USE OF DETACHING EQUIPMENT IN GRAPE POMACE PROCESSING TECHNOLOGY

STROESCU GH., PĂUN A., VLĂDUŢ V., DUMITRU M., VISAN AL., VOICEA I., DUMITRU I., IUGA D.
INMA Bucharest / Romania
E-mail: gigistroescu62@gmail.com

Keywords: detacher, grape pomace, marc, grape seeds, grape processing technology

ABSTRACT

The equipment is intended to operate within the fruit processing technological flows, respectively to detach- disintegrate the grape pomace which are formed during the fruit pressing using milling drums. These pomaces, usually are made up of fruit solid agglomerations, that have a greater seed concentration and humidity, especially when the rotary rollers are working with a certain distance between, in order to not crush the grape seeds. Based on these considerations, in the paper it is analyzed and presented the case in which the detacher can successfully be used in grape seeds separating technology from the pomace and its performances to separate the sub-products resulting from the grapes pressing operation.

INTRODUCTION

Usually the impact detachers and the drum detachers are integrated in milling plants technological flows to detach (separate) solid agglomerations, respectively pomace, that are obtained during the seeds grinding process (Râpeanu, R. and Măruță, N., 1965)

Typically, there are placed on the rolled product exit, before entering the sifting sieve. These pomaces are generated due to high pressure and temperatures when are passing through seeds crushing rollers. Starting from this application, an equipment has been studied and developed to process the grape pomace using a detacher that can be implemented in the technological flow, due to the fact that the cinematic regime can be adapted to its functional role in the technology and to the marc physical-chemical properties.

The marc is the result of grapes processing the to obtain white and rosé wines and non-alcoholic products, and in other cases to pressed fermented marc to obtain red wines.

Typically, in it are present all the grapes vegetable parts used in must or wine production, resulted from the pressing process, such as: bunch, skin (peel) and pips, depending on the grape variety.

The marc is made up of solid parts and a small amount of must. In scientific literature, the marc is composed from: 63 % of skin; 33% of pips and 4% of pulp. (Duca, Gh., 2007, Balteș, M.V., 2016).

The sub-product capitalization technologies are developed to obtained valuable pomace byproducts, to reach the next objectives:

- to better capitalize on the winemaking process by-products;
- to obtain high-quality raw material (as: grape seed and skins) to place on different market sectors as: food, cosmetic and Phyto-pharma industry, sectors for which it represents a source of high nutritional substances extraction;

- to use of these by-products in highly nutritious feeding formulations.

MATERIAL AND METHOD

To meet the real needs of wine producers who intend to align to new development and capitalization trends, namely to capitalize the secondary products resulting from the winemaking technologic process.

Usually, the wine technologic yield is an important indicator showing that, the ratio between the total grape mass and must quantity influence the grape pomace mechanical properties and the sub-product technology to be deployed, in order to reduce losses and maximize profits. The values of this parameter can be 50 [%] for wine presses and 90 % for continuous presses, some variations of it, can be found also, if it is considerate the type of the pressing actuation system and is position can rich 75 ÷ 80 % yield (for vertical hydraulic, horizontal mechanical or pneumatic presses) (Baltes, M. V., 2016). For this reason, INMA Bucharest has developed several technologies to capitalize the grape marc sub-products and to develop specific technical equipment's, Figure1.

