

# **Analysis and Measurement of Clogging Potential in Wines for Operational Decision-Making in the Bottling Process**

**Luis Francisco Lillo Otárola, Hanns de la Fuente Mella  
and Jose Ceroni Diaz**

Escuela de ingeniería Industrial  
Pontificia Universidad Católica de Valparaíso  
Valparaíso, Chile  
[luis.lillo@pucv.cl](mailto:luis.lillo@pucv.cl)

## **Abstract**

The wine industry faces global challenges, such as the decrease in per capita consumption, the increase in transportation costs for international shipments, and changes in final consumer preferences. In this global context, the Chilean wine market faces local challenges, such as climate change affecting crops and water availability, and the sustained increase in energy and labor costs. Within the wine production process, one of the most important stages in terms of cost and variability is the final filtration of the wine. This allows the removal of microorganisms such as yeasts and bacteria, as well as other particles and colloids, before bottling, as they can affect the organoleptic properties of the wine. Due to the nature of the processes and the use of additives in the winemaking stage, the wine may contain particles in different quantities and distributions, as well as different mechanical properties. Considering this, indirect methods have been developed to measure particle content and their clogging potential; however, there is no clear evidence of their level of use or implementation in the industry, nor detailed analyses of the variability associated with these methods and how they contribute to decision-making in the bottling process. In this context, a review is conducted of the methods used in the industry to estimate the solids content in a wine sample; the adoption of these methods is assessed through questionnaires and interviews with wine-producing companies in Chile; a systematic search of existing methods in the literature is carried out, and the variability and capacity of the method to contribute to operational decisions in the industry are analyzed using experimental methods, in addition to identifying the methodological and practical challenges associated with their use. With this, the aim is to provide useful and practical tools for decision-making in the bottling process, allowing the industry to control costs and adequately plan production.

## **Keywords**

Wine Filtration, Solids Content, Bottling Process, Comprehensive Indicators

## **Biographies**

**Luis Lillo Otárola**, with 18 years of work experience in business management and marketing in Chile, as well as in the development of productive and process applications in various markets throughout Latin America. This diverse work experience is complemented by a comprehensive academic background, including a Bachelor's degree in Applied Engineering, a Master's degree in Business Administration, a Master's degree in Industrial Engineering, and a Master's degree in Chemical and Biological Sciences. Currently, he is a Ph.D. student in Industrial Engineering at the Pontifical Catholic University of Valparaíso in Chile. Research focus includes the use of optimization tools, experimental methods, stochastic processes, and machine learning for decision-making and the management of productive processes in different industries.

**Hanns de la Fuente-Mella**, was born in Valparaíso, Chile. He received a Ph.D. degree in economics and organization management from Universidad de Zaragoza, Spain in 2009. He received his M.Sc. degree at Pontificia Universidad Católica de Valparaíso, Chile in 2004. He is a Professor of Economics and Organization Management at the Pontificia Universidad Católica de Valparaíso in Chile. He has more than 15 years of teaching experience in universities and about 10 years of experience working in research teams. He has published more than 120 scientific papers in different peer-reviewed international conferences and journals involving different topics such as econometric modeling, forecasting modeling, economics and statistics in administration sciences.

**José A. Ceroni** graduated as an Industrial Engineer from Pontifical Catholic University of Valparaiso, Chile, and received his Master of Science and PhD in Industrial Engineering from Purdue University, Indiana, USA. He is currently Professor at the School of Industrial Engineering at Pontifical Catholic University of Valparaíso, Chile. His research interests include collaborative production and control, industrial robotics systems, collaborative robotics agents, and collaborative control in logistics systems. He is member of the Board of the International Federation for Production Research, and a member of IFAC and IEEE.