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Effect of Apple Dregs Mass and Processing Time on Pectin Extraction from Apple Dregs

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ABSTRAK

Buah apel berpeluang untuk dikembangkan potensinya secara maksimal. Pada proses pengambilan sari apel akan diperoleh ampas apel. Dari ampas tersebut dapat diolah lebih lanjut atau diekstraksi sehingga diperoleh pektin. Penelitian ini dilakukan dengan tujuan untuk menentukan waktu dan massa ekstraksi yang optimum untuk menghasilkan pektin dari ampas buah apel. Prosedur percobaan meliputi: persiapan bahan baku, proses ekstraksi, destilasi, pengeringan dan analisa hasil. Metode yang digunakan adalah ekstraksi padat-cair dengan menggunakan pelarut etanol. Waktu dan massa ampas apel dan suhu sesuai dengan varabel berubah yang telah ditentukan yaitu untuk variable waktu ekstraksi 120 menit, 150 menit, dan 180 menit, sedangkan massa ampas apel kering 65 grm, 70 grm, dan 75 grm sedangkan suhu operasi tetap 70°C.dan bahan pengendap yang yang digunakan adalah alcohol atau etanol 95% dengan asam asetat 50% sebagai pelarut, serta analisa kandungan pektin dengan spektrofotometri (UV-VIS). Dari hasil penelitian bahwa pada konsentrasi terendah 0,002 ppm dan absorbansi terendah 0,006 nm. Dimana konsentrasi tertinggi 2,5 ppm dan absorbansi tertinggi 0,241 nm, sehingga terbentuk kurva kalibrasi yang berbentuk liniear dimana y = 0,0936x + 0,0111 dan R^2 = 0,9931. Dari hasil analisa grafik hubungan antara pengaruh konsentrasi dan massa terhadap waktu pada proses ekstraksi pektin ampas apel menunjukkan konsentrasi tertinggi sebesar 1,9 ppm pada massa 70 dengan waktu 180 menit dan konsentrasi terendah 0,7 ppm pada massa 65 dengan waktu 120 menit.

ABSTRACT

Apples have the opportunity to develop their potential to the fullest. In the process of taking apple cider, apple dregs will be obtained. The dregs can be further processed or extracted to obtain pectin. This research was conducted to determine the optimum extraction time and mass to produce pectin from apple dregs. The experimental procedure includes raw material preparation, extraction, distillation, drying, and yield analysis. The method used is solid-liquid extraction using ethanol solvent. Time and mass of apple dregs and temperature according to the changing variables that have been determined, namely for the variable extraction time 120 minutes, 150 minutes, and 180 minutes, while the mass of dry apple dregs was 65 grams, 70 grams, and 75 grams while the operating temperature remained 70°C and the precipitating agent used is alcohol or 95% ethanol with 50% acetic acid as a solvent, as well as analysis of pectin content by spectrophotometry (UV-VIS). The study results showed the lowest concentration of 0.002 ppm and the lowest absorbance of 0.006 nm. Where the highest concentration is 2.5 ppm, and the highest absorbance is 0.241 nm, a calibration curve is formed linearly where y = 0.0936x + 0.0111 and R2 = 0.9931. From the results of the graphical analysis of the relationship between the effect of concentration and mass on time in the apple dregs pectin extraction process, the highest concentration was 1.9 ppm at mass 70 with a time of 180 minutes, and the lowest concentration was 0.7 ppm at mass 65 with a time of 120 minutes.

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1. INTRODUCTION

In extracting apple cider, apple dregs will be obtained, which is economically relatively low in value compared to fresh apples. Usually, this waste is thrown away, used as a mixture of animal feed, or added to the manufacture of certain foods. Even though the dregs contain a substance that is quite valuable and useful, if the dregs are further processed or extracted, a product called pectin will be obtained. Pectin in plants functions as an adhesive between cells so that they blend [1]. Pectin is present in the form of protopectin, which is insoluble in water, and when cells become mature, the protopectin will turn into pectin, which is soluble in water [2].

