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# Beverage Dealcoholization Processes: Past, Present, and Future

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## Abstract

### *Background*

It is clearly observed that there is a highly significant increase on the demand of **non-alcoholic beverages** (such as **beer** and **wine**) for the last few years. However, there is a huge issue faced by the market, where most of the available non-alcoholic **beverages** are not organoleptically accepted, as they exhibit lack of flavor and aroma, and also different taste compared to the regular brews. Therefore, it is imperative to have appropriate processes or methods to selectively remove ethanol while retaining the volatile components that are related with flavor and aroma of original brew.

### *Scope and Approach*

To present a clear background about the **dealcoholization** and its importance, this paper will bring a brief discussion on the nutrient and health aspects related to the beer and wine. Furthermore, some conventional approaches for dealcoholization in the past will be discussed, mainly on the thermal-based processes. Moreover, the state of the art and the present status of the beverage dealcoholization processes will be discussed in detail, focusing on the approaches utilizing **membranes** along with some miscellaneous dealcoholization methods. In addition, the dealcoholization employing the membrane processes is the spotlight for the future perspective and development.

### *Key Findings and Conclusions*

The membrane processes demonstrate promising results for beverage dealcoholizations while preserving the sensorial properties. However, there is still a lot effort to be placed on the research for the development of the prospective separation process that may produce brews that are both healthy (dealcoholized) and delicious.

**Keywords:** *beer; dealcoholization; membrane; non-alcoholic beverage; wine.*

## 1. Introduction

Beer and wine are beverages produced via fermentation process. With the assistance of yeast, the mixture of malt and hops are converted into beer, while those of grape juices are transformed into wine, both having alcoholic content up to around 5 and 15 %, respectively. Recently, there is an increasing global demand for the alcohol-free beer (ranging from 0.05 to 1.2% ABV (alcohol by volume) or dealcoholized wine (less than 7% ABV) (Figure 1), due to improved paradigm aiming for healthy lifestyle, consciousness of moderate consumption of beer or wine, and also due to religious reasons. This is such a positive attitude where consuming beer or wine, especially when the disadvantageous alcohol content is sharply reduced, will let one to enjoy beneficial bioactive compounds, namely vitamins, minerals, antioxidants to anticancer agents.

Despite the increasing worldwide demand, producing such low-alcohol beverages are quite challenging. The manufacturer could just use grape with lower sugar content, perform arrested fermentation with special yeast that produces low alcohol concentration, or without any fermentation at all continued with blending with artificial aroma, but the products are quite disappointing, as they are organoleptically different with those of standard beer or wine. Physical separation processes are also employed in the post-fermentation stage to remove alcohol from the beverages, although facing the same obstacle in the quality of the end product (Figure 1). In this paper, a brief detail on the

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