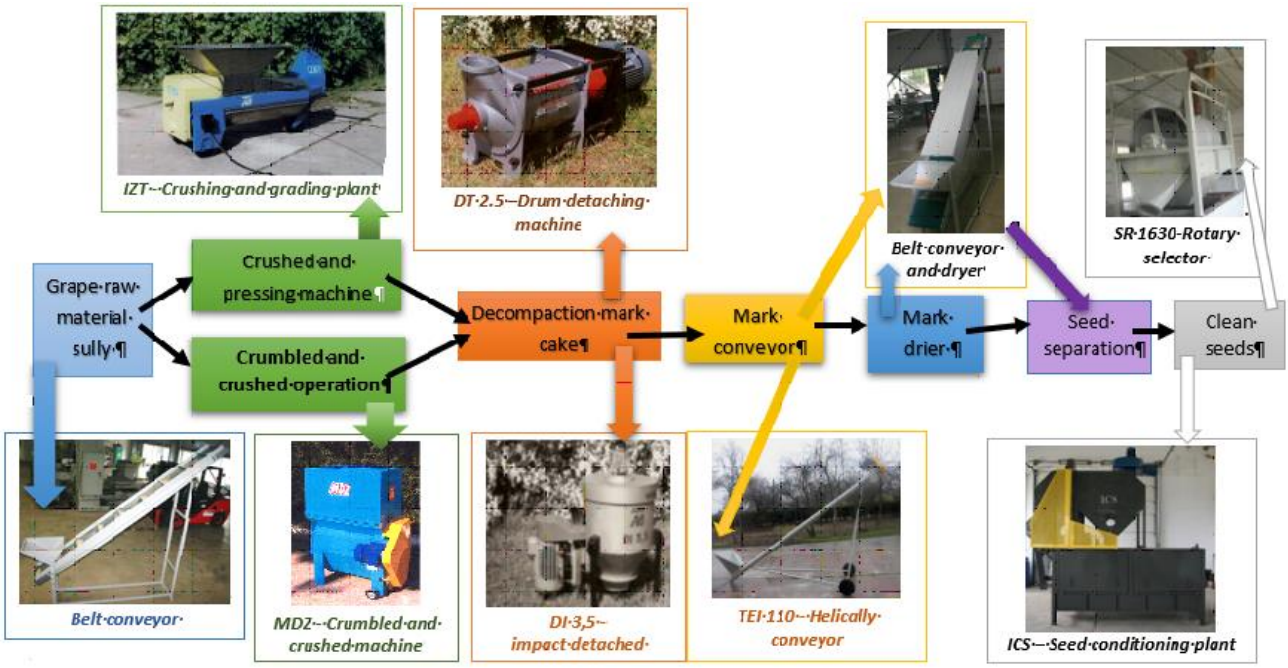

Figure 1. INMA Grape marc capitalization technology

In the technology presented above, 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 - mark detacher (model with horizontal detaching element positioned in line with the power source). From the transportation operation can be used successfully systems that cannot be gripped, allowing of the grape pulp and juice to be entirely collected and transported without leakage, from this technologic point of view it can fit the belt conveyor (with or without scraper) and horizontal or oblique spiral conveyors.

On the modern transportation systems is fitted with hot/cold air ventilation systems that can provide the proper operating mode to also dry the marc in accordance with its humidity and in this way the gauge technologic line is diminished.

The grape seed selection can be made using two selector types: SR 1630-rotary selector (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 mark composition.

Further, in the paper will present the drum detacher and the construction of its active element, see Figure 2 and 3.

Figure 2. DT 2.5 drum detacher equipment

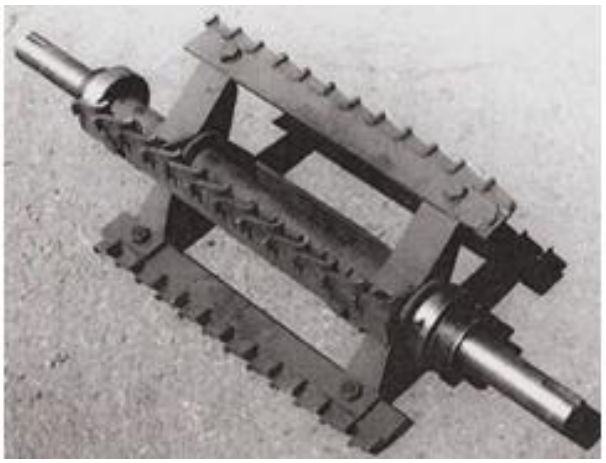

Fig. 3. Drum detacher active component

The DT 2.5 drum detachment equipment it has a simple construction and its main component is a cylindrical structure construction 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 3.

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 the during adjustments phase and to ensure maintenance in case of jamming.

The construction and functional characteristics:

- processing capacity 2,5 [t/h] (seeds and powder raw material);
- drum speed960 [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, lowers the losses and energy consumption by 7 %.