Pectin is widely used in various food, beverage, pharmaceutical, and other industries [3]. Soxhlet extraction is the separation of dry matter which is carried out intermittently or continuously which is carried out with a Soxhlet apparatus; in Soxhlet extraction, the solid-liquid method (leaching) is carried out because the tool is simple and efficient; this is due to the solvent dripping back into the soxhlet in a pure state because the solvent which already contains the solute is heated at 800C so that the steam that occurs comes from the solvent alone [4]. This study aimed to determine the effect of time and mass on the extraction of pectin from apple dregs.

Apple skin contains much pectin (a type of soluble dietary fiber), which, when eaten or juiced with the flesh, will be helpful as a cleanser of toxins from the body [5]. The vitamin C and potassium content in apples is high, but the fruit sugar content is low [6].

Pectin is a cell adhesive material in the plant of origin so that the cells can unite with each other [7]. *Pectin* is a polysaccharide purified through an extraction process from plant parts with dilute acid treatment. Pectin is a fine powder, yellowish white, and practically odorless. In general, pectin is soluble in water and insoluble in organic solvents [8]. The main component of pectin is D-galacturonic acid which has undergone polymerization, and there are also L-rhamnose, D-galactose, L-arabinose, and D-xylose groups. Pectin hydrolysis will give galacturonic acid as a derivative of galactose, whose alcohol group attached to the sixth carbon atom is oxidized to a carboxyl group and methyl alcohol [9].

Pectin can quickly become jelly when added to water and sugar in an acidic condition [10]. However, the straightforward nature of the jelly is highly dependent on the number of methoxyl groups in the molecule. The higher the methoxyl content, the faster the pectin produces jelly [11] [12]. Pectin is more stable in acidic solutions than alkaline.

Pectin coagulation can be carried out using organic solvents such as alcohol and acetone [13]. The methoxyl group in pectin is a pectin that is very influential in jelly formation. The ability to form jelly is determined by the high and low content of methoxyl groups in pectin [10].

Pectin compounds are located in the middle (intercellular commenting layer) and in the central plant cell sensing. In young fruit, the cell adhesive is called protopectin or pectin, while in ripe fruit, the protopectin will turn into pectin [14]. High pectin content is found in fruits and vegetables, while low pectin content is found in wood and some plant seeds. Some fruits with high pectin levels are apples, oranges, pears, and gooseberries, while those with low pectin levels are cherries, blackberries, and strawberries [15].

Based on the methoxyl content, pectin can be divided into two groups, namely pectin with high methoxyl content (7-14%) and pectin with low methoxyl content (less than 7%) [8]. Besides that, the quality of pectin can be analyzed to determine the ash content.

The principal process of making pectin powder includes several stages: preparation of raw materials, extraction, precipitation, separation of precipitates, and drying. The raw material used in the manufacture of pectin must be dry. This is because if the raw material is wet, the material will break easily during the extraction process into mush, so the extraction process cannot be carried out economically. In addition, wet raw materials will be elementary for microorganisms to grow to inhibit the extraction process, and the product produced is not optimal [16].

Chemicals that can be used to adjust the degree of acidity are ethanol and acetic acid. These materials function to release and dissolve pectin bound in the network during the process [17].

The results of Rising Parasu's research (2021) in pectin extraction using melon rind dregs stated that the yield value of pectin at each extraction time of 60, 90, and 120 minutes, respectively, was 4.16%, 11.91%, 5.49% for melon dregs and 2.29%; 6.86%; 3.57% for melon skin [18]. Meanwhile, Tjhang Winny K (2017) showed that the extraction of pectin from Pontianak orange peels stated that the highest yield of pectin from Pontianak orange peels obtained from pectin extraction with a temperature of 75°C, namely 20.48% and a time of 60 minutes, which was equal to 27, 54% [19].

