

## WINE SENSORY CHANGES CAUSED BY FILTERING SYSTEMS

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### Abstract

*In modern oenology it is necessary separate the lees rapidly from the wine in order to obtain better yield and delicacy. The solid fraction is responsible for the development of smells and constitutes the anchorage point for oxidizing enzymes and bacteria. The techniques used for the removing lees with a tendency to clog the filtering equipment can be more than one: decanters, press-filters, vacuum filters, tubular filters and now the new cross-flow filter with dynamic membrane from TMCI Padovan Spa called Dynamos.*

**Key words:** filtering, wine, Merlot, Community, European Union.

### INTRODUCTION

In modern oenology it is necessary separate the lees rapidly from the wine in order to obtain better yield and delicacy. The solid fraction is responsible for the development of smells and constitutes the anchorage point for oxidizing enzymes and bacteria. The techniques used for the removing lees with a tendency to clog the filtering equipment can be more than one: decanters, press-filters, vacuum filters, tubular filters and now the new cross-flow filter with dynamic membrane from TMCI Padovan Spa called Dynamos.

All these systems eliminate the solid fraction but, except for Dynamos, they present limits connected to either the quality of the final product or energy consumption, higher management costs, or the disposal of inert materials.

Recently the oenological sector has begun to recognise the need to stop using filtering adjuvants (perlite and fossil meal) for reasons of environmental and working safety. The classical conception cross-flow filtration usually means static membrane filtration performed with the liquid to be filtered flowing tangentially to the filtering surface. Dynamos, though a cross-flow filtration system, reverses the concept; that is the membrane becomes dynamic and flows tangentially to the liquid being filtered. With this internal research, TMCI Padovan wanted to study the best solution to offer the market of oenological mechanics while meeting the current demands for management economy, respect of the organoleptic characteristics of the product, and being environment-friendly.

## MATERIALS AND METHODS

Tests were performed on the clarification lees for static settling from Prosecco wine (type of white wine) and Merlot wine (type of red wine) whose original characteristics are indicated in tables 4 and 5 respectively, in the “as sampled” (As) column.

The clarification lees or sedimentation lees of Prosecco wine contained, in addition to the contents of the wine itself precipitated using the treatment, clarifying agents such as bentonite, gelatine and coal, whereas the clarification lees of Merlot wine included, in addition to the wine sediments, only gelatine as a clarifying agent.

For each type of clarification lees we performed filtration tests using the following filters produced by Padovan:

- Dynamic membrane cross-flow filter Dynamos
- Vacuum filter Taylo
- Tubular cross-flow filter

The tests were performed with a product starting temperature of 10 °C. The cross-flow filter Dynamos has microporous ceramic materials with micro-pores measuring 0.1 micron.

The Taylo filter was tested using perlite of Winkelman RandaliteW19 (permeability Darcies 1.6). The tubular filter has ultrafiltration membranes. The characteristics of the different filters used for the comparison tests are indicated in table 1.

**Tab. 1 Technical data of the filters**

	Vacuum filter Taylo 6 Lux	Filter Dynamos D20	Tubular Filter TA50
Filtering surface m <sup>2</sup>	6	19.6	50
Power installed kW	7.9	17	25
Vacuum weight Kg	1050	1750	1920
Dimensions A/B/C m	4.8/2/1.9	3/1.05/1.65	5/1.5/1.9

All the experimental theses tested the main macrocomposite parameters of the wines, the oxygen increase, the polyphenol and sensorial profile, and management costs.

The sensorial test was carried out by a panel trained in tasting of the wines being tested, the evaluation cards used are the OIV ones supported by

the trialcards, the data was processed by considering the median of the outcomes and eliminating the parameterization errors of the various tasters.

The management costs were assessed considering the standard amortization period of 5 years. Even the chemical parameters most significant in relation to the quality of the Merlot wine, such as the net extract, pH, total acidity, total polyphenols, anthocyanins, catechins, free sulphur dioxide, glycerine, oxygen show the better values when compared to those of the product obtained using other filters. This confirms the higher quality of the product and therefore also a greater versatility of use. The technical results concerning the practicality of using the filter show that for the same filtrate volume (tab. 3), even though the Dynamos cycle is longer, the process is continuous and does not need the continuous presence of an operator, it consumes much less energy, and does not consume frigories as the temperature of the product does not increase more than an insignificant amount.

**Tab. 3 Test results on clarification lees of Merlot wine**

	<b>Vacuum filter Taylo 6 Lux</b>	<b>Filter D20</b>	<b>Dynamos</b>	<b>Tubular Filter TA50</b>
Flow rate per hour l/h	650		480	712
Filtration cycle h	7 h 40 min		20	6h 10 min
Cycle repetition	2		0	1
Total filtration h	15 h 23 min		20 h 50 min	14 h
Treated volume hl	100		100	100
Filtration test energy consumption kW	110		95	260
Frigories consumption /h	0		0	20000

