VISENS: Pilot test to integrate next-generation sensors in Catalan wineries as a method to support decision-making

Summary

The winemaking process is complex and incorporates different geographic, climatic and temporal scenarios, with various parameters that affect the quality and safety of the final product. Having tools that monitor the different stages of the process more optimally than those that currently exist on the market would mean an improvement in winemaking, allowing preventive and not only curative actions. In this regard, the sensorisation of fermentation and ageing processes is becoming a key part of the wine sector's digitalisation strategy, not only improving the process but also the transparency and exchange of information with the consumer. This project represents for the first time an aggregation of all options concerning the sensorisation of fermentation processes and opens the door to the sensorisation of the ageing process. The strategy of VISENS is based partly on existing commercial sensors, but also on specific developments particularly for the monitoring of gases and volatiles in gaseous and liquid media. As a result, the activities will focus on the feasibility testing of these new developments for technology transfer. The use of micro and nano electronic sensor systems also incorporates generic advantages, such as: reducing the size of sensor systems and their environmental impact at the end of their lifetime and reducing the energy consumption of the instrumentation. In economic terms, sensorisation will free up personnel during the harvest for each winery. In addition, the implementation of sensors will help save a large number of reagents and consumables that are currently used for batch sample analysis. Along with the reduction in the use of reagents, the continuous monitoring of oxygen and sulphur concentration will enhance the strategy of reducing preservatives applied today.

Objectives

The main objective of the project is to obtain concrete results that will help to design the digitalisation strategy for the wine sector. In addition, it will lead to not only will technology transfer from research centres and companies, which also operate in other wine regions, but will also provide an estimate of costs differentiated by production volume, which will speed up the digital transition for all Catalan wineries.
The specific objectives of this project are as follows:

- The development of low-cost and interconnected tools to improve wine quality
- Validation and specification of the strategy so that the whole sector can become part of Industry 4.0
- The transfer of technology (sensors) developed for other industries such as the pharmaceutical or chemical sector to the agro-industrial sector.
- Training of technical staff to demonstrate the benefits of digitalisation
- Design of a digitalisation strategy adapted to all companies in the Catalan wine sector, regardless of their turnover.

Description of the actions planned in the project

- Test under fermentation conditions of sensors based on electrical potential difference (Leader: Vega Instruments).

This activity will focus on testing new sensors based on electrical potential difference (EDP) for fermentation monitoring in wineries. The actions will include the study of the return on investment and improvements in the process, the identification of potential risks that are mitigated by the installation of these sensors and the comparison of the data obtained with the winery's historical data.

• Manufacture of micro and nano sensors adapted to the challenges of the wine sector (Leader CNM (CSIC))
The manufacture and adaptation of micro and nano sensors will be aimed at the development of semiconductors sensitive to gases and volatiles in the wine sector. In particular, phenol detection will help identify possible contamination by *Brettanomyces bruxellensis* in order to establish preventive treatments. Activities will also include the adaptation of sensors for SO_2 detection in liquids for continuous monitoring of sulphur levels and much more efficient dose adjustment. The sensors will be validated first in the laboratory and then on the SC Robotics platform under real conditions.

• Integration of new sensors in smart caps (Leader SC Robotics)
The main objective of this activity is to adapt the existing smart cap and the existing data processing and exchange platform to integrate the new sensors. In addition, the data obtained by the SC Robotics sensors concerning oxygen dissolution and the pressure difference between the inside and outside of the barrels will be validated. Thus, a study and adaptation of the data processing and information exchange platform will be carried out in order to add more channels. In addition, the cap's casing will be mechanically adapted to integrate the new sensors developed by the CNM (CSIC). In the tests, both the sensors that SC Robotics already has and the sensors developed by the CNM (CSIC) will be validated. These initial units will be used to fine-tune the system in terms of ranges and working conditions. During the final harvest, more integrated sensors will be installed to collect and process more data and validate the system.

• Co-ordination of the project and consortium (INNOVI Leader)
Actions also include the management and coordination of activities throughout the project. In particular, a budget and timetable will be drawn up, ensuring compliance with the budget and project objectives. In addition, the appropriate communication and coordination will be carried out between all participating parties and access to all updated documentation (reports, minutes, timetable, goals, etc.) of the project will be managed and made available to all project participants.

Expected results and practical recommendations

The main outcome of the project is the prospecting of all the options currently available to wineries regarding the sensorisation of fermentation and ageing processes of wines. By testing and implementing technologies developed for other industries by leading research centres in sensor technology, we will facilitate the sensorisation of wineries. As we have already mentioned, we find ourselves in a sector in which, due to the seasonal nature of production and the fragmentation of companies, digitalisation has not become entrenched and this entails economic losses, above all due to the investment in manpower required for individualised sampling and analysis of the deposits.

In addition to the monitoring devices that we hope to bring to market as a result of this project, we want to generate and disseminate knowledge about the impact of the variables that the new sensors will monitor on the wine fermentation process. Despite a lack of similar large-scale studies, this project will allow us to better understand this process according to the type of wine (white, rosé, red, sparkling...), according to the type of environment (for example, according to designation of origin) or according to other variables that the wineries find potentially interesting.

This project also includes the design and validation of new prototypes based on micro and nano sensors. The inclusion of specialised sensor companies means that the results of this project can reach the market.

Leader of the Operational Group

ORGANISATION: CELLER LA VINYETA, SL

Coordinator of the Operational Group

ORGANISATION: INNOVI Association of Innovative Companies

Other members of the Operational Group (grant recipients)

ORGANISATION: GRAMONA, SA

ORGANISATION: GONZALEZ BYASS, SA

Other members of the Operational Group (not recipients of the grant)

ORGANISATION: CSIC SPANISH NATIONAL RESEARCH COUNCIL

Subject area(s) of application

☐	Agricultural production system
☐	Agricultural practice
☐	Agricultural equipment and machinery
☐	Livestock farming and animal welfare
☐	Vegetable production and horticulture
☐	Landscape / Territorial management
☐	Pest and disease control
☐	Fertilisation and nutrient management
☐	Soil management
☐	Genetic resources
☐	Forestry
☒	Water management
☐	Climate and Climate Change
☒	Energy management
☐	Waste and by-product management
☐	Biodiversity and environmental management
☒	Food quality/processing and nutrition
☐	Supply chain, marketing and consumption
☒	Competitiveness and agricultural and forestry diversification
☐	General

Geographical area(s) of application

PROVINCE(S)	**REGION(S)**
Barcelona, Girona	Alt Penedès, Alt Empordà

Dissemination of the project (publications, conferences, multimedia, etc.)

News on the progress of the project will be published on the INNOVI.cat website and posted on the social media of INNOVI and the Cluster members.

Project website

https://www.innovi.cat/visens

More information on the project

PROJECT DATES	TOTAL BUDGET
Starting date: July 2021	**Total budget:** €131,080.87
	DACC funding: €60,618.72
Current status: Under way	**EU funding:** €45,729.91
	Own funding: €24,732.24

With funding from:

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Order ARP/113/2021 of 20 May, approving the regulatory bases for grants for cooperation for innovation by promoting the creation of European Association for Innovation operational groups in the areas of agricultural productivity and sustainability and the execution of innovative pilot projects by those groups, and Resolution ACC/1660/2021, of 27 May, announcing the call for the grant.

Generalitat de Catalunya
Departament d'Acció Climàtica, Alimentació i Agenda Rural

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