From the literature study related to pectin extraction, the researchers wanted to see the effect of processing time and material mass on the extraction of pectin from apple dregs, so that optimal processing conditions for extracting pectin could be obtained.

2. RESEARCH METHODS

This research was conducted at the Chemistry Laboratory of Tribhuwana Tunggadewi University. The materials used were dried apple dregs, ethanol, and acetic acid. The primary tool used is extraction equipment complete with a Soxhlet column and a distillation apparatus. The analytical test used is spectrophotometry. This research was started by washing the apples, cleaning them, and weighing them. Then add water to the blender and take the dregs to dry using the oven at 100°C for ± 1 hour until completely dry.

The extraction tool is installed with the socket column and the heater. Then 65 grams of dried apple dregs was taken from the initial treatment, then extracted for 120 minutes using 200 ccs of ethanol solvent; the result was a yellow extract solution. This yellow extract solution is then distilled at a temperature of ± 70°C. Furthermore, this extraction process was repeated until the weight of the dregs was 70 grams, with an extraction time of 150 minutes, and the weight of the dregs was 75 grams, with a time of 180 minutes.

The distillation process is carried out until the solvent is separated and the resulting residue is a pink solution. This residue is then poured onto a watch glass that has previously been weighed empty; then, the residue is left in the open air until the material is semi-solid or a pink paste. Then the weight of the paste formed was recorded. The resulting paste is called oleoresin. The oleoresin produced from each sample was weighed as much as 0.01 gram, after which it was dissolved with 50% acetic acid, which was then marked in a 50 ml volumetric flask. The solution was put into the cuvette, and the absorbance was measured at a wavelength of 420 nm

3. RESULTS AND DISCUSSION

Effect of Pectin Standards on Various Concentrations

This pectin can be in the form of dry flour and is used in various industries, both food, beverage, and pharmaceutical, the purpose of which can also be used to make preserved food. Variation of concentration on absorbance (nm) with variations in concentration 0.002 ppm, 0.00252 ppm, 0.00375 ppm, 0.005 ppm, 1 ppm, 1.5 ppm, 2 ppm, 2.5 ppm, with an absorbance of 0.006 nm, 0.007 nm, 0.008 nm, 0.014 nm, 0.123 nm, 0.152 nm, 0.193 nm, 0.241 nm. The results of measuring the effect of standard pectin on concentration are shown in Table 1. and Figure 1.

Table 1. Effect of Standard Pectin on Concentration

No	Concentration (ppm)	Absorbance (nm)
1	0,002	0,006
2	0,00252	0,007
3	0,00375	0,008
4	0,005	0,014
5	1	0,123
6	1,5	0,152
7	2	0,193
8	2,5	0,241

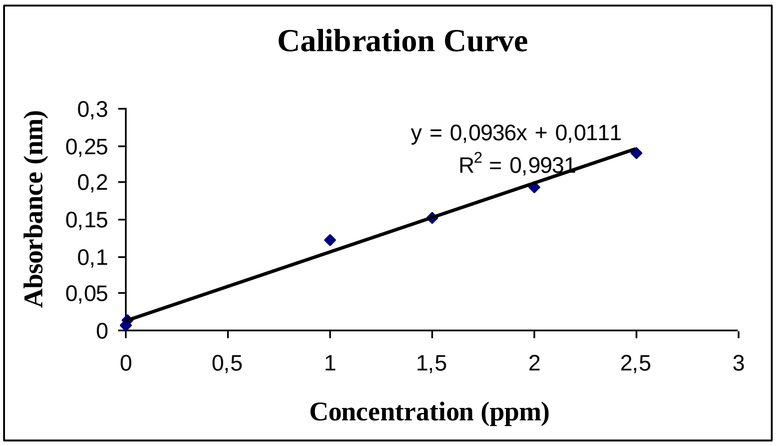

Figure 1. Relationship between Concentration (ppm) and Absorbance (nm)