RESULTS AND DISCUSSIONS

In order to make an analytical comparison between the test made on DT drum detacher in the milling and processing of the pomace, experiments were carried out, with the DT 2.5 detacher mounted in a wheat mill between the wheat roll and the flat sieve of sifting and its operation with the pomace obtained by processing with two different pressing equipment's.

Table 1 presents the characteristics of the processed raw material (different marc varieties) at the machine inlet.

Technological efficiency is presented in Table 2, where are presented the results obtained from experimental

activity when it is introduced into the marc processing technological flow.

Table 1

Determinations of wheat seeds characteristics

No.	Parameter name	Parameter value		
		Sample 1	Sample 2	Sample 3
1	Humidity [%]	14.1	12.8	12.1
2	Hectoliter mass [kg/hl]	75.1	75.3	75.6
3	Glassines [%]	32	41	45

Table 2

Technological efficiency

No.	Parameter	Parameter value		
		Sample 1	Sample 2	Sample 3
1	VI sieve refusal [%]	Lowers with 9	Lowers with 3	Lowers with 3.6
2	VIII sieve refusal [%]	Increases with 9-13	Increases with 5-7	Increases with 5-7

Table 3

Determinations of grape marc composition

No.	Characteristic	Parameter value		
		Sample 1	Sample 2	Sample 3
1	Degree of marc pomace compaction [%]	22	25	23
2	Skin (peel) [%]	61	63	60
3	Pips [%]	34	32	34
4	Pulp [%]	4	3	5
5	Must [%]	1	2	1

Table 3 presents the characteristics of the raw material processed at the entrance to the machine. The marc was obtained from red grapes by means of a mechanical press machine (MDZ) with a yield of 20 - 25 % marc.

Technological efficiency gained from experiments by introducing into the technological flow of the detacher is presented in Table 4.

Also, in this paper is presented the 3D model of the detacher active element, Figure 4 and an FEM analysis, in static regime where are applied the grape pomace forces, the 3D model simulation and results are presented din Figure 5.

Table 4

Determinations of Grape marc characteristics

No.	Parameter name	Parameter value		
		Sample 1	Sample 2	Sample 3
1	Drum speed [rpm]	450	450	450
	Decompaction Degree [%]	90	91	90
2	Drum speed [rpm]	960	960	960
	Decompaction Degree [%]	100	99	100

