

GRAPE (*VITIS VINIFERA*) POMACE AS A VALUABLE WINERY BY-PRODUCT WITH NOVEL POTENTIAL BIOTECHNOLOGICAL APPLICATIONS

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Abstract. Wine industry, the second most productive alcoholic beverage after brewing industry, generates annually important quantities of valuable by-products. Industrials and researchers are focusing in exploitation these by-products by developing ones cost-effective and eco-friendly in different industrial fields such as: chemical industry, pharmacology, animal feed production, food industry.

Keywords: grape pomace, characterisation, recent applications

INTRODUCTION

Wine, the second worldwide consumed alcoholic beverage after beer, and especially red wine, received considerable attention in respect to its protective role on risk of coronary heart disease. Responsibility for this benefit is given to its high content in polyphenols, especially resveratrol.

Wine industry generates high amounts of by-products. Grape pomace, the main solid waste of wine industry (Beres et al., 2017), accounts 20-25% of the crushed grapes (Yu and Ahmedna, 2013). Winery waste should be recycled or subjected to various treatments before being returned to the environment. Costs that involve these procedures are very high (Devesa-Rey et al., 2011). Studies found that one tone of processed grapes generates 0.13 t of marc, 0.06 t lees, 0.03 t of bunches and 1.65 m³ of waste water (Oliveira and Duarte, 2016), so that there is the need for waste reducing policies and by-products industrial exploitation.

Functional properties of grape pomace

Increasing consumers' awareness regarding the using and consumption of natural and safer food additives, creates the need for producers to create natural based food additives. To be cost-effective they appeal to low-cost ingredients and this way is created the alternative of using food industry by-products. In addition, more attention is given for the valorising of the bioactive compounds from these by-products.

High amounts of polyphenols and dietary pectins are found especially in red grape pomace (Deng et al., 2011). Grape polyphenols are recommended in the literature for their antioxidant, cardioprotective, anticarcinogenic, anti-inflammatory, antiageing and antimicrobial activities (Xia et al., 2010; Vauzour et al., 2010; Giovanazzo and Grieco, 2015). Resveratrol was proved to improve some symptoms related to Alzheimer's disease (Pasinetti et al., 2015), important cancer protector (Singh et al., 2015) and having metabolic

effect (Gambini et al., 2015; Bitterman and Chung, 2015). Table 1 summarizes the chemical composition of grape pomace – white and red grapes - as reported in previous studies.

Table 1.

Chemical composition of grape pomace reported in the literature

Parameter	Value found	References
Moisture content, g/100g	3.33 – 3.87	Sousa et al., 2014, Ziarati et al., 2017
Total solids, g/100 g	19.3-40.6	Achkar et al., 2017
Carbohydrates, g/100 g	19.47-46.44	Rondeau et al., 2013, Sousa et al., 2014, Ziarati et al., 2017
Ash, g/100 g	4.56-4.78	Sousa et al., 2014, Ziarati et al., 2017
Protein, g/100 g	8.19-8.66	Sousa et al., 2014, Ziarati et al., 2017
Total lipids, g/100 g	8.15-8.6	Sousa et al., 2014, Ziarati et al., 2017
Pectin, g/100 g	3.92	Sousa et al., 2014
Fructose, g/100 g	8.91	Sousa et al., 2014
Glucose, g/100 g	7.95	Sousa et al., 2014
Total dietary fiber, g/100 g	46.17-51.44	Sousa et al., 2014, Ziarati et al., 2017

The polyphenols responsible of the antioxidant activity of grape seed and pomace are catechin, epicatechin and dimeric, trimeric and tetrameric procyanidins (Rockenbach et al., 2011). The highest amounts of polyphenols in grape pomace are anthocyanins, catechins, procyanidins, flavonol glycosides, phenolic acids and stilbenes (Yu and Ahmedna, 2013). Depending on grapes variety and extraction methods applied, grapes pomace polyphenols encountered different values as presented in Table 2.

Table 2.

Important classes of polyphenols found in grape pomace		
Phenolic compound	Amount	References
Epicatechin	53-355	Oliveira et al., 2013
Gallic acid	106-3969	Oliveira et al., 2013
Tannic acid	203-3849	Oliveira et al., 2013
p-OH-benzoic acid	116-5066	Oliveira et al., 2013
Vanillic acid	38.5-588	Oliveira et al., 2013
Protocatechuic acid	5371-9867	Oliveira et al., 2013

Biotechnologies applied for grape pomace based products

Grape pomace is a valuable source for bioactive compounds. Recent low-cost and eco-friendly techniques for its exploitation recommend grape pomace as a novel ingredient of many industrial fields. Some of the last decade developed products are summarized in Table 3.

Table 3.

Recent grape pomace application

Type of product	Industrial field	Reference
Food additives production	Chemical industry	Fontana et al., 2013
Dietary supplement	Pharmacology (cardiovascular diseases, antiageing activity)	Yu and Ahmedna, 2013
Feed supplement	Animal husbandry	Fontana et al., 2013; Fiesel et al., 2015
Antimicrobial agent	Food industry	Yu and Ahmedna, 2013
Food ingredient	Food industry	Fontana et al., 2013
Plant protector	Agriculture	Fontana et al., 2013

CONCLUSION

Grape pomace represent the winery's industry most important by-product. Its valorising becomes of interest in many industrial fields and medicine. Still, industrials are focusing to integrate the valorisation of grape pomace, with cost-effective, eco-friendly techniques, capable to deliver natural value-added products.

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