

Promoting Efficiency of Apple Pomace-Derived Pectin

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Abstract- Background: Apple pomace is a high-quality source of pectin. Organic pectin can be used as an alternative chemical food additive in food processing. **Objective:** To evaluate optimal condition for extraction of pectin from apple pomace using hydrochloric and citric acids. **Methods:** Pectin was extracted from apple pomace and dry apple pomace using deionized water and hydrochloric acids to maintain pH (1.8-2.8). 20 ml of 2 N (NaOH), 50 ml of 1 M acetic acid, and 50 ml of 0.5 M calcium chloride were added to the solution. After filtering the solution, ethanol and boiling tests were performed to extract pectin. **Results:** Pectin was produced in brown color, and a higher pectin yield of 13.6% was observed from dry apple pomace using citric acid extraction methods, compared to 9.3% from apple pomace. **Conclusion:** It has been found that pectin has gelling agent properties and can be used in many food processing industries.

Index Terms: Food, process, conventional, pomace

I. INTRODUCTION

Pectin is a raw material that can be easily obtained from apple pomace, which is often produced as a byproduct of juice factories (Canteri-Schemin, *et al.*, 2005). (14.5%) of pectin is mostly produced from apple pomace (Ciriminna *et al.*, 2016). The current market demand for environmentally friendly and sustainable products makes using pectin derived from agricultural waste a viable and potentially profitable business. Using agricultural waste for pectin extraction adheres to circular economy and sustainability principles by converting agricultural waste into value-added products and reducing waste and its associated

costs. It helps reduce environmental pollution by converting waste into a valuable product.

Pectin are complex polysaccharide found in primary cell wall of the plant (Dranca and Oroian, 2019). The structural properties and chemical composition made pectin suitable for many food industry application (Dranca, and Oroian, 2018). Pectin has water-binding and gel-formation properties. As a result, the extracted pectin could be used in a variety of food industry as a gelling agent in jams, thickener, or stabilizer in yogurts (Dranca and Oroian, 2019; Dranca and Oroian, 2018). Furthermore, according to the European Food Safety Authority (EFSA), pectin acts as a dietary fiber and prebiotics have numerous health and nutritional benefits. Also, it reduces postprandial glycemic responses, blood cholesterol levels, and weight loss by increasing satiety, resulting in low calorie and high food quality intake (EFSA, 2010).

Because the market is rapidly expanding and there is an increasing consumer demand for natural, high-quality, and low-calorie food products, using apple pomace for pectin extraction is cost-effective. The objective of this research is to evaluate optimal condition for extraction of pectin from apple pomace using hydrochloric and citric acids.

II. MATERIALS AND METHODS: STUDY DESIGN AND SETTING

Pectin extraction

Apple pomace was purchase from local market. Apple pomace was washed with tape water to remove any dust and impurities. The apples were cut into small thin pieces after removing of seeds and half of apple pomace were dried in oven until reach to constant weight then the dried apple pomace were powdered.

100 g of apple pomace was placed in a beaker with 800 ml of deionized water, then hydrochloric acids was added to maintain pH (1.8-2.8). The solution was boiled (70-80 C⁰) for one hour to deactivate enzymes. Then the solution was filtrate twice and cooled. 20 ml of 2 N (NaOH), 50 ml of 1 M acetic acid, and 50 ml of 0.5 M calcium chloride were added to the solution and mixed slowly. The solution was boiled, cool, and filtrate through weighted filter paper. The filtrate was washed with deionized water to remove calcium chloride residue. The experiment was repeated by replacing hydrochloric acid by citric acid. Moreover, the experiment was repeated with 100 g of dried apple sample (Moreira *et al.*, 2015; Rojas-Grau *et al.*, 2008).

Extraction of pectin.

100 g of the obtained sample was diluted with 25% deionized water (v/w). The solution was then boiled for 1 hour while being vigorously stirred to prevent lump formation. After boiling, allow the solution to cool before filtering through pre-weighted Whitman paper.

