A SURVEY OF SUSTAINABLE WINE WASTE MANAGEMENT METHODS IN CONTEXT OF ENVIRONMENTAL POLICIES AND GRAPE MARC VALORIZATION

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Abstract
Nowadays the environmental policies are directed towards sustainable waste management methods and technologies in accordance of this trend is encouraging the waste capitalization and implementation of circular economic concepts. In Romania, the most important industry, is the wine sector, which produces a significant waste quantity. For this reason, was made a survey of the sustainable wine waste management methods that can be used in accordance of mark producer's valorization, the local possibilities (fertilizer, food, feed and Phyto-pharma industry) and in line with national environmental policies. This article also presents, the mark capitalizing technologies that can be implemented after the winemaking process by the Romanian producers and their techno-economic advantages.

Keywords: wine waste, sustainable management methods, environmental policies, grape mark valorization, circular economy.

Introduction

This real need of wine stakeholders wishes to align with the technological development and secondary products capitalization trends from the vilification technological process, respectively Marc. Thus, in one hand, the byproducts are re-incorporated into the economic circuit, in order to reduce waste quantities that have negative effect on the environment, and on the other hand, it is desirable to enter in the related fields to capitalize it, by obtaining: the vegetable oil sector, the Phyto-pharmaceutical and highly nutritious feed). Appling those concepts the wine industry can rich a close loop cycle with low environmental impact and also to support the circular economy in the European Union, these actors are encouraged to enter in this economic sector by the Romanian Environmental Ministry by applying package waste legislative proposals with long-term goals for reducing waste disposal and increasing recycling and re-use.

Commission communication to the European Parliament, the Council, the European Economic and Social Committee, but also to the Regional Committee, COM (2015) 614 final document published in Bruxelles in 2015, had the objective to close the loop and develop an action plan toward a UE Circular Economy. The visons presented in this document are: the value of products, materials and resources is kept in the economy for as long as possible and the generation of waste is minimized, it is an essential contribution to the EU's fora for the development of a sustainable, low-carbon, resource-efficient and competitive economy. Such

a transition is the opportunity to transform our economy and to have new and sustainable competitive advantages in Europe.

The wider benefits of the cyclical economy include the reduction of current carbon dioxide emissions. (Ellen MacArthur Foundation at all, 2015). Therefore the circular economy measures are therefore closely linked to key EU priorities, including employment and growth, the investment agenda, climate change and energy, the social agenda and industrial innovation, as well as with global efforts in the field of sustainable development.

Appling the circular economy concept in wine-viticulture field, it was concluded, after a detailed research of the technological stage in the field and the degree of implementation at the biggest wine producing companies and similar products this principal is perfect integrable and can create a valuable chain reaction, Figure 1.

Figure 1. Diagram of wine technological process and waste recycling [4]

Romania is one of the most important quality wine market in Europe, respectively 5th place after Spain, France, Italy and Portugal, registering a market fair of 350 up to 450 million Euro, although are a small number of wine exporters, around of 25 companies, according to APEV estimations from 2015. On international and European level, the wine by-products capitalization grows, due to their significant quantity, which is estimated to be 18-20 % of the processed grapes and the most important fraction of it is the mark.

At this moment Romania has not the technological means to entirely capitalize the wine by-products and to be in line with the development trends in European and international sector of activity. Due to this technological gape the wine by-products cannot be capitalized and obtain the valuable Phyto-pharmaceutical compounds. After a thrall technologies research and market analysis of mark capitalization possibilities, the INMA institute concluded that is opportune to develop innovative technologies to capitalize the wine by-products and to provide the scientific and technological expertise for the wine industry stakeholders.

1. Technologies and methods

To meet the technological needs of wine producers, that are willing to align with development and capitalization trends, namely to capitalize the secondary products resulting from the winemaking technological process and applying a circular economy system, INMA Bucharest has developed several technologies to capitalize the grape Marc by-products and to develop specific technical equipment's.

Taking into consideration the technological aspect of agro-ecosystem sustainability and ecological aspects of waste recycling the INMA presents an innovative technology to recover the vineyard by-products, in accordance of the newest trends in this field of activity, Figure 2.

