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Environmental Perspectives on Wine Packaging: A Comparative Study of Single-Use and Reusable Options

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1. INTRODUCTION

Spain is the world's leading vineyard, accounting for 13% of the global total. In terms of production, Spain ranks third in the world. Wine packaging plays a crucial role in preservation and aging. EU Directive (EU) 2018/852 emphasizes reuse for resource efficiency and environmental impact reduction (EU, 2018). Spain aligns with this directive, focusing on promoting glass packaging reuse and the European Commission targets 70% glass recycling by 2025 and 75% by 2030 (BOE, 2022). In wine production, glass bottles have a significant climate impact due to high energy consumption in manufacturing. Therefore, reuse is key for mitigation. The main objective of this research is to analyse the environmental feasibility of implementing a reusable glass bottle system in the wine industry at the national level that can serve as a sectoral contribution to the Spanish Circular Economy Strategy as part of the GO REBO2VINO project.

2. METHODS

In this study, the life cycle assessment (LCA) method is used to compare the environmental impacts of two different wine packaging systems in Spain: single-use and reusable glass bottles. The functional unit considered is the volume of wine bottled by the winery during the pilot test, and a cradle-to-grave approach is adopted (Figure 1). The LCA was conducted using the latest version of GaBi software (Sphera, 2022) with integrated databases, employing the Environmental Footprint (EF) method (European Commission, 2021).

3. RESULTS AND DISCUSSION

An Excel tool is designed for wineries to compare the environmental impact of wine packaging options. Figure 2 displays a screenshot of this tool, featuring guidelines, boundaries, inventory data, calculation, and results. Key inputs in the inventory sheet include functional unit, the quantity of bottles, material composition (% of recycled content), volume and weight of bottles, and weight of boxes. Breakage rates and for reusable bottles, the number of cycles in the pool (the pool, the total amount of reusable bottles to guarantee the performance of the system, is estimated bearing in mind the input data) are crucial for impact assessment. Transportation data covers bottle transport from producer to consumer and, for reusable bottles, collection, washing, return, and disposal transport. The end-of-life stage for both options is also considered in this tool. The calculation sheet assesses environmental impacts using LCA for Experts software (results of GaBi are hidden in this tool). Data is sourced from database inventories or software-performed models (such as for glass bottle production and washing). The final sheet presents a comparative analysis of both packaging options.

4. CONCLUSIONS

This tool will be utilized to demonstrate which packaging option single-use, or reusable bottles is more environmentally efficient. Considering the diversity of business models and typologies of companies in the Spanish wine sector, LCA is very helpful in this context to determine under what circumstances the implementation of circular economy strategies remains environmentally beneficial, avoiding the transfer of impacts from one stage to another.