III. RESULTS AND DISCUSSION

The main source of pectin extraction is apple pomace. Pectin compromises the main components of plant cell wall. Figure 1. Shows the average pectin yield from apple pomace extracted using various methods. The lowest pectin yield was obtained from pomace using hydrochloric acids with an average of 4%, compared to 8.2% of average extraction pectin from dry apple powder, and the highest pectin yield was obtained from dry apple powder using citric acid extraction with an average of 13.6%, compared to 9.3% from apple pomace. The ability of hydrochloric acid to degrade pectin molecules and produce undesirable byproducts was attributed to the results (Kumar *et al.*, 2018). Our results consistent with those of (Canteri-Schemin *et al.*, 2005), who found that dried apple pomace treated with citric acid yielded a higher pectin yield. Citric acid extraction also results in a high pectin yield (Canteri-Schemin *et al.*, 2005). Citric acid, found naturally in lemon, can lower the pH of water and increase pectin yield (Cinkmanis *et al.*, 2020; Abu-Salem and Azab, 2022). The use of pectin in food processing contributed

The precipitate was dissolved in deionized water, then 95% ethanol was added, and the pectin was filtered and weighted. The procedure was carried out again with dry apple. Both experiments were carried out twice. The average weight of the obtained pectin was taken into account.

For isolation of pectin 1 gram of pectin was dissolved in deionized water at concentration of 1%. The solution was boiled with replace the evaporated water until the gel was formed, which indicate positive result of pectin presence.

Physicochemical properties of obtained pectin:

Pectin yield was calculated based on the following formula:

$$\% \text{ pectin yield} = \text{pectin obtained} * 100 / \text{weight of apple waste}$$

Statistical analysis

Statistical analyzes were conducted using the Analytical Statistical System for Social Research, version 25, Statistical Package for Social Sciences - (SPSS). The samples were analyzed using descriptive statistics.

to its physicochemical properties such as gelling agent, thickener, and texture stabilizer, as well as fat replacer (Tyagi *et al.*, 2015; Zhu *et al.*, 2022). (Sulieyman *et al.*, 2013) suggested for jam production using local raw materials such as natural pectin derived from local fruits. Traditional pectin extraction methods result in lower quality and yield; additionally, optimizing pectin extraction methods has a strong influence on yield, quality, and properties. The pectin extraction methods of the current study produce light brown pectin from fresh and dry powdered apple pomace as shown in image 1. These results are inconsistent with (Valdes *et al.*, 2015), that pectin from apple is a white and colloidal polymer of carbohydrate. This may attributed to the different types of raw materials used to extract pectin and different methods of extraction. Optimal pectin extraction is essential to improve physicochemical properties of pectin to use it in food industry replacing chemical substance in jams and jellies and fruit gels as gelling agent, also, as thickening

agents in soup, canned vegetable and food coatings (Hua et al., 2015).

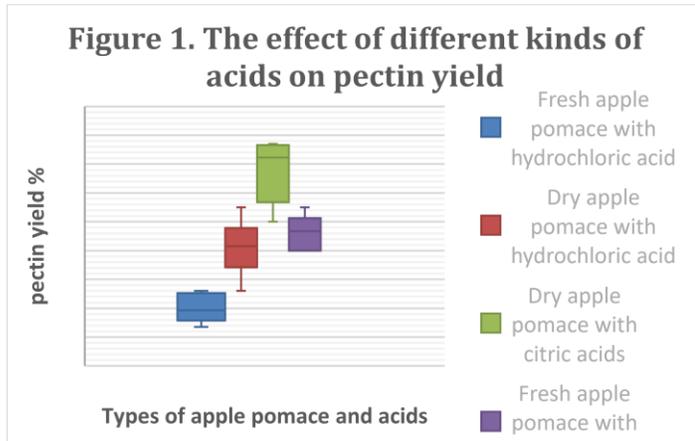


Image 1. The color of pectin obtained from apple pomace

IV. CONCLUSION

By extracting pectin from agricultural waste, it is possible to meet the current market's demand for environmentally sound and sustainable products, making it a viable and potentially profitable business. Many studies have been conducted in order to develop the most effective techniques for extracting pectin from agricultural waste. Apple pomace is a common byproduct that can be used to extract pectin. In general, more research is needed to optimize pectin extraction from various agricultural byproducts for use in food processing rather than conventional chemical substances.

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CONFLICT OF INTREST

The authors declare that they have no conflict of interest.

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