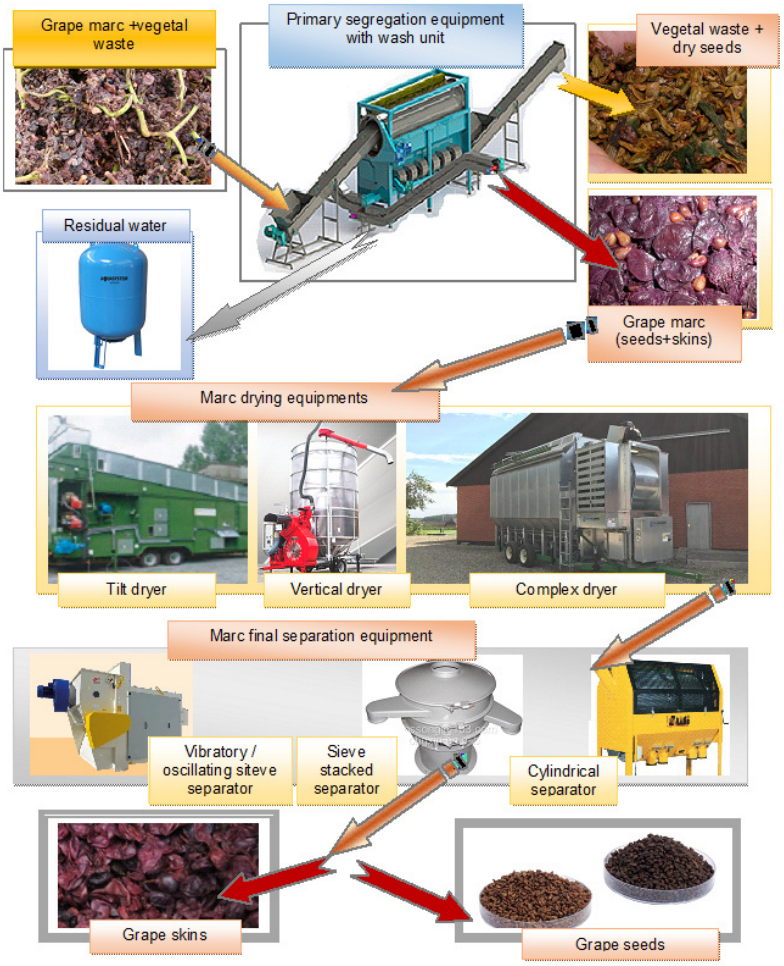

Figure 2. Innovative Technology to capitalise the washed suit marc [4]

This technology incorporates a marc complex processing process that can be easily adapted in accordance of the marc quality (marc type: suit or fermented marc). For this reason, the

technological flow incorporates a succession of machines and equipment's dedicated to separate, wash, dry and select the processed material.

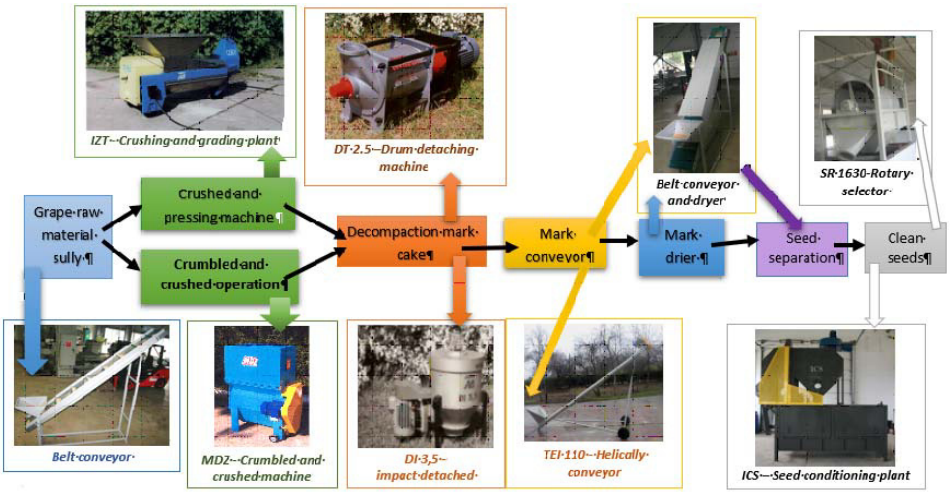

Figure 3. INMA grape marc capitalization technology [6]

In Figure 3, it can be seen that in the technological flow are presented two decompaction equipment's: the DI 3.5 - impact detacher (model with vertical detaching active element positioned parallel with the power source) and DT 2.5 - marc detacher (model with horizontal detaching element positioned in line with the power source). The transportation operation can be successfully used systems that cannot be gripped, allowing the grape pulp and juice to be entirely collected and transported without leakage, from this technology point of view, it can fit the belt conveyor (with or without scraper) and horizontal or oblique spiral conveyors.

