

## TECHNOLOGICAL AND ECOLOGICAL ASPECTS OF SOME WINE WASTE RECYCLING AND THEIR CAPITALIZATION IN FOOD INDUSTRY

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### ABSTRACT

*The wine waste management aspect is very important for small and industrial wine producers from technologic, ecologic and legal aspect. The most important reason for the wine producers on the market is the legal one because, it has multiple implications at national level (economic, technological, ecological and food) if it has branch in Romania and also international, if the producer wishes to play on European and international market. Analyzing the actual*

*legislation, in this paper will be presented an innovative technology to capitalize some wine wastes, namely the marc byproduct, to be used in the food industry as raw material for high value phytopharmaceutical compounds. In this way is presented an alternative to recycle the wine technologic waste, to reduce the business ecological impact on the environment and to apply circular economic marketing strategies.*

### INTRODUCTION

This article is published due to a real needs of wine producers who wish to align with the development and capitalization trends of the secondary products resulting from the vinification technology, respectively marc, and by by-products re-incorporation into the economic circuit, it is intended, on the one hand, to reduce the waste quantities with negative effect on the environment, and on the other hand, it is desirable to penetrate the connected sectors related to the valorization of the by-products (the vegetable oil industry, the Phytopharmaceutical sector and the use of these by-products in highly nutritious feed). Applying those concepts the wine industry can rich a close loop cycle with low environmental impact.

This subject has a benefic impact also in Oenology field. In accordance of scientific literature there are two branches of this field the General Oenology – branch that studies: the raw material study - the physical-chemical and biochemical processes occurring during

the grapes processing; that grape collection as raw material; the fermentation of the must; the ripening and the aging of the wine; the wine-making technologies, and ending with the delivery of the finished product. The other branch that is Special Oenology - field that include preparing various types of wines and special drinks technologies (sparkling wines, spirits, etc.) and also with wine secondary products capitalization (wine waste such as: yeast, marc, seeds, tartrate, etc.). [3]

In circular economy this principal is perfect integrable and can create a valuable chain reaction, Figure 1.

In Romania from approximatively 1 million tones from grapes processed to obtain wine, are obtained 120,000 tons of marc without bunch and 400,000 hectoliters of yeast. Usually 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 marc and yeast is resulted 8.8 [l] alcohol,

approximative 22 liters of yeast brandy of 40 % vol. (Pomohaci Nicolai, 2002).



Figure 1. Diagram of wine technological process and waste recycling

Depending by the wine technology the marc can be 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:

- the seed drying to a maximum temperature of 110 [°C];
- Conservation humidity of 10 ÷ 12 %;
- assuring sterile conservations conditions to inhibit the growth of lactic bacteria and molds.

In scientific literature was proven that the antioxidant concentration of grape skins and shells, namely the free radical, can be easily established using ABTS tests, Figure 3. (Duda-Chodak, A., Tarko T., 2007).

As it can be observed the antioxidant concentration in grape skin – pells, greater then in to their seeds and comparing to other fruits is placed in the place, that 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, a valuable substance in human nutrition and not only.

From this reason are made valuable products not only in food industry but also in cosmetics, phyto-pharmaceutic sector and in the animal feeding or biofertilisers (if it used the proper technology) in Figure 4 is made a diagram of the most important products that can be found on the market place by the some most important plaiers in the market. Those exemples are are presented to see the

potential of these byproducts and how to implement an sustainable

agroecosystem.