Figure 1. above shows that variations in concentration can give different absorbance values. At the lowest concentration of 0.002 ppm and the lowest absorbance of 0.006 nm. Where the highest concentration is 2.5 ppm, and the highest absorbance is 0.241 nm, a calibration curve is formed linearly where $y = 0.0936x + 0.0111$ and $R2 = 0.9931$. The results of this study indicate that the higher the concentration, the density of space will increase so that the attractive forces between the particles are getting stronger; this causes the absorbance level to be higher, as seen in the picture above. The Influence Between Concentration Against Time The results showed that the effect of the concentration on the time used for extraction requires five circulations. The viscosity causes the time difference. Solvents concentrated by solutes will find it difficult to circulate again, so it takes a long time to carry out further circulation. The relationship between concentration and time can be seen in Table 2 and Figure 2.

Table 2. Effect of time and mass of pectin extraction from apple dregs

Mass of dregs (gram)	Time (Minute)	Temperature (^{0}C)	Absorbance 1	Absorbance 2	Average of Absorbance	Concentration ppm
65	120	70	0,073	0,074	0,074	0,7
	150		0,094	0,094	0,094	0,9
	180		0,143	0,143	0,143	1,4
70	120	70	0,099	0,099	0,099	0,9
	150		0,107	0,109	0,108	1,03
	180		0,186	0,189	0,187	1,9
75	120	70	0,083	0,086	0,084	0,8
	150		0,108	0,107	0,107	1,02
	180		0,145	0,147	0,146	1,44

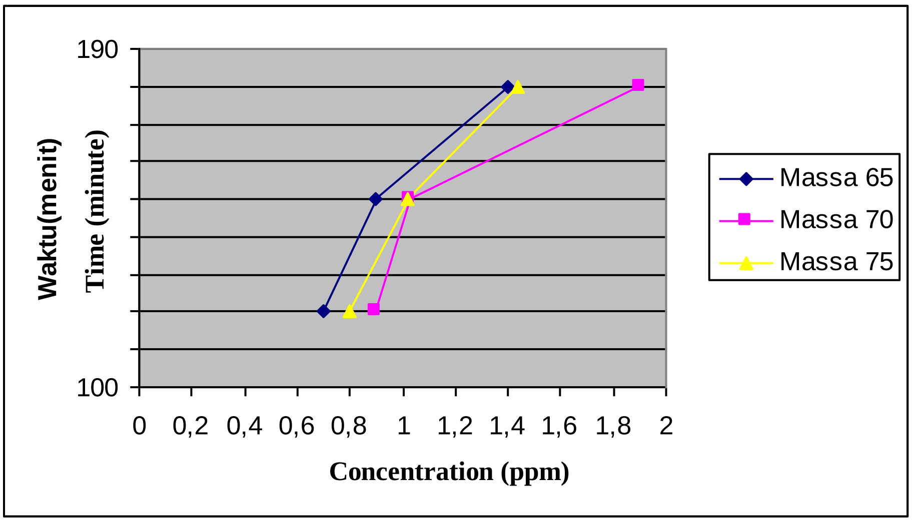

Figure 2. Relationship between concentration (ppm) and time (minutes)

From the results of a graphical analysis of the relationship between the effect of concentration and mass on time in the apple dregs pectin extraction process, the highest concentration was 1.9 ppm at 70-gram mass for 180 minutes, and the lowest concentration was 0.7 ppm at 65 mass for 120 minutes. Where changes in concentration and time significantly affect the mass, at a mass of 70 grams with a time of 180 minutes, there is an increase in pectin levels because solvents with high viscosity have a sizeable frictional force so that solvents penetrate solids more easily. This is evidenced by the weight of the apple dregs, which is too dry so that solutes quickly concentrate the solvent. An increase in mass characterizes the concentration; the higher the concentration and time, the higher the mass. This follows the statement of Yuli Ristianingsih (2014), which states that by extracting the albedo of durian, pectin levels of around 3.09-17.91 grams are obtained [20].

