MiniTubes™: The Revolutionary Production Technology that Guarantees Practical, Health and Efficiency Aspects in Winemaking Additive Use.

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Manufacturing capabilities that guarantee the final product quality only in terms of the results that can be obtained, are no longer sufficient now. It is necessary to go beyond the "industrial" aspect and diversify with competence and awareness with regards to environmental protection and human and animal health. These aspects are often misused and are used solely for marketing purposes.

Introduction

Modern technologies are based on the industrial capacity to produce goods where the concern is not only the simple and direct application qualities of the goods produced.

The winemaking industry, which lived a notable growth after the Second World War, has over time seen a continual introduction of more treatment, chemical, physical and biological elements in a continuous search for the most modern technological solutions for the stabilization and improvement of wines and their qualities; that are the most appreciated by consumers.

In particular, many products (additives and processing aids) were first introduced in powder form (soluble and dispersible) and then after in solutions or aqueous dispersions for an easy and reasoned use.

The use of powder forms is often fastidious due to the well-known fact that the dispersion is difficult and of course it is bothersome to the user since the fine particles can provoke irritations to exposed mucous membranes (nose, eye, mouth) and they can also cause severe allergic reactions.

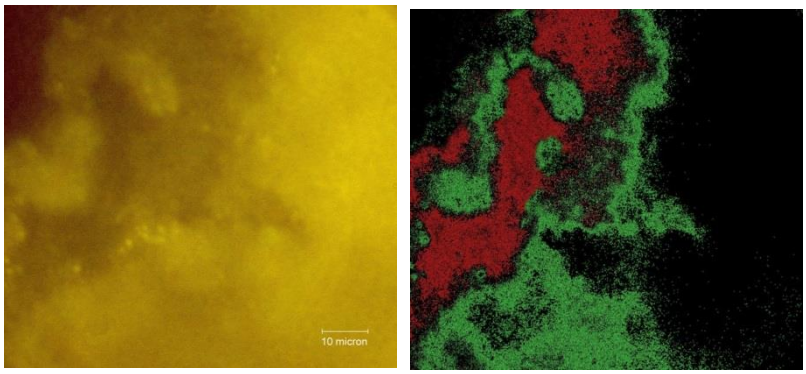
The proposal of aqueous solutions, pellets, tablets or wet products instead of powder products brings about another set of problems. Aqueous solutions lead to more water consumption, greater transportation volumes and when used they release aerosols that are breathed in.

Pellets and tablets, because of the high pressure used to obtain their compact format lead to a limited or difficult dispersion. Furthermore the binding products used are almost never chosen for their functionality and often lead to a decreased effect of the real active components.

Lastly, it is possible to wet the powder products (ex. carbon, diatomaceous earth) to make them humid, so that there is no more dust formation nor the formation of aerosols while maintaining a good dispersion in polar liquids (water, wine, must). However these products are susceptible to microbiological contamination (moulds, fungi, bacteria).

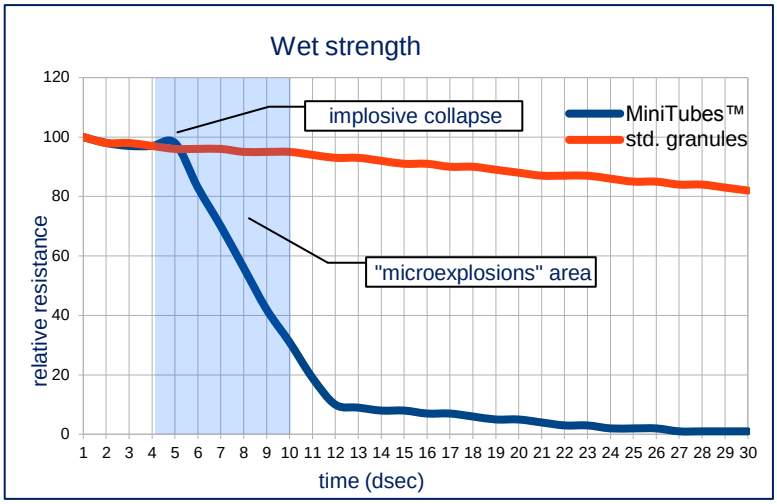
It is also possible to produce granules by using specific rotating mixers. The powder and/or the active component are placed in the granulation chamber in spray or agglomerate form for the drying process, even at cold temperature, with air currents.

