INFLUENCE OF EXTRACTION PARAMETERS ON SOME QUALITY CHARACTERISTICS OF TANNIN EXTRACTS FROM ACORN KERNEL

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ABSTRACT

Acorn (*Quercus ithaburensis* subsp. *macrolepis*) is the fruit of the oak tree and natural spreading area of acorn oak is Eastern Mediterranean countries. Acorn is rich in tannin which is one of the most important forest by-products exported by Turkey. After removal of the tannin by extraction, the acorns are discarded or used as animal feed. However, acorn flour can be used as a substitute for wheat flour in a wide variety of applications in gluten-free food production of cakes, cookies, pasta, and thickener. In the present study, the removal of tannin from shredded acorn kernel to a certain concentration (0.03 mg tannin/mg of dry matter) by aqueous extraction with different acorn/water ratios (1:2 and 1:20 w/v) at different temperatures (20-40-60°C) was investigated. The effects of extraction process parameters on pH, brix, turbidity, and tannin content were determined. It was determined that acorn/water ratio did not have significant effect on pH value (p> 0.05) however, higher brix and turbidity values were obtained by 1:2 w/v ratio (p< 0.05). Also, it was revealed that the acorn/water ratio did not have a significant effect on the tannin removal rate from acorns (p> 0.05). The highest turbidity was obtained for the extraction temperature at 60 °C (p< 0.05). While all extraction temperatures had similar effects on pH, the lowest brix value was obtained for 20 °C (p< 0.05). In addition, it was determined that the target concentration value was reached in 8.0±0.4 h at 60 °C, 10.5±0.5 h at 40 °C and 16.0±0.8 h at 20 °C. The results of the present study will give valuable information for the efficient removal of tannin from acorn being used in novel gluten-free products.

Keywords: Acorn, extraction, tannin

INTRODUCTION

Acorn (*Quercus ithaburensis* subsp. *Macrolepis*) is the fruit of the oak tree, which is grown in Mediterranean countries, especially in Turkey (Bozkurt and Göker, 1981). Acorns contain many biologically active components such as gallic acid and ellagic acid (Bahmani et al., 2015), vitamins A and E, minerals and unsaturated fatty acids (Vinha et al., 2016). Acorns are rich in tannin, which is a phenolic compound and exported as an important forest by-product (Baytop, 1999).

Tannic acid, a commercial additive, is produced by extracting tannin from the shell of acorns. It is used in leather, pharmaceutical, dye industries, cosmetics, petroleum, packaging and food industries (Baytop, 1999). It is especially used as an alcohol clarification agent in the food industry.

After removal of the tannin the acorn kernels are discarded or used as animal feed.

By removing the tannin component from acorns, the bitterness can be reduced and gluten-free flour can be obtained which have a very important place in the daily diet of celiac patients.

Acorn flour can be used as a wide variety of applications in food production, mainly the production of breads, cakes, cookies, pancakes, pasta, noodles, pizza crust, pie crust, and also to thicken sauces and soups (Polimac, 2016).

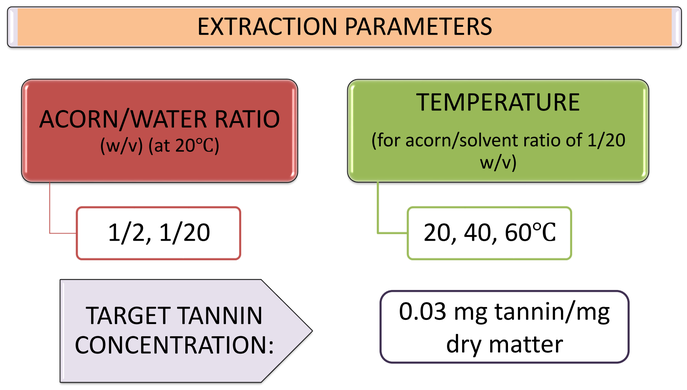
MATERIAL AND METHODS

Acorns were obtained from Ar-Tu Kimya Industry and Trade Inc. (Salihli, Turkey).

Before extraction, acorns were dried in a tray dryer (Eksis Dryer) at 60°C and air velocity of 1 m/s for 38±3 hours to a moisture content of 13%.

Then the kernels which were separated from their shells were divided into average sizes of 5 mm x 5 mm x 5 mm.

