Resumen de Tesis Doctoral

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Título de la tesis	Desarrollo de un sistema de medida ultrasónico para monitorizar el proceso de fermentación maloláctica del vino tinto en un ambiente industrial.
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(Mínimo 1 y màximo 4, podéis verlos en http://doctorat.upc.edu/gestion-academica/carpeta-impresos/tesis-matricula-y-deposito/codigos-unesco)

Resumen de la tesis de 4000 caracteres máximo (si se superan los 4000 se cortará automáticamente)

This work is a contribution to a measuring system based on ultrasonic techniques to analyse and monitor, in real time, malolactic fermentation (MLF) in red wine, both at industrial and semi-industrial level.

In the wine sector, MLF is of great importance due to its influence over wine organoleptic and sensory profiles, for it largely defines the quality of the final product. This process, whose main feature is that lactic acid bacteria (LAB) convert malic acid into lactic acid, is monitored, generally, in labs with analytical techniques. These techniques have several drawbacks, however, regarding costs, response times and chances to be included in production lines (they are off-line). On the contrary, the characteristics of the ultrasonic measuring method developed in this Thesis overcomes those and provides other advantages associated to this kind of technology (non-invasive, non-destructive, hygiene and accuracy among others).

The main measuring instrument is the ultrasonic sensor, which has been designed and manufactured for measures ultrasonic propagation velocity. It is based on a transmission and reflection of ultrasonic waves technique (pulse-echo). Besides, a buffer rod is used to allow both signal conditioning (echoes) and also the coupling and start of the system in the big stainless steel tanks where the wine is kept during its production. Moreover, several methods to process the collected ultrasonic information are compared and classified according to their computing cost-precision relationship in order to facilitate selection depending on available resources.

Regarding lab experiments, the system has proved an appropriate accuracy to detect variations when, in aqueous and hydroalcoholic solutions, lactic and malic acid levels of concentration are changed. It also works in the ultrasonic characterization of hydroalcoholic solutions when temperatures vary with different alcohol concentrations or to detect parameter changes such as turbidity. Regarding field tests, the behaviour of the ultrasonic propagation velocity is clearly related to several conventional parameters that are measured during MLF (malic and lactic acid concentrations, volatile acidity, bacteria population, etc.), which proves the usefulness of the system when predicting the end of the malolactic process on-line. This prediction shows a constant behaviour in ultrasonic propagation velocity when MLF is reaching the end, or none at all when LABs do not perform the process.

The breaking point of the system in field tests is control over wine temperature. This parameter is influenced by variations on room temperature and changes generated by the process itself. Temperature must be precisely monitored in order to apply, when necessary, the corresponding compensations to ultrasonic results.

The results confirm the feasibility of using ultrasonic waves to monitor the MLF of red wine, even the possibility to include them in a real time control system.

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Firma