

## Ph.D. Thesis proposal<sup>1</sup>

General Information		
<b>Ph.D. Thesis Title</b>	<i>Extraction and valorization of bioactive compounds in apple and grape pomace from juice, wine and arak production: Comparison between conventional and green processes</i>	
USEK Doctoral Program	<i>Agriculture and Food Sciences</i>	
Research Center	NA	
Research Group	NA	
Research Axis	<i>Sustainability</i>	
PhD Supervisor	Name & Title : Youssef El Rayess / Associate professor	University Address : Holy Spirit University of Kaslik- USEK
	Email : youssefrayess@usek.edu.lb	
Co-supervisor (if applicable)	Name & Title : Nancy Zgheib / Associate professor	University Address : Holy Spirit University of Kaslik- USEK
	Email : nancyzgheib@usek.edu.lb	
Location (s)	Location 1: USEK	Work shift calendar /per year (%):
	Location 2: (if applicable)	Work shift calendar /per year (%):

Applicant Profile and/or Special Requirements	Master in Food Engineering or Chemical Engineering, Agriculture Engineering or Master in Chemistry or biochemistry	
Comps Exam Language	<input type="checkbox"/> Arabic	<input type="checkbox"/> French <span style="float: right;"><input checked="" type="checkbox"/> English</span>

Context of the Topic & Scientific Methods <i>(Research impact, objectives, design, methods, and outputs)</i>	
<p>A major problem experienced by agro-based industries in developed and developing countries is the management of wastes. By-products from the fruit and vegetable industry, in particular are of interest since they are inexpensive and available in large quantity. Fruit cultivation is considered a very important element in the Lebanese agricultural sector; it presents 28 % of the total productive agricultural area. Apples and grapes are the most prominent fruit product. Big part of the production of these fruits undergo transformation into juice, wine and arak. These transformations generate huge amounts of by-products. The main part of these by-products is regarded as waste, but considering their available volume and practical low cost, food waste and by-products should be analyzed as potential sources of chemical, bioactive, or functional components (Lin et al., 2014).</p> <p>Polyphenols are the principal compounds related to the apples and grape products consumption benefits due to their antioxidant and free radical scavenging properties. Both flavonoids and non-flavonoids compounds exhibit anti-inflammatory, antibacterial, antifungal, antiviral, neuroprotective, antiproliferative and antiangiogenic activities by reducing harmful low-density lipoprotein (LDL) cholesterol oxidation, modulating cell signaling pathways, reducing platelet aggregation, inhibiting the growth of some tumor types (Guilford and Pezzuto, 2011; Costa et al., 2017).</p>	

<sup>1</sup> Thesis proposal should not exceed two pages

During transformation, only a small part of phytochemicals especially polyphenols is transferred from fruit to the product, while large quantities remain in pomace, the by-product consisting of pressed grape or apple leftovers. Thus, it would be of a great interest to efficiently exploit disposed pomace as a rich and inexpensive source of beneficial phytochemicals, which could be successfully used in food, cosmetic and pharmaceutical industries.

The main goal of this study is to define the most suitable process for the extraction of polyphenols from grape and apple pomaces. These processes consist into conventional processes using solvent extraction and green processes as ultrasound, microwave and pulsed electric fields. Many parameters will be studied for each process as solvent type, solvent concentration, ratio solid to liquid, temperature, extraction time and the matrix parameters. Chemical composition of the obtained extracts will be monitored by spectrophotometric and LC-UV/VIS. For biological properties, antioxidant activity (free radical scavenging), enzyme inhibitory (against cholinesterase, tyrosinase, amylase and glucosidase), antimicrobial and cytotoxic effects will be tested.

#### Outcomes (OCs) : What do we wish to achieve?

OC1:	Definition of the suitable process for the extraction of bioactive compounds
OC2:	Determination of the optimum parameters for each studied process
OC3 :	Valorization of the extracts through determination of their biological activities
OC4 :	Resolution of waste problem in food industries through valorization of the by-products

#### References (R) ( 5 most recent peer-reviewed publications in the field)

R1:	Pintać, D., Majkić, T., Torović, L., Orčić, D., Beara, I., Simin, N., ... & Lesjak, M. (2018). Solvent selection for efficient extraction of bioactive compounds from grape pomace. <i>Industrial Crops and Products</i> , 111, 379-390.
R2:	da Rocha, C. B., & Noreña, C. P. Z. (2020). Microwave-assisted extraction and ultrasound-assisted extraction of bioactive compounds from grape pomace. <i>International Journal of Food Engineering</i> , 16(1-2).
R3 :	Sette, P., Fernandez, A., Soria, J., Rodriguez, R., Salvatori, D., & Mazza, G. (2020). Integral valorization of fruit waste from wine and cider industries. <i>Journal of Cleaner Production</i> , 242, 118486.
R4 :	Malinowska, M., Śliwa, K., Sikora, E., Ogonowski, J., Oszmiański, J., & Kolniak-Ostek, J. (2018). Ultrasound-assisted and micelle-mediated extraction as a method to isolate valuable active compounds from apple pomace. <i>Journal of Food Processing and Preservation</i> , 42(10), e13720.
R5 :	Vodnar, D. C., Călinoiu, L. F., Dulf, F. V., Ștefănescu, B. E., Crișan, G., & Socaciu, C. (2017). Identification of the bioactive compounds and antioxidant, antimutagenic and antimicrobial activities of thermally processed agro-industrial waste. <i>Food chemistry</i> , 231, 131-140.