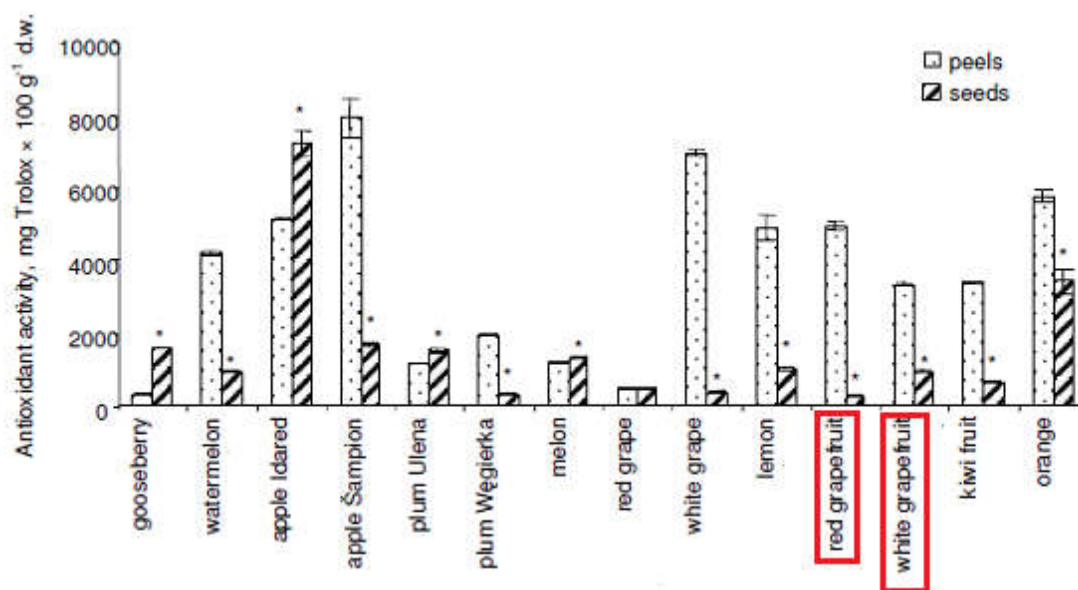


Figure. 2 Antioxidants concentration from fruit seed and skins, free radical ABTS tested (Duda-Chodak, A., Tarko T., 2007)

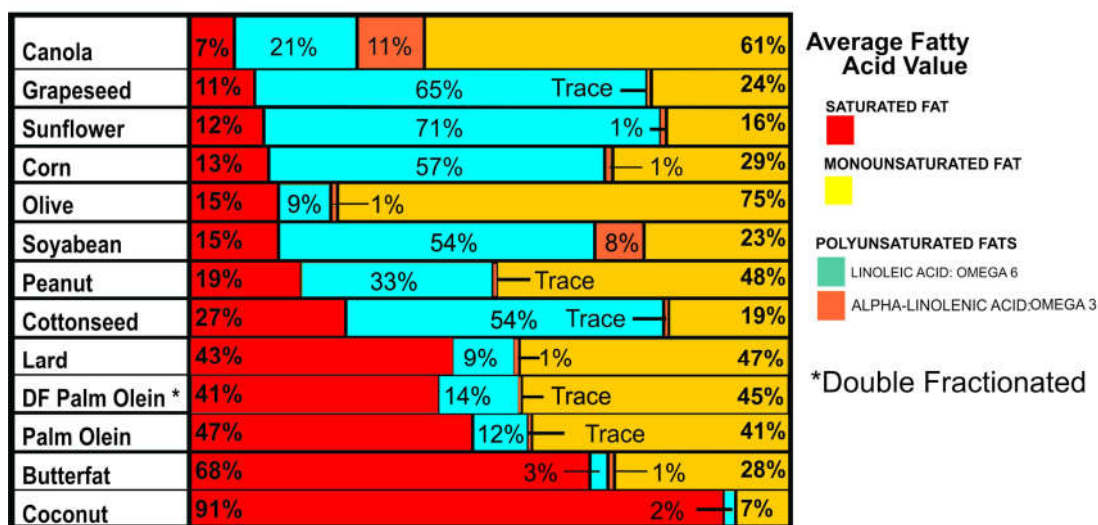


Figure. 3 Comparison of average fatty acid values of dietary fats (Sabini M., Justin Yu, & Lee J., 2014)

## MATERIAL AND METHOD

Taking in to consideration the technological aspect of agroecosystem sustainability and ecological aspects of waste recycling the INMA presents an innovative technology to recover the vineyard by-products, in accordance of newest trends in this field of activity, Figure 5.

