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Review Article

OLIVE POMACE: FROM AN OLIVE MILL WASTE TO A RESOURCE, AN OVERVIEW OF THE NEW TREATMENTS

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ABSTRACT

In this article, an overview of treatment alternatives of olive pomace that is olive oil mill waste are covered. Olive pomace characteristics, the new treatments for improving the extraction of olive oil are mentioned. Attention is drawn to present-day applications of olive pomace. The search concerning the improving of the nutritional value of olive pomace is referred, focusing, on biological treatment with microorganisms in liquid and solid-state fermentation.

Keywords: Olive pomace, Biotreatment, Valorisation

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INTRODUCTION

Olive oil farming is a significant feature of land use in Mediterranean regions [1], covering over five million hectares in the EU Member States [2]. Most of the world's production of olive oil, 2918000 tons in 2017 (International Olive Council, 2017) [3], is based in the countries of southern Europe, the Near East and North Africa, where olive (*Olea europaea* L.) cultivation is a centuries-old tradition, especially for oil extraction [4]. However, many other countries such as Argentina, Australia, and South Africa are becoming emergent producers since they are promoting intensive olive tree cultivation [5].

Olive pomace, also called, olive cake or olive husk is the solid residue obtained after olive oil extraction. It is one of the most abundant agro-industrial by-products in the Mediterranean area [6]. According to the International Olive Council reports, 2017, world olive production in 2018 is expected to come in at around 6000000 tons. The olive pomace consists of the lignocellulosic matrix (cellulose, hemicelluloses and lignin) with phenolic compounds, uronic acids, and oily residues [7, 8]. The amount and physicochemical properties of these residues (olive pomace) produced will depend on the method used for the extraction. Indeed, there are two ways of extracting the oil: traditional pressing, used for many centuries with only minor modifications and centrifugation (two and three-phase system) one, that the olive oil industry has taken over in the last decades [5].

The management of these huge quantities of residues involves a problem for these industries due to their high phytotoxicity [5] and their potential as pollutants in some cases and to the costs associated to the treatments needed for their proper removal [7, 9, 10].

This study provides a summary of updated information on research works that propose different valorisation methods based on scientific studies, laying special emphasis on olive pomace.

Search criteria

In this review, articles were included from Google Scholar, Mendeley, Research gate, PubMed databases, and Science Direct, using several keywords for search: olive pomace/cake, olive oil, extraction system of olive oil. The articles were selected for reviewing using as a filter from the most recent to the oldest.

Olive oil extraction systems and waste products

The extraction of olive oil involves different processes such as washing the olives, grinding, mixing and the extraction itself, which is the basic step of the whole process. The quantity and physic-chemical properties of the waste produced will depend on the method used for the extraction [11, 12]. Discontinuous (press) and continuous processes are the main methods used in the production of olive oil. According to the separation method used in continuous operation, two technologies are recognized: two and three-phase centrifugation processes [11, 12]. Even though traditional pressing is a relatively obsolete technology, it is still in use by some olive oil producers in the world. In the traditional press process, olives are washed, crushed and kneaded. The resulting paste is then pressed to drain the oil. After extraction, a solid fraction, called olive pomace, is obtained as a by-product with an emulsion containing the olive oil which is separated by decantation of the remaining wastewater of the oil mill (fig. 1). It is also a three-phase system as it generates three fractions at the end of the process: a solid (olive pomace) and two liquids (oil and wastewater) [12, 13].

On the other hand, the three-phase continuous centrifugation system, which is the predominant process in modern oil mills at the Mediterranean level, generates three phases: oil, wastewater, olive pomace. The extraction of olive oil is done in successive phases, unlike the discontinuous process. The olives are washed, crushed, mixed with hot water and kneaded to form the olive paste which is then diluted. The liquid and solid phases are separated by centrifugation giving the olive pomace and must (an emulsion). The must then undergoes centrifugation to separate the oil from the wastewater (fig. 1). Despite the advantages of this system over pressing (complete automation, better oil quality, reduced surface area), it also has drawbacks (higher water and energy consumption, higher wastewater production and installations more expensive) [4, 12, 14].

For the two-phase centrifugation system, the olives undergo the same steps as those of the previous three-phase system. However, this method of extracting olive oil works with a new two-phase centrifugal decanter (oil and olive pomace) which does not require water for the separation of oily phases and solids containing olive pomace and wastewater. This system was launched on the market with the labeling of "ecological", due to the reduction of water consumption, and "two phases" because it produced two fractions: a liquid (olive oil) and a solid called wet olive cake (fig. 1) [12–14].

The choice of the extraction system determines a variation of the performance in the case of the super-intensive farming method [15]. Indeed, the 2-phase system can only be used for industrial