**Tab. 4 Surface hypothesis for various filter types for 1000 l/h filtration with clarification lees at 30% v/v s.s.**

<b>Parameters</b>	<b>U.M.</b>	<b>Dynamos</b>	<b>Vacuum filter Taylo</b>	<b>Cross-flow Tubular Filter</b>
Flow rate with lees 30% v/v s.s.	l/mq/h	40-60	80-100	15
Perlite/meal consumption	Kg/100 l	0	1.2	0
Waste material production	Kg/100 l	0	3.6	0
Energy consumption	kW/mq	0.4	1	0.9
Washing/cleaning consumption				
alkaline	Kg/mq	0.25	0.05	0.05
acid	Kg/mq	0.01	0.01	0.03
oxidizer	l/mq	0.05	0	0.1
water	l/mq	25	200	50

Required surface with flow rate of 1000 l/h with clarification lees at 30% v/v s.s.	mq	40	10	70
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**Tab. 5 Comparison general costs of the three types of filters for equal volumes of product (100 hl)**

Costs	U.M.	Dynamos 20 mq	Vacuum Filter Taylo 6 mq	Cross-flow Tubular Filter TA 50 mq
Amortization 5 years/10000 h	€/h	6	2.40	7.14
Membranes	€/h	0	0	7.86
Perlite/meal	€/h	0	3	0
Panel disposal	€/h	0	9	0
Detergents + water	€/h	0.50	0.42	1.07
Labour force	€/h	0.50	3.30	1.07
Electric power	€/h	0.50	1.80	3.21
<b>Total</b>	€/h	<b>7.50</b>	<b>19.92</b>	<b>20.35</b>

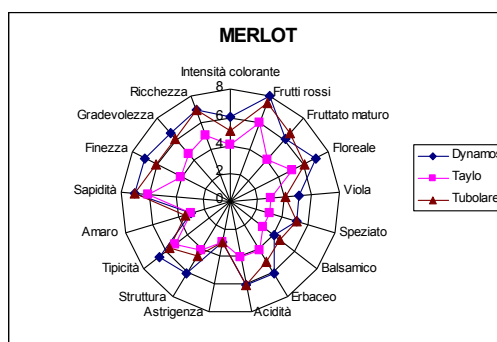
Considering costs and consumption (tab.5) energy consumption is considerably limited, there is no consumption of perlite and/or fossil meal and therefore there is no waste material such as filtration adjuvants, consumption related to washing and cleaning is also lower because the use of water is limited, and use of other detergents is partially limited. This entails a considerable decrease in costs (tab.5) related to the management and amortization of the filter-machine for equal volumes of treated product.

Both the chemical results and the organoleptic results from this experimentation, as well as the economic and environmental safety data obtained, show the considerable improvement this filtering system brings to both white and red wines.

## RESULTS AND DISCUCTIONS

The results of the sensorial analysis (fig. 1) of the Merlot wine coming from filtration show that the product obtained using Dynamos possesses more marked typical indicators such as red fruits, floral fragrance, violet, structure, typicality, pleasantness, delicacy, colour intensity.

**Fig. 1 Sensorial analysis Merlot wine**



ITALIAN	ENGLISH
Intensità colore	Colour intensity
Frutti rossi	Red fruits
Fruttato maturo	Ripe fruit
Floreale	Floral fragrance
Viola	Violet
Speziato	Spicy
Balsamico	Balsamic
Erbaceo	Herbaceous/herby
Acidità	Acidity
Astringenza	Astringency
Struttura	Structure
Tipicità	Typicality
Amaro	Bitter
Sapidità	Flavour
Finezza	Refinement/delicacy
Gradevolezza	Pleasantness
Ricchezza	Richness

## CONCLUSIONS

The use of the Dynamos, rotating dynamic cross-flow filter, for the filtration of the must and wine sediments without adjuvants considerably improves production technology as it presents tangible advantages:

- a single instrument provides functions which were until now performed using various different plants;
- the machine is “multi-sector” and makes it possible to use one system for more than one product (eg. musts, wines and juices);
- wine filtration using this system is more refined and accurate and the resulting product is of a higher quality;
- the filtering plant and method are self-regulating and the working cycle parameters self-adjust according to the characteristics of the liquid being filtered and/or the plant conditions, or the variation of such characteristics and/or conditions during the working cycle;
- the need for inert materials is eliminated (lower environmental impact, better safety for the cellar operators), with the consequent reduction of costs for fossil meal disposal;
- the electric and water consumption for the washing decreases, with the consequent reduction of operating costs;

- the costs relating to a specific labour force are reduced, and there are safety benefits;
- it presents high nominal efficiencies and autonomy of the filtration cycles;
- it presents a better filtration flow rate in comparison with the current alternatives.

This process is also energy efficient, it provides for long filtration cycles (up to 50 hours continuously) and high nominal efficiencies (40-50 l/mq/h), does not reduce the red colour (Abs at 520 nm), allows very limited oxygen absorption and preserves the high quality of the treated product, it also allows the recovery of more than 95% of the product (in case of products with a low lees content).

The characteristics of Dynamos allow its use on all the ranges of musts and wines including the sparkling bases.

This type of dynamic system is innovative in comparison with the existing ones and may become, for some types of cellars and products, the only machine usable for all stages of filtration from must to bottling with considerable improvements and simplifications in relation to existing systems.

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