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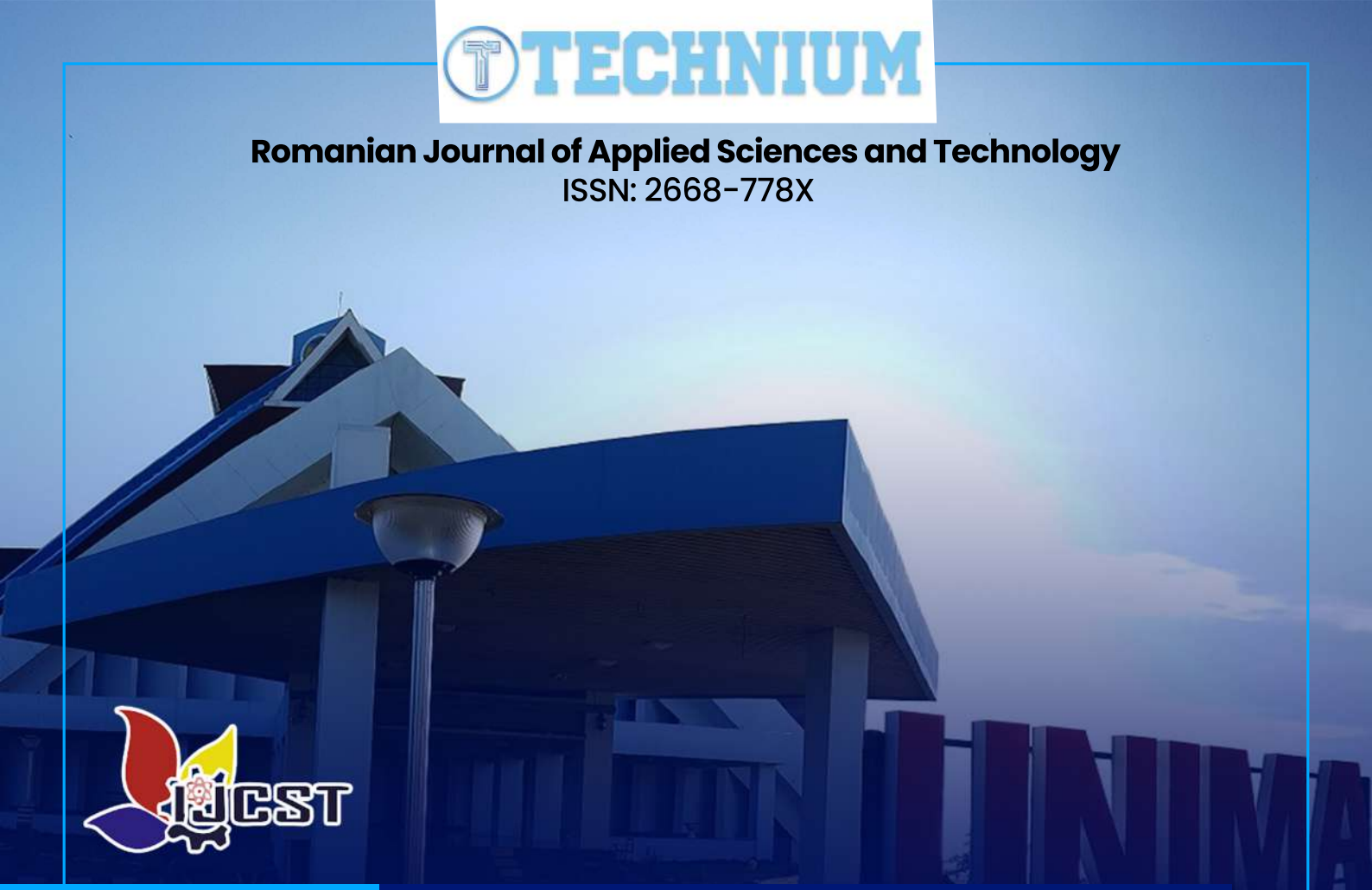

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Utilization of pineapple cobs and peels for fruit leather processing