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

Here in presented technology is made in a logical order to ensure the development of a technological grape seed separation from skins, in accordance with specific processes of

secondary material, in order to obtain the finished products grape seeds, skins and cod, which can be later capitalized in order to obtain new products.



Figure 4. Products obtained by capitalizing the marc by-product

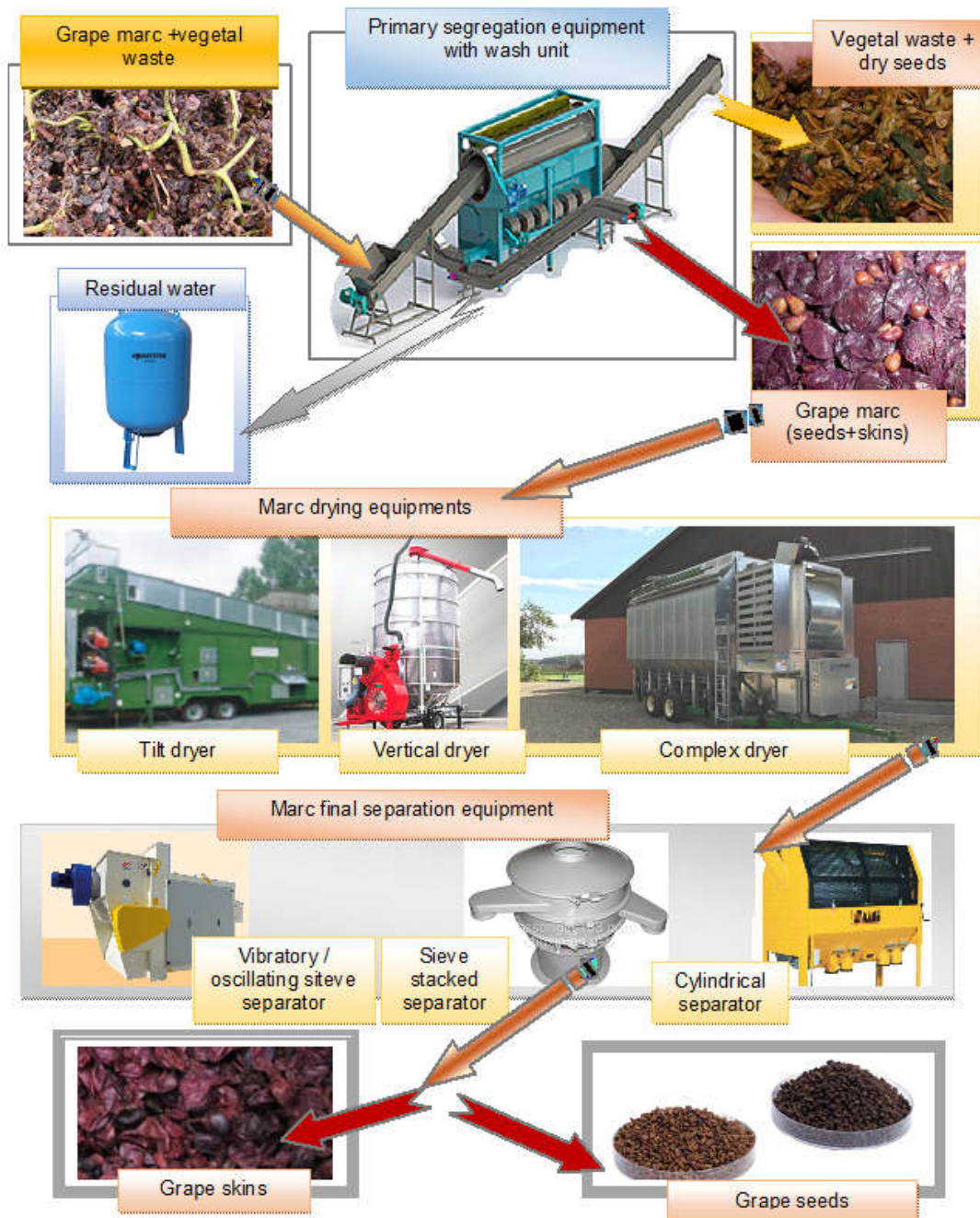


Figure. 5 Tehnologie inovativă de valorificare a tescovinei spălate ( INMA Study, 2018)

## RESULTS AND DISCUSSIONS

In this innovative technology was designed in order to achieve the separation of valuable components from the winemaking blend (seeds, skins, trunks) into a continuous stream and with a higher capacity adapted to the requirements of the beneficiaries.