Even though this is a much more pure product than that in pellet form (drastic or complete reduction of binding product), there is still the risk



DC-Pol G: internal micro-canal (high contrast optical microscope) and the same image in false colours with the micro-canal highlighted in red.

that the dispersion of the product is difficult because of its compact nature. To resolve this problem it is often necessary to add "separating" additives to facilitate the disintegration of the granule within the liquid that is being treated.



Graph 1: Wet strength. Comparison of DC-POL G (*miniTubes™*) with standard PVPP granules

MiniTubes™

By analysing the difficulties and the negative aspects described, it was possible to conclude that the critical factors that reduce the environmental and health benefits of an "aggregated" preparation are the following:

- difficulty to dissolve the product in the treatment liquid (compactness)
- possible undesirable secondary effects of binding or separating additives
- microbiological contamination risks.

It is therefore clear that in order to avoid these above mentioned critical points a production method that can respond to all these following rules must be created and applied:

- reduction of binding/separating additives to a minimum
- the choice of binding/separating additives that are inert or synergetic with the active component
- to limit as much as possible the presence of water (humidity)
- increasing the speed of spontaneous disaggregation of the product once wet.

The main issue is to find a technological solution to compact the product without compromising the quick dispersion during the application process, which in our case is into *polar* liquids, and without generating secondary dust formation in the packaging due to rubbing.

The technology that lead to the creation of the *miniTubes*™ range is based on the micro-encapsulation of very thin air canals inside a homogeneous mass of an active compound in dry state; these can easily be observed using an optical microscope.

These micro-canals (defined by us as *"mini-tubes")* represent empty spaces with reduced length, that are minimally branched, which in aqueous phase (polar) tend to collapse hence facilitating the demolition of the structure form of the granule or pellet, that first tends to implode and few instants later "explodes" because of the minimal pressure difference with the exterior. In comparison with standard granules or pellets, the *MiniTubes*™ are different since the resulting mass is not compact or consistent.

This particular behaviour, that characterizes this innovative product, was measured by evaluating is resistance to being wetted (proportional to the force needed to disaggregate the granule in H_2O) over time, expressed in deciseconds (Graph 1).

The final effect is the total dispersion of the product in the liquid to be treated, with a minimum of inert gas microbubble formation, without floating particles and with a wetting effect that reaches every single particle of the product, while avoiding a "layer hydration" that goes more and more internal, typical of any granular product obtained for example by extrusion.

Therefore no more powders, perfect dispersion, 100% activity guaranteed at the suggested dosage, no collateral effects nor risk of microbiological contaminations.

The quantity of air naturally found in the micro-canals is absolutely negligible. How was it possible to achieve this result? The micro-canals are formed in a casual manner but in a well distributed way thanks to the unique physical

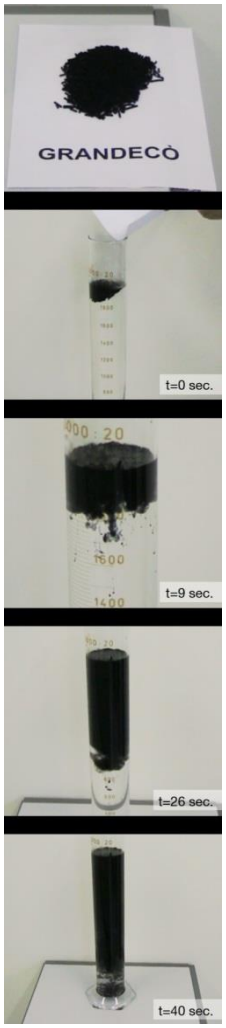
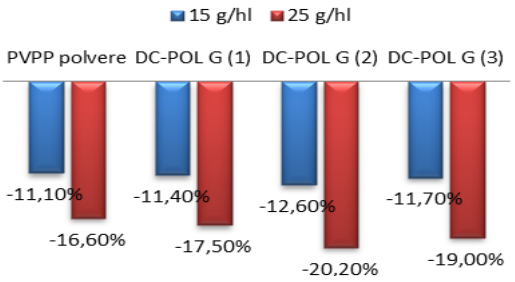
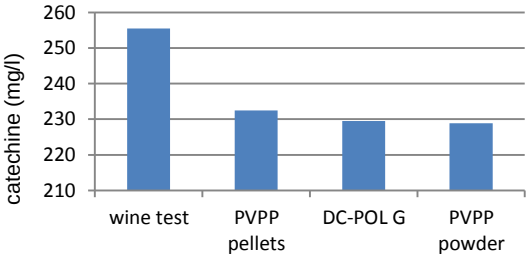