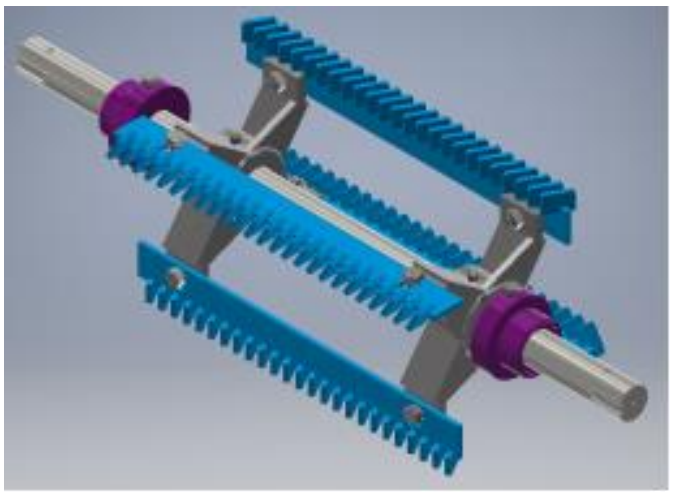

Fig. 4. Active element 3D model that is placed on detacher

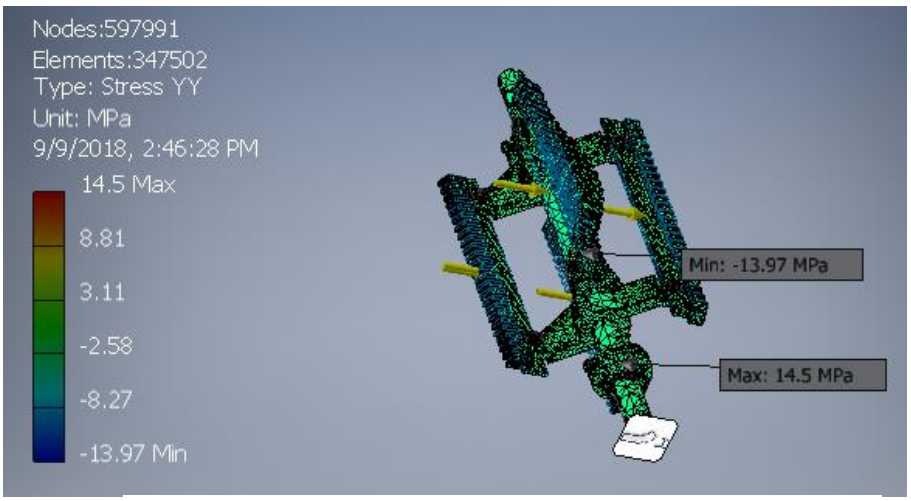

Fig. 5. FEM analysis of active element- in static regime

From Figure 5, it can be observed that 3D model (designed in SolidWorks) it was discretized with volume elements with variable dimension in order to be suited to all components par from this assembly, especially the detacher flippers that are speeding the grape marc and disintegrate the pomace in order to obtain a more homogenous material which will be supply to the marc drier or marc separation unit. The stress was applied on the outer surface of the flipper on direction YY and its value was chosen in accordance with the experimental value gadder from the tests. The simulation results are presented in the color cod: the minimum value (13.97 MPa) is presented in blue and usually is obtain on flipper impact surface; the maximum stress (14.5 MPa) is estimated to the bearing and on the assembly, structure are not critical areas (red zones), fact that leads to the conclusion that the detacher active element is properly designed and assures the theoretical safety level.

From mechanical point of view, this model must be tested also in laborator on an test bench in order to validate the measurements, because thoause results are obtained based on a mathematical model applied on a specific structure. Ussualy thouse simulations can not include all the technological fenomenon that occure in the detcher chamber whwn marc hase the most desavantageous structure (the gratest compactation level / or the lowesr moisture/ the greatest grape seed concentration).

CONCLUSIONS

Analyzing the obtained results we find the following conclusions:

- The introduction into the technological flow of a wheat mill of the DT 2,5 drum detacher leads to increased technological efficiency because it ensures the disaggregation of the grist cakes before entering the flat sieve;
- Technological efficiency is influenced by the quality of the raw material: the moisture content of the seeds subject to grinding and their glassiness.
- The use of the drum detacher in the flow of technology in Figure 1 ensures 100% decompaction of the pomace cakes;
- Technological efficiency in the case of pomace cakes is influenced by the type of press used and the yield of the marc may be determined; This yield is important due to the increasing interest in the re-use of this wine by-product.
- The machine used to obtain the pomace falls into continuous horizontal mechanical presses.
- It is found that in the case of the pomace, good results can also be obtained for much smaller revolutions (speed) of the detacher drum.

ACKNOWLEDGEMENT

This paper was financed with the support of National Agency for Scientific Research and Innovation, NUCLEU Programme, no. 18N / 16.03.2018, Addendum no. 1/2018, project PN 18/30/02/01 – “Cercetări privind dezvoltarea unei tehnologii inovative de recuperarea produselor secundare din viticultură”.

BIBLIOGRAPHY

1. **Balteș, M.V.**, 2016 - *Valorificarea subproduselor vinicole cu obținere de produși valoroși pentru industrie și alimentație*, Teza doctorat;
2. **Duca, Gh.**, 2007 - *Prelucrarea și utilizarea deșeurilor din industria vinicolă, precum și obtinerea produselor noi*, Chișinău;
3. **Râpeanu, R., Măruță, N.**, 1965, - *Mașini și instalații în industria morărăritului*, Editura Tehnică, Bucharest; Romania,
4. DT 2.5 drum detacher equipment – Product shet INMA Bucarest;
5. http://www.inma-ita.ro/tabel_proiecte.htm