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Abstract. Pineapple cobs and peels are agricultural waste that have not been utilized optimally, but still have a high nutritional content including carbohydrates and proteins, and contain phenolic compounds and flavonoids. Efforts to utilize the waste of pineapple cob and peels by processing it into fruit leather to increase its economic value. The purpose of this study was to determine the effect of the proportion of cobs: pineapple peel and the addition of carrageenan on product quality, and to determine the best treatment to produce fruit leather with good characteristics and be liked by the panelists. This study used a completely randomized design (CRD) with a two-factor factorial pattern with two replications. Factor I was the proportion of tubers: pineapple peels (w/w) 60:40, 50:50, and 40:60. Factor II was carrageenan concentration of 0.6%, 0.8% and 1%. Based on the results of the study, the best treatment was the proportion of cobss: pineapple peels 50:50 (w/w) with a carrageenan concentration of 1% which produced fruit leather with a water content of 16.26%, reducing sugar content of 24.83%, vitamin C content of 15 .37 mg/100g, antioxidant activity 27.37%, crude fiber content 3.08%, and tensile strength 3.02 N.

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1 Introduction

Fruit leather is a dry candied food product with a moisture content of 10-20% (1) in the form of thin sheets with a thickness of 2-3 mm, has a distinctive taste according to the fruits used, and is high in fiber (2). According to Febrianto (3) the requirements for fruit that can be used for making fruit leather are fruits that are sufficiently ripe, have low water content, contain high fiber, and have a strong flavor. Pineapple cobs has a water content of 83.68%, ash content of 2.13%, pH 4.32, reducing sugar content of 14.38%, pectin content of 1.82% (4), crude fiber 1.39% (5), and vitamin C 68.56 mg/100g (6). Meanwhile, pineapple peels contains 81.72% water, 17.53% carbohydrates, 4.41% protein, 13.65% reducing sugar, 24.4 mg/100g vitamin C, and 59.05% antioxidant inhibition activity (7), crude fiber content of 2.41% (5) and 8% pectin (8). Pineapple cobs and peels also contain phenolic compounds and flavonoids (9). Based on the characteristics of the two materials, they meet the requirements as raw materials for making fruit leather.

The expected criteria for fruit leather are that it has an attractive color, a slightly tough and compact texture, and has good plasticity so that it can be rolled or not easily broken or torn (10). The texture quality of fruit leather production is determined by the acid content, sugar content, and high fiber or pectin content (7).

To improve the texture of fruit leather, a gel-forming agent, namely carrageenan, was added. Carrageenan is used because apart from being hydrophilic, it is because carrageenan is more stable in immobilizing water at lower concentrations and stronger in gel formation. Carrageenan has the property of soluble in hot water and will form a gel at temperatures of 45ºC and 65ºC, is stable at neutral and acidic pH, and is strong in gel formation (11).

The process of forming carrageenan gel begins with the transformation of the carrageenan polymer into random coils. This change was due to the heating process at a higher temperature than the carrageenan gel formation temperature. When the temperature is lowered, the carrageenan polymer will form a double helix structure and produce junction points and polymer chains (12).

Materials and Methods

1.1.1 Materials

The raw materials used are pineapple cobs and peelss, as well as granulated sugar obtained from the Pucang market in Surabaya, and kappa carrageenan obtained from Tristar Stores in Surabaya. As well as chemicals for analysis including distilled water, H2SO4, starch, DPPH, NaOH, K2SO4, Iodine, and methanol.

The tools used are scales, knives, blenders, pans, cabinet dryers, analytical balances, spectrophotometers, texture analyzers. water baths, and glassware for analysis.

1.1.2 Fruit leather processing

Pineapple cobs and peelss are washed and crushed with a blender (with the addition of water: ingredients = 1:1). Then do the mixing of the cobs: pineapple peels as much as 60:40, 50:50 and 40:60 (w/w), carrageenan (0.6%; 0.8%; 1%), and 20% sugar, heating to 70oC for 3 minutes while stirring until homogeneous. The mixture is then printed onto a baking sheet which has been coated with plastic with a thickness of ± 2-3 and dried using a cabinet dryer with a temperature of 70oC for 7 hours. The fruit leather dough is cut into 5 x 5 cm sizes and rolled up and then the product is packaged using polyethylene plastic.