Photo 1: dissolution of Grandecò

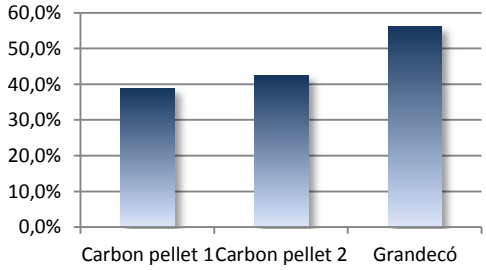
Result of traditional yeast derivative (left) and wynTube Prepara (right) after 5' wait and mixing (dissolution in water 1:10).



Graph. 2 – Percentage reduction of O.D. 420 nm in white wine treated with DC-POL G (three times) and PVPP powder.



Graph 3 – Reduction of catechins in red wine treated with 20 g/hl of DC-POL G, PVPP powder and PVPP in pellets.



Graph. 4 – Percentage reduction of O.D. 420 nm in white wine treated with 15 g/hl of Grandecó and two different carbons in pellets.

elaboration process at high pressure, which after the continual exposure to atmospheric pressure generates a sort of "structural embolism" which forms the described canal spaces , partly on the surface and mostly inside the mass.
The process temperature and the amount of time in the high pressure phase are the two variables that are the most important parts of the process. They help to 0avoid product disintegration before packaging and excessive compactness which could result in a granite like product that can no longer be used.
This production technique was re-fined after several years of experience and research efforts that were always more specific, and which were conducted at the production facilities of Dal Cin in Foggia. It all started from the observation of what could happen when observing the mechanics of dense fluids, such as heterogeneous mixtures, where there are two or more physically different phases.
It is important to highlight that the application possibilities of the above described production technique are not unlimited. Some materials do not react to the "instant depressurization" stage in the desired way, turning the material into powder form. This is quite limiting from the application point of view, but it does provide enough margin for a series of winemaking additives that are important and widely used, such as those described below.

DC-POL G and GRANDECÓ

The two additives that were most revolutionized by the *MiniTubes*™ technology are PVPP and oenological carbon. Both products are useful and sometimes indispensable but are often disliked by winery staff members because of the amount of dust they form and because of the difficulties associated with their dissolution.
The objectives obtained with *DC-Pol G (PVPP), Grandecó* and *Carb-Off* (oenological carbon) are instantaneous dispersion, complete elimination of dust and, even more important, 100% active component efficiency as can be seen in the descriptive graphs.
The choice of Dal Cin to apply the MiniTubes™ production technology to the largest possible number of technological additives, permitted for the creation of complex fining agents such as *Mosaico* and also the nutrients of the *WynTube* range. These products are appreciated for the ease and "cleanliness" of use. They are characterized by a more gradual dispersion that the above mentioned products but are easy to wet and do not remain on the surface of the liquid (water, must, wine) and they contain only the active ingredients without

any binding components.
With other substrates, in particular protein based materials, the *MiniTubes*™ technique is not for the moment applicable and at the present time the subject is being researched and there should be results available soon.

Conclusions

The production of additives for wine industry processes with the *MiniTubes*™ technique cannot be applied yet to all the substances or preparations that are permitted by the current regulation; however it can be possible for some of these and research is already underway so as to use this process on all the powdered products that are currently available on the market. The process can be adapted accordingly and has already been shown to be versatile and reliable. The first products already released have been accepted with enthusiasm by cellar masters and winery users.