The application of new technologies will facilitate the extraction with maximum efficiency of the marc fraction containing specific active principles, which will allow them to be used in the production of new food and pharmaceutical formulations

The proposed technical equipment that was developed will present the following features:

- fractions separation by combining the separation principle on a flat site with oscillatory motion (separation by thickness) and separation into air streams (after float velocity);

- will be obtained suitable materials conforming to the quality standards and will incorporate new technical solutions which will ensure the separation process is enhanced and the content of the secondary components is reduced to useful fractions (skins and pips);

- shall be provided with air flow control systems designed to provide as smooth a speed as possible;

- the equipment will perform an advanced decompaction of the pressed marc and will be equipped with a cleaning system for active elements in the separation process;

- will be provided with an electrical control and control system which will ensure the change of the kinematic working regime according to the characteristics of the raw material;

- will provide a high degree of separation of the useful fraction and at the same time will achieve a reduced percentage of injured secondary components in the working process.

Grape seed separation technical equipment, named ESSS, it is designed so that to separating grape seeds using oscillating screens and an air cleaning system to ensure high grain seed purity, Figure 6. The hopper must be fill with marc mixture from the dry pomace supply system 1, provided with a marc finger shaft de-compaction unit (skins and grape seeds). After that the material falls on an inclined plane system to be aerated and to aspire to light impurities (very small dust and shells).