The removal of tannins from shredded acorn kernel was investigated by applying aqueous extraction with different acorn/water ratios at different temperatures.



pH: pH value vas determined with pH-meter (Thermo scientific, Orion 5 Star, USA).
Brix: Brix value was determined with a digital refractometer (Hanna, HI96801, USA.
Turbidity: Turbidity was determined with turbidimeter (WTW, TURB 355 IR, USA)
Tannin content: 0.1 g of polyvinyl-polypirrolidone (PVPP) was added to 5 ml of the extract for binding tannins. After vortexing, it was allowed to wait at 4°C for 15 minutes. Then, it was centrifuged (Hettich Zentrifugen, Germany) for 10 min at 3000 rpm and 100 µl of clear supernatant was taken. Then, The Folin-Ciocalteu method was applied and non-tannin phenolic content was determined. Tannin content was calculated as a difference between total and non-tannin phenolic content.

RESULTS AND DISCUSSION

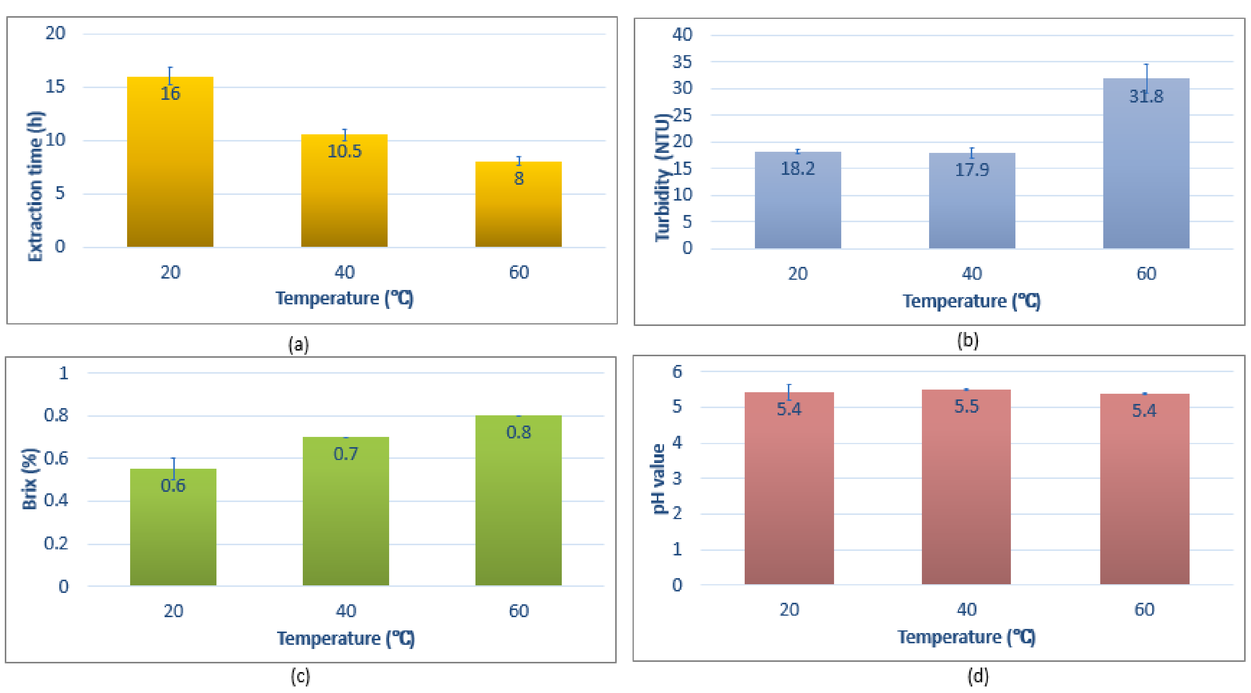


Figure 1. Effect of temperature on extraction time (h) (a), turbidity (b), brix (%) (c), pH (d)

- As the extraction temperature increased, the time to reach the target tannin content of the acorn decreased (p<0.05) (Fig. 1a).
- However, the turbidity at 60°C was higher than those at 40 and 20°C (p<0.05) (Fig. 1b).
- The brix value increased as the temperature increased (p<0.05) (Fig. 1c), but the temperature had no effect on the pH value (p>0.05) (Fig. 1d).

- In the extraction process performed at 20°C, the acorn/water ratio did not affect the extraction time and pH values (p>0.05).
- The turbidity (143.88±7.43 NTU) and brix values (%3.3) increased significantly when extraction was performed at 1/2 (w/v) acorn/water ratio. (p<0.05).

The results of the present study will give valuable information for the efficient removal of tannin from acorn being used in novel gluten-free products.

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