounds.

A2) Recovery of bioactive compounds by means of membrane processes.

1. Will take place the characterization of the wine lees from the red and white wine.

1. Selection of the membrane, separation of the particles of greater diameter and determination of the conditions of extraction of the bioactive compounds from the residue of the winemaking process using the filtration system.

2. Characterization of the permeate after the filtration process.

A3) Optimization in the reuse of extracted compounds from the wine lees in the vinification process

1. Addition of compounds extracted from the wine lees to the vinification and to the wine.

2. Physicochemical characterization of wine during storage.

A4) Microencapsulation by spray drying of the bioactive compounds from wine lees

1. After establishing the best conditions of the spray drying, the microencapsulation of the polyphenols will be obtained.
2. The obtained microencapsulation will be chemically characterized, also in terms of antioxidant activity.

A5) Statistical evaluation of the data

Will be used a multifactorial optimization designs in order to establish the best workings conditions. The yield of spray-drying process, total phenols index, percentage of phenolic compounds oxidations, powder mixture, water activity, solubility, higrscopicity will be used as response variables in the optimization studies.

A6) Writing scientific paper and Preparation of thesis

At least three manuscripts on the topic of the PhD project will be prepared and submitted for publication into a high impact factor International Scientific Journal.

Table 1. Gantt chart of the PhD research activity Diagramma di Gantt dell'attività di ricerca del dottorato

Activities	Month	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	
A1)	Survey of sample and Research																			
	1) Literature review																			
	2) Basic Experimental Design and Laboratory Training																			
A2)	Recovery of bioactive compounds by means of membrane processes																			
	1) Characterization of wine lees from red and white wine (e.g. polyphenols, mannoproteins, succinic acid)																			
	2) Selection, separation and determination of the conditions of the membrane filtration process																			
	3) Characterization of the permeate obtained by separation (e.g bioactive compounds, mannoproteins, succinic acid)																			
A3)	Optimization in the reuse of extracted compounds from the wine lees in the vinification process																			
	1) Addition of extracted compounds in vinification and wine																			
	2) Physicochemical characterization of wine, sensory and shelf-life study																			
A4)	Microencapsulation by spray drying of the bioactive compounds from wine lees																			
	1) Establishing the spray drying conditions																			
	2) Characterization of microencapsulated compounds from the wine lees (antioxidant activity)																			
A5)	Statistical evaluation of the data																			
	Statistical analysis																			
A6)	Writing scientific paper and Preparation of thesis																			

4. References

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