In this case, the pectin extraction time occurs up to 180 minutes; when the extraction time is more than 180 minutes, pectin levels will decrease. The pectin produced ranges from 0.7 ppm to 1.44 ppm with an optimum time of 180 minutes. The more mass of apples with a longer extraction time, the more pectin will be produced; this is because the more mass of apples with a long time, the ethanol solvent has a more significant opportunity to attract compounds (pectin) contained in the apple dregs, p. This causes the concentration of pectin to be higher.

4. CONCLUSION

From the research results on the effect of time and mass extraction of pectin from apple dregs, it can be concluded that at the lowest concentration of 0.002 ppm and the lowest absorbance of 0.006 nm. Where the highest concentration is 2.5 ppm, and the highest absorbance is 0.241 nm, a calibration curve is formed linearly where y = 0.0936x + 0.0111 and R2 = 0.9931. From the results of the graphical analysis of the relationship between the effect of concentration and mass on time in the apple dregs pectin extraction process, the highest concentration was 1.9 ppm at mass 70 with a time of 180 minutes, and the lowest concentration was 0.7 ppm at mass 65 with a time of 120 minutes. Where changes in concentration and time significantly affect the time and concentration, marked by an increase in mass. The higher the concentration and time, the higher the mass.

5. REFERENCES

[1] S. R. Antika and P. Kurniawati, “Isolasi Dan Karakterisasi Pektin Dari Kulit Nanas,” in *Prosiding Seminar Nasional Kimia FMIPA UNESA*, 2017, pp. 218–225.

[2] V. A. Devianti, R. D. Chrisnandari, and R. Darmawan, “Pengaruh Metode Ekstraksi Terhadap Mutu Pektin Dari Kulit Pisang Raja Nangka,” *J. Kim. Ris.*, vol. 4, no. 2, pp. 170–179, 2019.

[3] A. Arimpi and S. Pandia, “Pembuatan Pektin Dari Limbah Kulit Jeruk (Citrus Sinensis) Dengan Metode Ekstraksi Gelombang Ultrasonik Menggunakan Pelarut Asam Sulfat (H_2SO_4),” *J. Tek. Kim. USU*, vol. 8, no. 1, pp. 18–24, 2019.

[4] G. A. R. Saputri, A. M. Ulfa, and N. K. D. Utami, “Determination Of Total Fat Content In Sweetened Condensed Milk Chocolate Sold In Minimarket Bandar

Lampung With Soxhletation Method," *J. Anal. Farm.*, vol. 5, no. 2, pp. 104–110, 2020, [Online]. Available: https://ejurnalmalahayati.ac.id/index.php/analisfarmasi/article/download/4082/pdf.

[5] D. P. N. Falah, N. Kurniaty, and H. A. W, "Pembuatan Dan Karakterisasi Edible Film dari Pektin Buah Apel Hijau," in *Prosiding Farmasi*, 2020, pp. 1–6.

[6] A. D. Sutrisno, Hasnelly, and Habibaturrohmah, "Identifikasi Kandungan (Antioksidan, Vitamin C Dan Serat Kasar) Pada Buah Lokal Dan Impor (Jeruk, Apel Dan Mangga)," *Pas. Food Technol. J.*, vol. 6, no. 1, pp. 1–7, 2019.

[7] D. F. Rosida, *Buku Ajar Modifikasi Pati Dari Umbi-Umbian Lokal Dan Aplikasinya Untuk Produk Pangan*, 1st ed. Surabaya: CV. Putra Media Nusantara (PMN), 2021.

[8] P. Husni, U. K. Ikhrom, and U. Hasanah, "Uji dan Karakterisasi Serbuk Pektin Hasil Ekstraksi Albedo Durian sebagai Kandidat Eksipien Farmasi," *Maj. Farmasetika*, vol. 6, no. 3, pp. 202–212, 2021.

