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EXTRACTION OF PECTIN FROM PASSION FRUIT RIND (*PASSIFLORA EDULIS VAR. FLAVICARPA DEGENER)* FOR *EDIBLE COATING*

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Abstract. One of fruit preservation method is by applying the edible coating. Rind of passion fruit (*Passiflora edulis var. flavicarpa Degener*), which is kind of waste, can be utilized as edible coating through pectin extraction process. The purposes of this work were to determine the suitable solvent for the pectin extraction and techniques for applying the produced edible coating on strawberry, to produce edible coating from the pectin, and the test the performance of the edible coating which was applied to strawberries. Pectin from passion fruit rind was collected through conventional extraction method using two types of solvent, i.e. acetic acid solution and hydrochloric acid solution with concentration of 0.01 N, 0.015 N, 0.02 N, 0.025 N, and 0.03 N. The results showed that chloric acid solution was more suitable for the pectin extraction from passion fruit. Maximum yield of 30.78% was obtained at hydrochloric acid concentration of 0.02 N. Obtained pectin from the extraction was then processed into the edible coating by adding plasticizers and calcium chloride dihydrate. Storability of the coated strawberry was observed to measure the performance of the edible coating

INTRODUCTION

Passion fruit (*Passiflora edulis)* is originally from Brazil. This fruit has variation in colors such as black, purple, and yellow [1]. This fruit was then spreadto some regions in Indonesia, i.e. at Gowa highland, Malino, South Sulawesi, North Sumatera, West Sumatera, and West Java. Passion fruits, is also known as Markisa, are consumed as fresh fruit or can be processed into syrup, traditional food, etc. In 2003, production of passion fruit in Indonesia reached 71,899 tons and it increased to 131,988 tons in 2010 [2]. About fifty one percent of the passion fruit is its rind [3]. Usually, the passion fruit rinds from passion fruit extract/syrup are left as waste. This waste is potential to be processed into the more valuable material. Astuti (2011) found out that passion fruit rind powder and seeds could be processed into food supplement [4]. Passion fruit rind contains pectin around 14%w [5] that can be collected through extraction using chemicals, microwave induced [6], and ultrasound [7]. This research was aimed to find the proper solvent for the pectin extraction process, to produce edible coating from pectin, and to test the performance of the edible coating which was applied to strawberries.

Pectin is kind of group of polysaccharides which available in plant cell which influence the integrity and rigidity of the plant tissue. Pectin contains aldehyde, ketone, carboxylate, ester, carbonyl, and alkene [8]. It plays important role in defense against plant pathogens and wounding [9]. Pectin is widely used in food industry as gelling agent, thickener, stabilizer, and edible coating.

The edible coating is a film which is not harmful to be eaten so that it may be placed on top or in between food component. Edible coating is functioned to hinder water transfer, to avoid flavor loss, to improve firmness, and as additive component carrier [10]. In fruit preservation, pectin based edible coating plays role as water resistant membrane.

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MATERIAL AND METHODS

Materials

Raw material used in this research was rinds of yellow passion fruit (Passiflora edulis flavicarpa degener) from the local market in Surakarta. Other materials were aquadest (H_2O), hydrochloric acid (HCl 95%w, acetic acid (CH_3COOH), ethanol (C_2H_5OH), glycerol, and calcium chloride dihydrate ($CaCl_2.2H_2O$). Strawberries were used to test the performance of the edible coating.

Extraction of Pectin from Passion Fruit Rinds

The first step of the pectin extraction was to collect the albedo yellow passion fruit using the spoon. Albedo was dried under the sun until the water content was about 51%. Dried albedo was then blended and screened to get albedo powder (size less than 40 mesh screen). Two types of solvent were used for the extraction, i.e., HCl and CH3COOH, with concentration variation of 0.01 N, 0,015 N, 0,02 N, 0,025 N, and 0,03 N. Ten grams of dried albedo powder was poured and mixed with 500 ml solvent. Extraction was conducted by heating the mixture until 98°C and this temperature was kept constant for 90 minutes. Next step was to separate the filtrate from the solid. Produced filtrate was then evaporated so that its volume remained half of the original volume. Acid-alcohol solution which was prepared by mixing of C_2H_5OH and HCl) was added to the remained filtrate and settled for 10-14 hours. Solids formed from this process was then filtered and washed using ethanol. Solids was then dried using oven at temperature of 60°C for 14 hours. Pectin produced from extraction was analyzed using Fourier Transform Infrared Spectroscopy (FTIR). Table 1 presents the frequency used in FTIR. Pectin yield can be calculated using Eq. 1.