Results and Discussion

Tabel 6. Chemical composition of pineapple cobs and peels

Composition	Pineapple cobs	Pineapple peels
Moisture content (%)	80,82 ± 0,18	79,08 ± 0,19
Reducing sugar content (%)	16,56 ± 0,32	14,20 ± 0,15
Vitamin C content (mg/100g)	72,44 ± 0,92	29,70 ± 0,56
Antioxidant activity (%)	68,10 ± 1,15	58,06 ± 1,15
Crude fiber content (%)	1,53 ± 0,03	2,04 ± 0,03

Table 1 shows that the pineapple cobs has relatively high levels of water, reducing sugar, vitamin C and antioxidant activity than pineapple peel. While pineapple peels has a relatively high level of crude fiber and pH. The crude fiber content of pineapple cobs and pineapple peelss is 1.53% and 2.04% which are almost the same as the research by Sengar, et al (5), namely 1.39% and 2.41%.

Vrianty, et al (6), stated that the antioxidant activity of pineapple cobs is 64.86%, while the antioxidant activity of pineapple peels is 59.05% (7). Antioxidant compounds found in pineapple cobs and peelss, namely phenol compounds and flavonoids (9).

1.1 Reducing sugar and crude fiber content

Fig 1. Reducing sugar content of fruit leather from proportion of pineapple cobs:peels and carraagenan concentration

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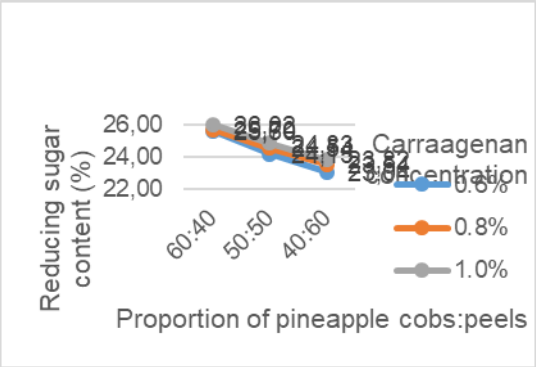

Fig 2. Crude fiber content of fruit leather from proportion of pineapple cobs:peels and carraagenan concentration

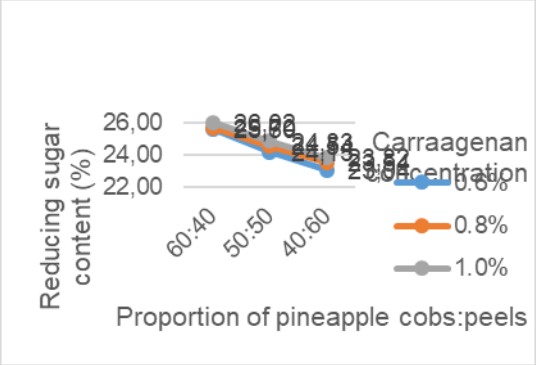

Fig 1 and 2 show that the higher the proportion of pineapple cobs and the higher the carrageenan concentration, the higher the reducing sugar content of the product. This is because the pineapple cobs has a higher reducing sugar content of 16.56%, compared to pineapple peels which is equal to 14.20%. According to Efendi, et al (4) that the reducing sugar content of the pineapple cobs is 14.38%, while the reducing sugar level in pineapple peels is 13.65% (8).

The crude fiber content of the product increased with the increase in the proportion of pineapple peels and the addition of carrageenan. This is because the pineapple peels has a higher crude fiber content of 2.04%, compared to the pineapple cobs of 1.53% (Table 1). Meanwhile, carrageenan contains 6.61% crude fiber (13).

Sengar, et al (5), stated that the crude fiber content of the pineapple peels was 2.41%, while the crude fiber content of the pineapple cobs was 1.53%. The fiber content in the material plays a very important role in the manufacture of fruit leather. This can make the texture of the resulting fruit leather more elastic, compact, and not sticky (14).

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1.2 Vitamin C content and antioxidant activity

Fig 3. Antoxidant activity of fruit leather from proportion of pineapple cobs:peels and carraagenan concentration

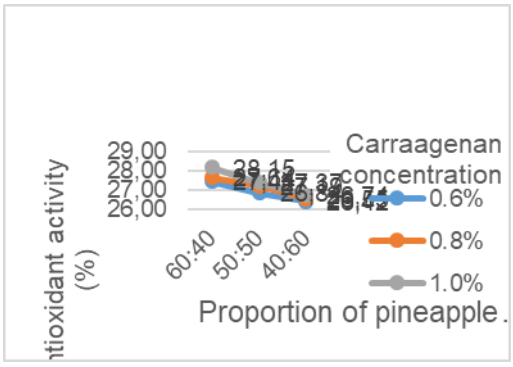

Fig 4. Vitamin C of fruit leather from proportion of pineapple cobs:peels and carraagenan concentration