[9] R. S. S. Tumangger, Muhammad, N. ZA, Jalaluddin, R. Nurlaila, and Z. Ginting, "Pengaruh Asam Nitrat (Hno3) Sebagai Pelarut Pada Ekstraksi Pektin Dari Okra (Abelmoschus Esculentus)," *J. Teknol. Kim. Unimal*, vol. 11, no. 1, p.) 91-101, 2022.

[10] H. Husnawati, I. Y. Astutik, and L. Ambarsari, "Karakterisasi Dan Uji Bioaktivitas Pektin Dari Kulit Pisang Kepok (Musa balbisiana) Hasil Ekstraksi Dengan Berbagai Pelarut Asam," *Curr. Biochem.*, vol. 6, no. 1, pp. 1–10, 2019.

[11] D. Silsi, L. Susanti, and M. Febreini, "Rendemen Dan Karakteristik Pektin Kulit Buah Naga Merah (Hylocereus Costaricensis) Dengan Perbedaan Metode Dan Waktu Ekstraksi," *J. Agroindustri*, vol. 11, no. 2, pp. 120–132, 2021.

[12] T. A. B. Irawan and A. Prihanto, "Ekstraksi Pektin Dari Kangkung Darat Menggunakan Pelarut Asam Sitrat," *METANA*, vol. 12, no. 1, pp. 13–16, 2016.

[13] A. Aji, S. Bahri, and Tantalia, "Pengaruh Waktu Ekstraksi Dan Konsentrasi Hcl Untuk Pembuatan Pektin Dari Kulit Jeruk Bali (Citrus maxima)," *J. Teknol. Kim. Unimal*, vol. 6, no. 1, pp. 33–44, 2017.

[14] D. A. Damanik and S. Pandia, "Ekstraksi Pektin dari Limbah Kulit Jeruk (Citrus sinensis) dengan Metode Ekstraksi Gelombang Ultrasonik Menggunakan Pelarut Asam Klorida (HCl)," *J. Tek. Kim. USU*, vol. 8, no. 2, pp. 85–89, 2019.

[15] N. N. Sari and A. Arumsari, "Studi Literatur Metode Ekstraksi Pektin dari Beberapa Sumber Limbah Kulit Buah," *J. Ris. Farm.*, vol. 1, no. 1, pp. 55–63, 2021.

[16] N. E. Handayani and I. D. Kumalasari, "Analisis mikrobiologi dan organoleptik mi basah hasil formulasi dengan penggunaan ekstrak bunga telang (Clitoria ternatea L.)sebagai pengawet alami dan antioksidan," *Agrointek J. Teknol. Ind. Pertan.*, vol. 16, no. 2, pp. 153–163, 2022.

[17] N. K. Y. Kesuma, I. W. R. Widarta, and I. D. G. M. Permana, "Pengaruh Jenis Asam Dan Ph Pelarut Terhadap Karakteristik Pektin Dari Kulit Lemon (Citrus limon)," *J. Ilmu dan Teknol. Pangan*, vol. 7, no. 4, pp. 192–203, 2018.

[18] R. Parasu, E. A. Aisyah, V. Nurhadianty, and L. K. Dewi, "Pengaruh Waktu Ekstraksi pada Pektin Ampas dan Kulit Buah Melon (Cucumis Melo L. var. Sky Rocket)," *J. Rekayasa Bahan Alam dan Energi Berkelanjutan*, vol. 5, no. 2, pp. 24–30, 2021.

[19] T. W. K and M. A. A. M, "Kajian Pengaruh Suhu Dan Waktu Ekstraksi Terhadap Karakteristik Pektin Kulit Jeruk Pontianak Untuk Pembuatan Edible Coating," *J. AGROSAINS*, vol. 14, no. 2, p. 15021, 2017.

[20] Y. Ristianingsih, I. F. Nata, D. S. Anshori, and I. P. A. Putra, "Pengaruh Konsentrasi Hcl Dan Ph Pada Ekstraksi Pektin Dari Albedo Durian Dan Aplikasinya Pada Proses Pengentalan Karet," *Konversi*, vol. 3, no. 1, pp. 30–34, 2014.