TABLE 1. Groups in pectin and frequency range

Group	Frequency (cm^{-1})
Aldehyde, ketone, carboxylate, ester	1740.83
Carbonyl	1633.78
Alkene	948.05

$$Yield\ (\%) = \frac{Weight\ of\ Pectin\ (gram)}{Weight\ of\ dried\ albedo\ powder\ (gram)}\ x100\ \% \quad (1)$$

Production of Edible Coating

One and half grams of pectin was mixed with 100 ml of glycerol solution (1%w). This mixture was then heated to 70°C and steered for 90 minutes. Pour calcium chloride dihydrate solution slowly into the pectin solution. This solution was then air cooled to room temperature.

Edible Coating Performance Test

Strawberries were immersed in edible coating solution in varied immersing duration time (15, 30, and 45 seconds). Number of immersion was varied from 1, 2, and 3 times. Performance test was conducted by visual observation and measuring the strawberry weight reduction. Criteria for the strawberry's conditions were its firmness (dry or wet),

appearance of the fungus after certain storing period. Weight reduction was calculated using Eq. 2, based on the weight of the strawberry.

$$Weight\ reduction = initial\ weight - final\ weight \quad (2)$$

RESULTS AND DISCUSSION

Effect of Type and Concentration of Solvent on Pectin Extraction

Fig. 1 shows the amount of pectin which has been extracted from dried albedo using various concentration of HCl and CH_3COOH solution. Pectin rendemen was influenced by the concentration of the solvent. Low pectin rendemen were produced during extraction, for both solvents, when solvent concentration were below 0.2 N. These happened because at low concentration, both solvents were not able to solve dried albedo completely, thus it hindered the extraction process. At solvent concentration of 0.01 N and 0.015 N, extraction using solvent CH_3COOH produced more pectin than while using solvent HCl. The amount of pectin reached maximum when extraction was conducted using It is showed HCl with concentration of 0.2 N, with yield value of 30.87%. This phenomenon was caused by the hydrolysis process of the protopectin to form pectin through heating process in acid environment. At concentration of HCl higher than 0.2 N, pectin rendemen decreased. This happened because the solvent has already saturated with pectin, thus pectin formed during hydrolysis process was not able to solve in solvent.

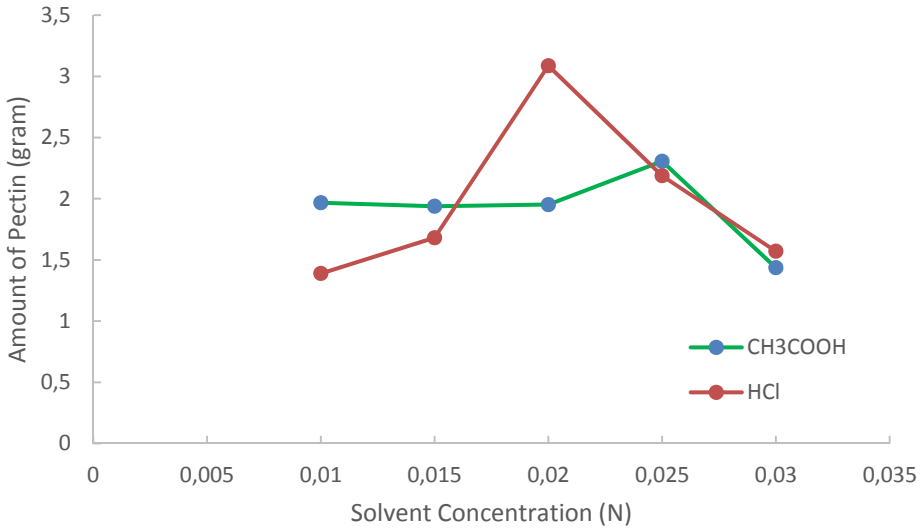


FIGURE 1. Effect of solvent type and concentration on pectin extraction

Fig. 2 presents the groups contented in pectin produced from extraction using HCl with concentration of 0.2 N and frequency used in FTIR