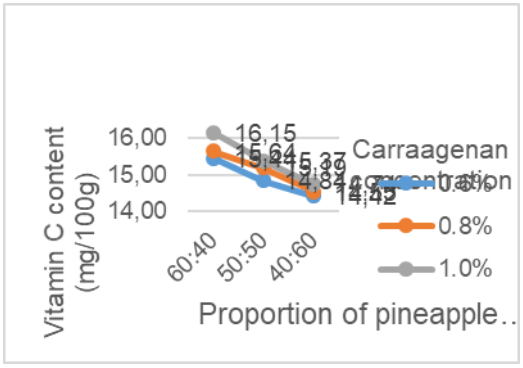

Fig 3 and 4 show that the higher the proportion of pineapple cobs and the addition of carrageenan will increase the antioxidant and vitamin C activity of the product. This is because the pineapple cobs has a higher antioxidant activity (68.10%), compared to the pineapple peels (58.06%) (Table 1).

Similarly, pineapple cobs have higher levels of vitamin C, namely 72.44 mg/100g, compared to pineapple peels, which is 29.70 mg/100g (Table 1). the vitamin C. This is also supported by Titin, et al (15), that the vitamin C content of the pineapple cobs is 68.56 mg/100g, while the vitamin C content of pineapple peels is 24.4 mg/100g.

The addition of carrageenan is able to prevent the oxidation of antioxidant compounds during the heating process in the manufacture of fruit leather, because carrageenan is a hydrocolloid compound which has properties that can bind water and can protect the components in the material from heating and avoid the loss of antioxidant compounds and vitamin C products.

1.3 Moisture content and Tensile Strength

Fig 5. Moisture content of fruit leather from proportion of pineapple cobs:peels and carraagenan concentration

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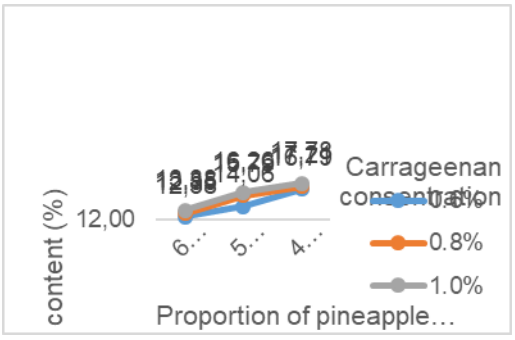

Fig 6. Tensile strength of fruit leather from proportion of pineapple cobs:peels and carraagenan concentration

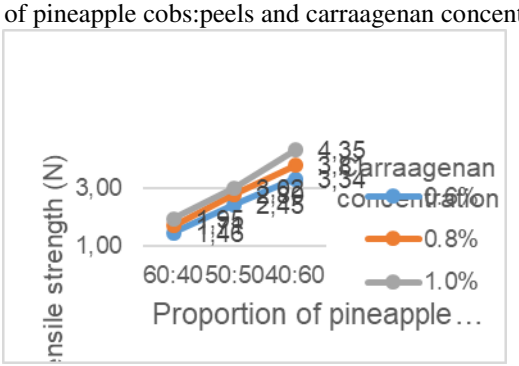

Fig 5 and 6 show that the lower the proportion of pineapple cobs and the higher the proportion of pineapple peels, and the more carrageenan is added, the water content of the fruit leather increases. This is because fiber is easy to bind water so that the higher the fiber content will increase the water content of the product.

Fiber is able to bind water and maintain texture (14). This is also supported by Legowo and Nurwanto (16) who stated that the higher the hydrocolloid concentration, the more water bound in the hydrocolloid network, and the formation of a gel in carrageenan occurs due to cross-linking of polymer chains so that a continuous three-dimensional mesh is formed which will catch the water in it so as to form a strong and rigid structure (17).

Conclusion

Analysis of variance showed that the treatment and significant interaction on the levels of reducing sugars, crude fiber, water, vitamin C and antioxidant activity of fruit leather products. The best treatment was the proportion of cobs: pineapple peel 50:50 with the addition of 1% carrageenan concentration, resulting in a water content of 16.26%, a reducing sugar content of 24.83%, a vitamin C content of 15.37 mg/100g, an antioxidant activity of 27.37%, crude fiber content 3.08%, tensile strength 3.02 N, and total food fiber content 20.21%.

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