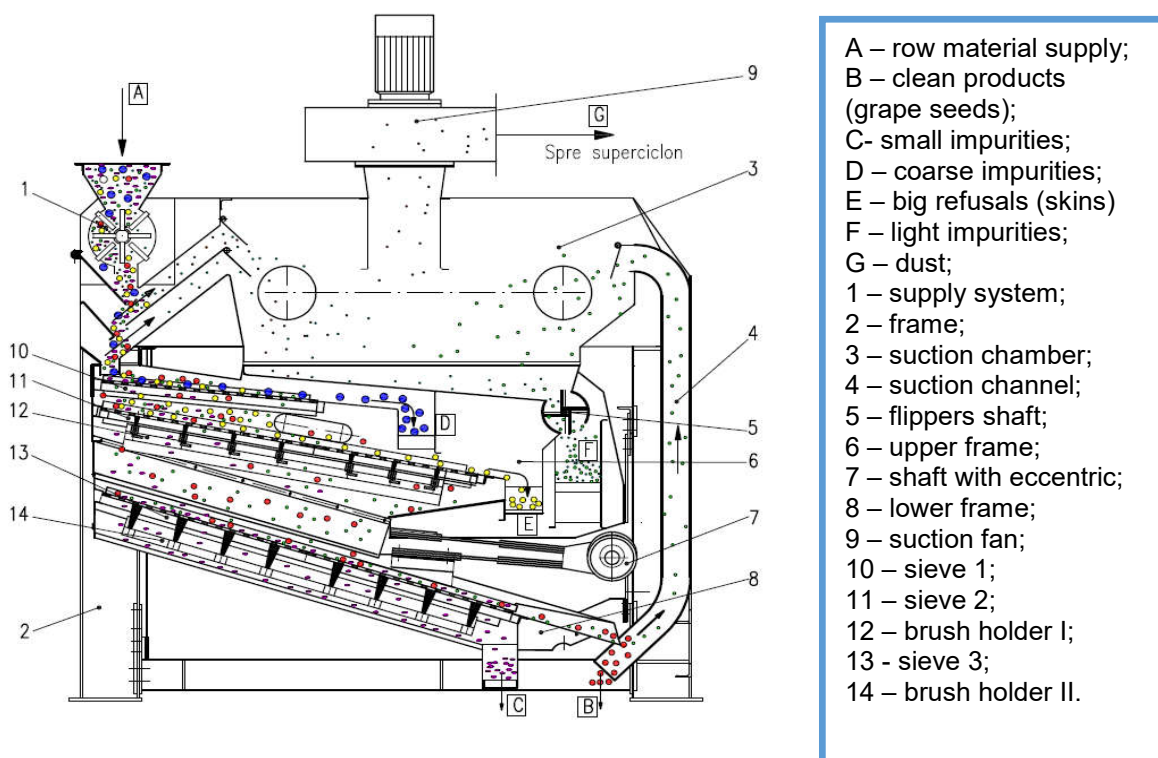


Figure 6. Technical equipment scheme for separating grape seed from marc

Subsequently, the raw material is separated by means of vibrating screens 10, 11 and 13. At the first pass, a coarse

separation takes place because the vegetal debris (clumps, bunches, etc.) with large dimensions that are collected in

a trough and evacuated laterally outside the equipment. On the second stage of separation there is the mixture of skins and seeds, and large refuses are then collected and transported by means of another trough to the evacuation mouth *E*. Sieve 13 eliminates impurities that are smaller than healthy grape seeds and then directed to the outlet mouth *C*. Healthy seeds are then collected in the trough *B*, and the particles which are glued therefrom are aspirated by the air flow through the suction duct 4 into the collection chamber 3. Batch 6 directs light impurities to the blade shaft 5. The evacuation of the air used in the separation process is driven by the suction fan 9 which can be connected to

a super cyclone in order to collect the finest particles from the process of separating grape seed from the marc. Screens are fitted with cleaning brushes 12, which will be mounted on mobile trolleys on which is printed a translation movement. All systems will be positioned and sustained by frame 2 and which will be covered to ensure tightness and efficiency of the technological process.

Estimated technical and functional characteristics:

- processing capacity, up to 600 [kg/h];
- active power 7,5[kW];
- active sieve width 600 [mm];
- equipment gauge: length 2750 [mm], width 1400 [mm] and height 2700 [mm].

## CONCLUSIONS

Agroecosystem sustainability can be evaluated in accordance with socio-economic effects and the environmental benefits.

The economic impact of this innovative technology is estimated to:

- maintaining and increasing the employment in wine industry, fact that is leading to of human resources sustainability and regional development;
- reducing the waste management costs from winemaking and viticulture;
- the superior valorization of the by-products from the wine industry;
- introduces high-quality raw material (grape seed, skins) into the market for high-nutrition food producers for the pharmaceutical, cosmetic and phytopharmaceutical industry;
- increasing labor productivity by approx. 15% compared to current technologies – manual marc valorization;
- ensuring the necessary equipment endowment to recover the wine by-products;
- encouraging to increase in the number of economic agents and people benefiting from results of this highly innovative project;
- increasing Romania's capacity to produce safe and performing products

with a high level of quality, in accordance with national and international regulations (in particular the European Union)

The social impact is highly connected to the economic and cultural:

- ensuring working conditions at European wine-growing standards;
- securing jobs at medium term, improving the quality of life and rural development in Romania;
- encouraging people and local authorities to protect the environment and recover secondary by-products from local winemaking process by awareness and capitalization campaigns;
- the use of bioactive compounds from the by-products of the winemaking sector and the achievement of a beneficial contribution of products with high nutritional value.

Environmental impact of this innovative technology and its equipment's does not pose risks from the point of view of environmental pollution, the quality of the processed material, respectively, marc and vegetal remains and the quality of the environment, leading to:

- decreasing the amount of wine-vineyard waste;
- increasing the collection and capitalization level of the by-products;

- increasing the potential for organic products if the by-products are

administered as natural fertilizers.

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