The modern transportation systems are fitted with hot/cold air ventilation systems that can provide the proper operating mode, but also to dry the marc in accordance with a certain humidity regime and in this way, the technologic line gauge is diminished.

The grape seed separation can be made using two selector types: SR 1630 – rotary selector (a separation process that is often made using the centrifugal systems) and ICS – seed conditioning plant (equipped with low weight particle aspiration chamber and a segmented rotary drum with three dimensions sieves), every plant can be used in accordance of mass composition. The drum detacher and the construction of its active element, can be seen in Figure 4 and 5.

The DT 2.5 drum detachment equipment it has a simple construction and its main component has a cylindrical structure made from: a central shaft, on which is placed a four-branch rack that are mounted four impact bars with complex structure. The grape pomace detachment is practically made due to bars structure that presents twelve profiled fins which are designed to break and separate the grape seeds without deterioration, their placement is thus achieved to increase the technological effect, namely the decompaction effect, Figure 5. Due to the inclination of the beaters and under the pressure of the product entering the machine, the material is displaced (pushed) to the discharge mouth.

The DT case is provided with two viewing openings to set the equipment operation mode during the adjustment phase and to ensure maintenance in case of jamming.

Figure 4. DT 2.5 drum detacher equipment [6]

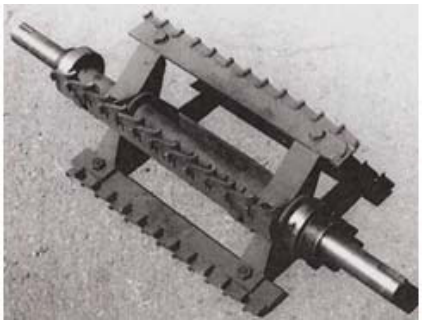

Figure 5. Drum detacher active component [6]

The DT 2.5 construction and functional characteristics: processing capacity 2.5 [t/h] (seeds and powder raw material); drum speed 960 [rot/min], drum diameter 260 [mm], electric power, engine 5.5 [kW] and 1000 [rot/min]; pins elastic power transmission; equipment gauge (lxLxH) 1268x365x505 [mm]. This equipment presents a plan sieve production rate, increases the quality of processed material, and decreases the losses and energy consumption by 7 %.

Usually, the wine technology yield is an important indicator that represents the ratio between the total grapes mass and must quantity, which usually is influenced by grape pomace mechanical properties, from this point on, the by-product capitalization technology must be deployed, in order to achieve a good separation and maximize profits. The values of this indicator it was evaluated at 50 % (wine presses) and 90 % (continuous presses), in some technical papers this indicator variants between 75 ÷ 80 % yield if it is considerate the type and position of the pressing actuation system, the lower value is for vertical hydraulic systems and the upper value for horizontal mechanical or pneumatic presses (Baltes, M. V., 2016).

Depending by the wine technology and the by-product type, respectively sweet (fresh and unfermented) or fermented (resulting in fermentation of the bush). In the case of sweet marc, the diffusion juice must be immediately processed. For obtaining quality grape seed oil and the following procedure is recommended to fulfill: I- seed drying to a maximum temperature of 110 [^{0}C]; II – to reach the conservation humidity of 10 ÷ 12 %; III - assuring sterile conservations conditions to inhibit the growth of lactic bacteria and molds.

Here in presenting technologies are done in a logical order to ensure the development of a technological grape seed separation from peels, in accordance with specific processes of secondary material, in order to obtain the finished products, grape seeds, peels and cod, which can be later capitalized in order to obtain new products.

2. Results and discussions

Taking into account that the Romania winners produce large quantities of grapes from which are processed: approximately 1 million tons of wines; 120,000 tons of march without bunch and 400,000 hectoliters of yeast (Milea D. In all, 2018), its opportunities to develop the above presented technologies, because from 1 [tone] of grapes it is made 1.2 [kg] of tartaric acid,

180 [kg] of Marc and 4.5 [kg] of yeast, and by processing the mass and yeast is resulted 8.8 [l] alcohol, approximately 22 [l] of yeast brandy of 40 % vol. (Pomohaci Nicolai, 2002).

