PERSPECTIVE

Creation of a sonotrode ultrasound-assisted phenolic compound extraction from apple pomace

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ABSTRACT

The primary by-product of apple processing used in the juice industry is known as apple pomace, and it is thought to be a source of polyphenols with a number of health benefits. Therefore, the goal of this study is to establish the use of a sonotrode for the extraction of total phenolic compounds from apple pomace, specifically phloretin and phloridzin, which have significant antioxidant activity. With 15 tests and 3 independent parameters (ethanol (%), duration (min), and amplitude (%), we employed a Box-Behnken design. The results were determined by HPLC-MS-ESI-TOF for the total phenolic compounds, phloretin and phloridzin, and by DPPH, ABTS, and FRAP for the antioxidant activity. ANOVA provided proof that the model was valid. Additionally, several apple pomaces with or without seeds that were extracted under ideal conditions were compared. 7% to 32% of the total phenolic compounds in the apple pomaces were phloretin and phloridzin. Gala apple pomace had the highest phenolic content and antioxidant activity out of all the apple pomace studied. Apple pomaces with seeds were found to contain the cyanogenic component amygdalin as well as increased levels of phloretin and phloridzin but lower levels of flavan-3-ols.

Key Words: *HPLC–MS; Malus; Antioxidant activity; Amygdalin; By-product; Waste revalorization*

INTRODUCTION

In order to meet the shift from a linear to a circular economy model, bio prospecting to recover wastes of natural origins is a very practical idea in a variety of sectors, from agronomy to forest management as well as for marine byproduct valorization .According to this definition, an apple is the edible fruit of the common apple tree, Malus domestica, which Moritz Balthasar Borkhausen called in 1803. Depending on the type, Malus domestica is a pome fruit with a spherical shape and a very sweet flavor. With a 17.7% increase from 2010 to 2020, the global apple production was 86.44 million metric tonnes, and the trend is unmistakably upward. China was the world's top apple grower in 2020–2021. With a market share of 15.7%, apple juice had the highest production volume in 2017. With an output of 103.475 million litters, Spain came in fifth place in terms of apple juice production behind Germany, Poland, the United Kingdom, and France. Additionally, the number of litters generated in the European Union in 2017 was 2.04 million, which was 17.7% more than in 2008. However, a significant amount of apple pomace was produced as a byproduct of the juice industry. 25% of the processed apples are made up of these byproducts, according to Shalini et al. According to reports, apple pomace has a variety of bioactivities, including prebiotic, impacts on cholesterol levels, as well as anticancer, antibacterial, anti-inflammatory, antioxidant, and car-dioprotective properties . The revaluation of this apple pomace by "prod" in recent year's uct has been studied for a variety of applications, including the creation of biofuels, dermal formulations, polymeric composites, fortification of meat products, and beer flavor. Additionally, apple pomace is a source of phenolic substances as hydroxycinnamic acids, dihydrochalcones, flavan-3-ols, flavones, and flavan-3-ols. Because of the existence of these compounds, revalorization of the phenolic compounds found in apple pomace has proven to be more challenging.Due to its high moisture level (80%) and sugar content, of the degrading enzyme polyphenol oxidase. Inactivating apple polyphenol oxidase activity with blanching has been shown to be sufficient by several writers searching for the best method to handle it. The drying of blanched or unbleached apple pomace, however, results in a considerable decrease in bioactive phenolic compounds, according to Heras-Ramrez et al. Otherwise, vacuum freeze drying is a

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good alternative to manufacture apple pomace powders without losing phenolic content, anthocyanin, and dietary fiber, but it is costly and out of reach for most people, claim Yan et al. Therefore, a system that uses apple pomace as soon as it is produced can offer a remedy to enterprises suffering financial losses due to its disposal. Many various methods, including thermal maceration, assisted with enzymes, assisted with non-ionic emulsifiers, assisted with microwaves, and supercritical fluid extraction have been used by some writers to study the extraction of polyphenols from apple pomace. Although there is minimal study on the application of ultrasound technology for extracting phenolic compounds, it has been used in the past to extract pectin and xyloglucans from apple pomace. In order to obtain the highest phenolic content, particularly phloretin and phloridzin, from apple pomace as well as the highest in vitro antioxidant activity as measured by DPPH (2,2′-diphenyl-1-picrylhydrazyl), FRAP (ferric reducing antioxidant power), and ABTS (2,2′-azino-bis-3-ethylbenzothiazoline-6-sulphonic acid) assay To that end, HPLC-MS was used to determine the presence of phenolic chemicals. Additionally, various apple pomaces from various apple kinds were contrasted, and the level of amygdalin was also assessed.

CONCLUSION

The optimal parameters for ultrasonic extraction by sonotrode were determined using a Box-Behnken design in order to extract more phloretin, phloridzin, total phenolic compounds, and antioxidant activity (DPPH, ABTS, and FRAP) from apple fruit. The best sonotrode settings were chosen to be 50% ethanol, 23 minutes, and 65% amplitude. The recovery of phloretin and phloridzin, among other compounds with a high content of antioxidants from apple pomace that could be used as functional ingredients, has been demonstrated to be possible through the use of sonotrode extraction, which has been shown to be a non-thermal, time-efficient, and scalable method. Additionally, juice apple pomaces from several types, both with and without seeds, were extracted under ideal circumstances and compared.