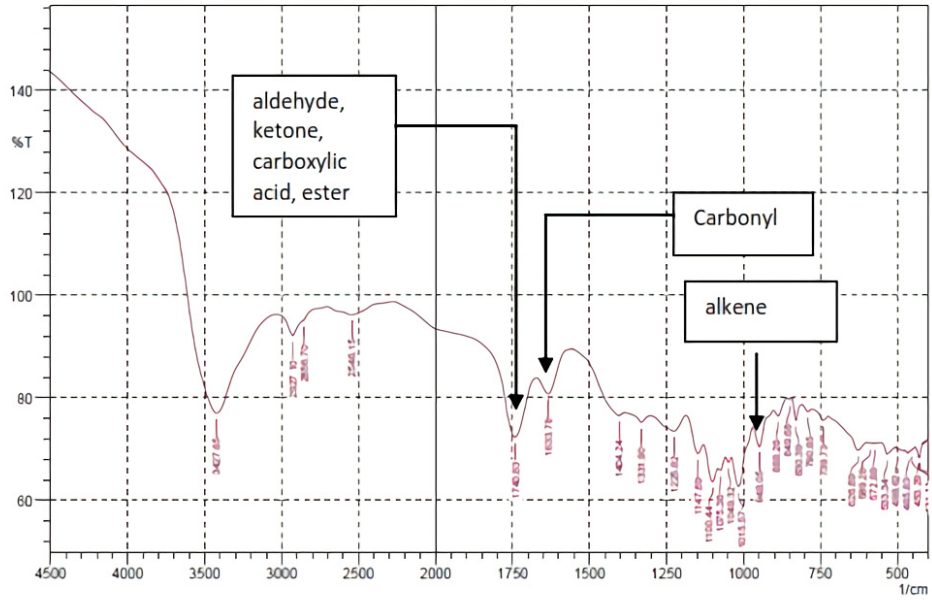


FIGURE 2. Groups in pectin produced by extraction using HCl 0.2 N

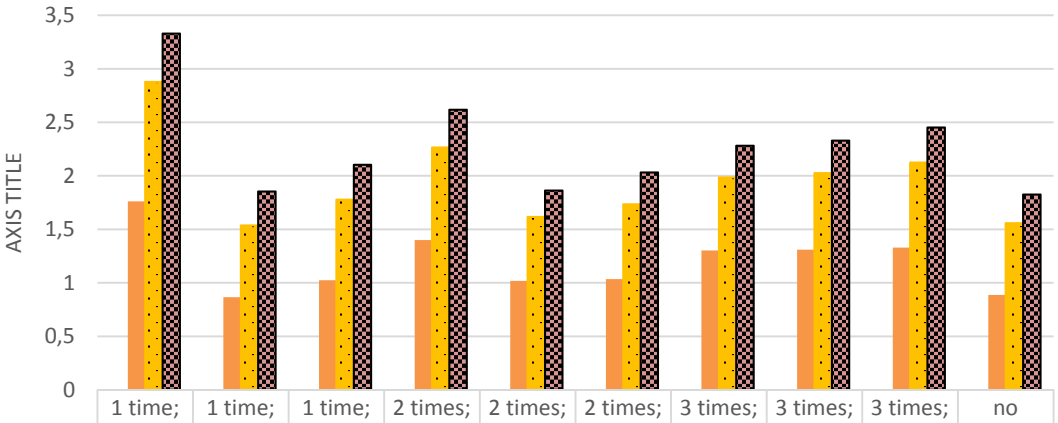
Effect of Immersion time on Strawberry Storability

Performance test results of the edible coating applied on strawberries based on visual observation is presented in Table 2. From the table, it can be seen that strawberry condition was still in good shape when it was coated using edible coating with 1 and 2 times immersion for 30 seconds immersion time.

TABLE 2. Edible coating performance test

Edible coating applied	Number of immersion	Immersion duration time (seconds)	Storage time (days)	Strawberry physical condition
No	0	0	2	Wet, fungus appeared
Yes	1 time	15	1	Dry, fungus appeared
		30	3	Dry
		45	2	Dry, fungus appeared
Yes	2 times	15	1	Dry, fungus appeared
		30	3	Dry
		45	2	Dry, fungus appeared
Yes	3 times	15	2	Dry, fungus appeared
		30	2	Dry, fungus appeared
		45	1	Dry, fungus appeared

Influence of the immersion time using edible coating formulated using pectin from passion fruit is presented in Fig. 3. Pectin used for edible coating was produced by extraction using HCl with concentration of 0.02 N.



	1 time; 15 sec	1 time; 30 sec	1 time; 45 sec	2 times; 15 sec	2 times; 30 sec	2 times; 45 sec	3 times; 15 sec	3 times; 30 sec	3 times; 45 sec	no coating
day 0	0	0	0	0	0	0	0	0	0	0
day 1	1,762	0,866	1,024	1,4	1,018	1,035	1,302	1,31	1,329	0,886
day 2	2,877	1,537	1,777	2,265	1,615	1,733	1,985	2,026	2,124	1,558
day 3	3,329	1,854	2,103	2,618	1,863	2,032	2,281	2,329	2,451	1,825

FIGURE 3. Effect of Pectin Coating on Strawberries Weight Reduction

It can be seen that the weight of strawberry least reduced when it was edible coated, with 1 time immersion for 30 seconds. Weight reduction is usually caused by water evaporation and respiration through the skin. With thicker coating, weight reduction of the strawberry was higher. This was caused by trapping the heat inside the strawberry, thus increasing the rippening speed and strawberry was spoiled faster. Proper thickness of the coating prevents those phenomena.

CONCLUSIONS

From the results of this research, it can be concluded that pectin can be extracted from yellow passion fruit. Hydrochoric acid (HCl) was more suitable for pectin extraction of dried albedo powder from yellow passion fruit. Maximum pectin yield was achieved in extraction using HCl with concentration of 0.2 N. Strawberry can be stored longest in good condition when immersed 1 and 2 times in edible coating for 30 seconds. Minimum weight loss was achieved when strawberry was immersed 1 time for 30 seconds in pectin edible coating.

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