And if we take into consideration the Phyto-pharmaceutic potential of those byproducts, especially for antioxidant concentration of grape skins and shells, known in scientific literature as free radical – Figure 6, Romania can enter on the European market with valuable products on that sector and to gain income from this activity. (Duda-Chodak, A., Tarko T., 2007).

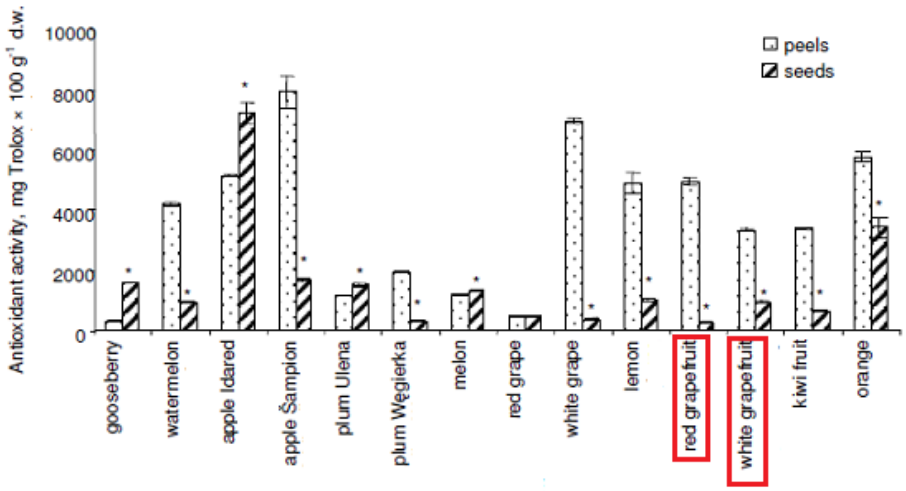

Figure 6. Antioxidants concentration from fruit seed and skins, ABTS tested [3]

As it can be observed the antioxidant concentration in grape skin – peels is greater than their seeds, and compared to other fruits, it takes the 3th place, which means that the grapes represent a valuable source to extract those substances. If we take also in consideration the fact that the oil extracted from grape marc presents a low ratio in fatty acids am high concentration in Omega 6 – Fig.7 (Sabini M., Justin Yu, & Lee J., 2014), it can be stated that the grape marc represents a valuable substance in human nutrition.

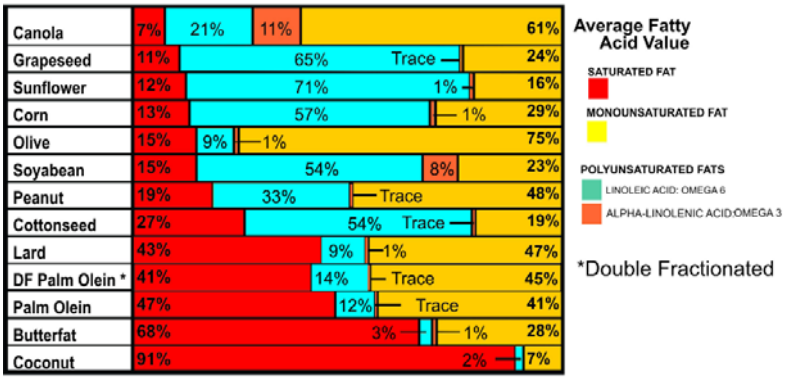

Figure 7. Comparison of average fatty acid values of dietary fats [5]

Conclusion

In this paperwork are presented two sustainable wine waste management technologies, that incorporates different types of equipment's and machines dedicated, and methods adequate to be used in context of environmental policies and grape marc valorization strategy

At the end are mentioned some of the valuable products that can be obtained from grape marc not only in food industry but also in cosmetics, phyto-pharmaceutic sector and in the animal feeding or bio-fertilizers (if it used the proper technology). In Fig.8 is made a diagram of the products that can be found in the marketplace commercialized by the most important players

Figure 8. Products obtained by capitalizing the marc by-product [4]

Those examples are presented to see the potential of these byproducts and to make an example of their activity and the way that they implement a sustainable agro-ecosystem.

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