5. ACKNOWLEDGEMENTS

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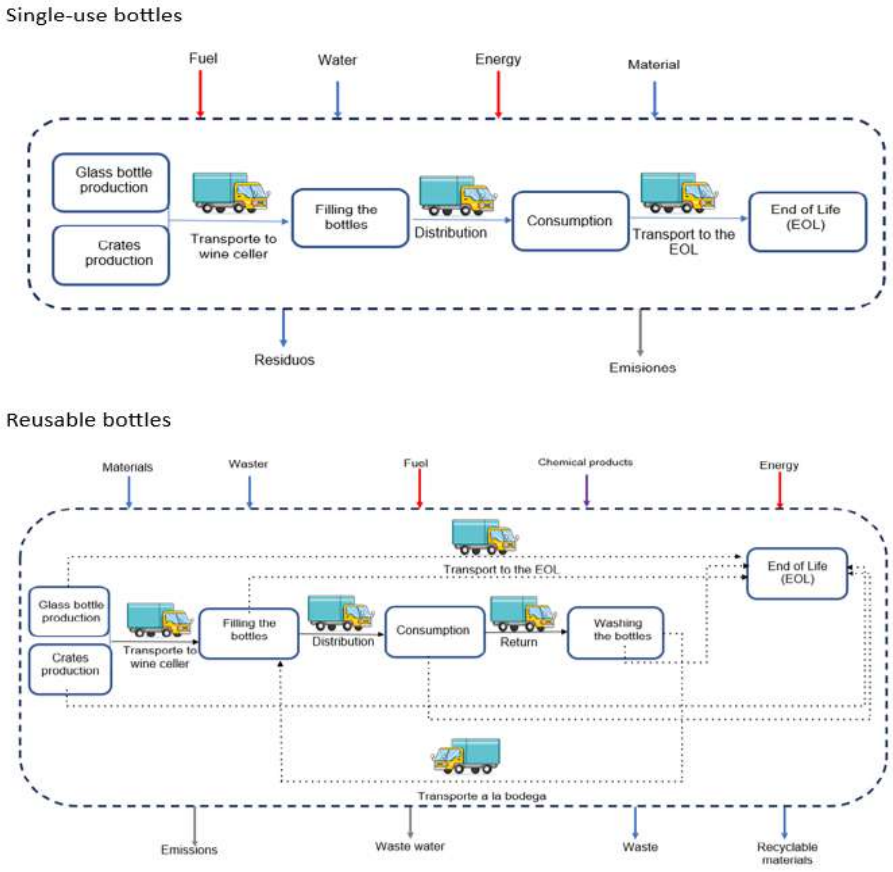

Figure 1. Boundaries of the study

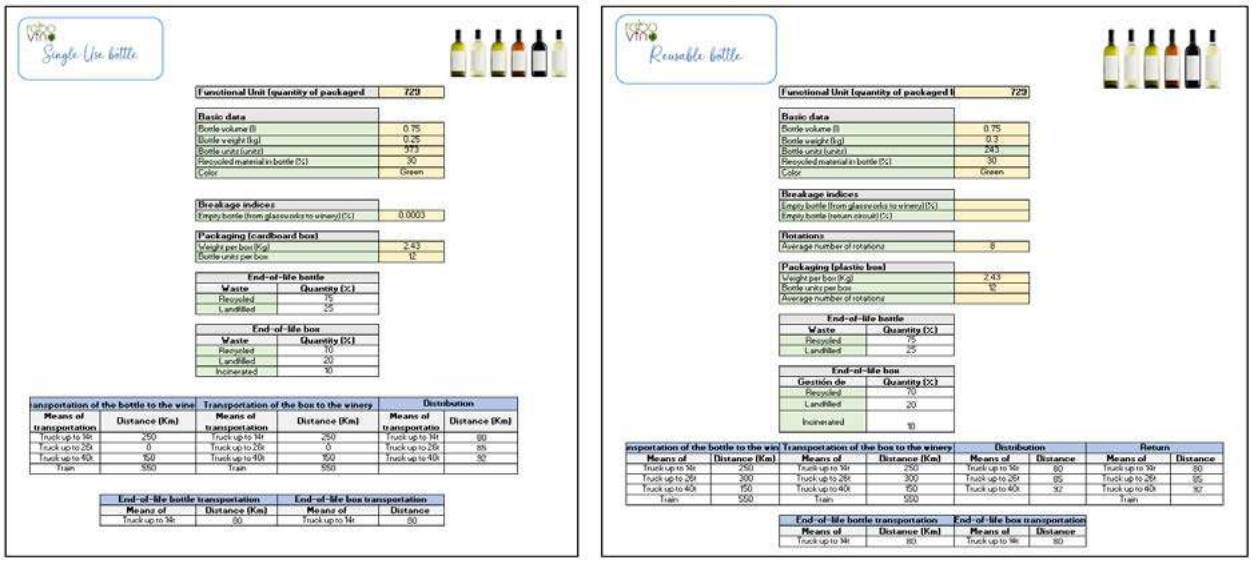

Figure 2: LCA Inventory Excel-based tool