

PECTIN EXTRACTION OF SIAMESE PUMPKIN SKIN WITH CONCENTRATION OF HYDROCHLORIC ACID (HCL) SOLUTION

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ABSTRACT

Pectin is commonly used to soften jellies, jams and other products. In addition, fruits and vegetables contain pectin to maintain plant cells. Pectin is a high-value food fiber that can be called a functional food. This pectin plays an important role in gel formation and as a stabilizer in the manufacture of jelly, jam, and marmalade. Pectin is widely used in the food industry because it has the ability to act as a fruit preservative and to form a gel as a base for forming jelly as well as a thickener and stabilizer, while in the food industry it is used in the production of jams, confectionery, pasta and dairy products. The objectives of this study are: To determine the physical and chemical properties and quality of pectin extracted with hydrochloric acid (HCL) and to achieve the optimal concentration of hydrochloric acid solvent. The study was conducted in the agroindustrial laboratory of the agricultural faculty of the university of Tadulako, Palu, Sulawesi Tengah. The duration of the study will be from october 2022 to january 2023. This study is an experimental study based on fruit skins with hydrochloric acid concentrations using a complete one-factor random design (RAL) pattern. The factors tested consist of several hydrochloric acid concentration levels, namely: 1N; 1.5N; 2N; 2.5N; AND 3N. The analytical parameters observed include: yield, methoxil level, water level, ash level and galacturonal acid level. the results of the research carried out that: the concentration of HCl solvent in the extraction of pectin fruit peels is best at a concentration of 3N. The concentration of 3N HCl extracted from the Siamese Pumpkin Skin physical characteristics, namely yield 36.11%, while the chemical properties were 1.99% water content, 0.42% ash content, 3.615% methoxyl content and galactoronate acid 137.88%. and for provide the best quality of pectin from fruit siamese pumpkin skin according to the quality standards set by ippa (international pectin manufacturers association), so it has potential as a thicker and gel forming. based on the results of the research conclusion: Concentration of hydrochloric acid solvent, on extract siamese pumpkin skin best at 3N concentration.

Keywords: Extraction of hydrochloric acid; Siamese pumpkin skin; Pectin.

INTRODUCTION

In Indonesia, *sechium edule* (Jacq.) sw is a horticultural commodity that is often consumed as an accompanying food base and has never been grown commercially. According to a survey conducted by the Central Bureau of Statistics (BPS), the volume of production of Pumpkin siamese oatmeal in 2009 was 321,023 tons per year, then increased to 369,846 tonnes per year in 2010, and eventually reached 428,197 tons a year in 2011. This shows the potential for waste from Pumpkin Siamese is quite large in the form of outer skin, most Siamese Pumpkin is processed into foods. While other parts such as Siamese Pumpkin Skin have not been widely used by the community.

Pectin, a very valuable food fiber that is considered to be a functional food, plays an important role in the formation of gels and serves as a stabilizer in the making of clocks, jelly, and malmalads.

Rosmiati T, 2000 said that the Siamese Pumpkin Skin beetle has a pectin content between 2.7 and 3.3% based on dry weight. If used as a source of pectin, it is expected to improve the quality of Siamese oats.

So far, the pectin needed by the industry has been imported from China, America, Germany, and Denmark, research shows that Indonesia's demand for pectin continues to increase every year According to the study, the amount of demand is estimated to reach 1.320 tons by Devianti, et al, 2020.

Pectins are widely used in the food industry because of their properties as fruit preservatives, thickeners, and stabilizers. Used in the manufacture of salad, candy, pasta, and dairy products. Non-food industries, such as pharmaceutical and cosmetics, use pectin widely (Rofiah S, et., al, 2021).

In the process of plant pectin extraction, hydrochloric acid is often used as a solvent. Previous studies have shown that hydrochloric acid as an extraction solvent can extract pectin with a higher

success rate compared to other solvents. Its position towards the dissociation balance (K) of chloric acid is 107. High K values can cause more dissociated acids and more hydrogen ions, which causes propectin hydrolysis into pectin faster. In addition, a hydrochloric acid solvent is a solvent that produces a higher amount of pectin than other solvents.

Chemical extraction of pectin is usually done using acid extraction, such as tartrate acid, malonic acid, or chloric acid. (HCl). This extraction can be done by heating the skin of fresh fruits for an hour at a temperature of 90-95°C using appropriate acids, such as chloric acid. (HCl). Pectin in the filter is moisturized with acetone or ethanol 96% (Fakhrizal F, et.,al, 2015).

Based on the above description, research should be carried out on the extraction of pectin from the skin of Pumpkin Siamese with a concentration of a solution of Hydrochloric Acid (HCl). Pectin is part of a pectate compound found between the cell walls of vegetables and fruits. In plants, pectins are mainly found in the layers of the skin of the fruit. With the help of acid and sugar, pectin can form a gel.

RESEARCH METHODS

Place and Time. The study was conducted at the Agroindustrial Laboratory of the Agricultural Faculty of the University of Tadulako.

The Research Plan. Research using complete random design (RAL), one-factor pattern Each treatment is repeated 4 times so that 20 units can be obtained. The concentration of treatment in this study is as follows:

- K1: concentration of 1 N
- K2: concentration of 1.5 N
- K3: Concentration of 2 N
- K4: Concentration of 2.5 N
- K5: Concentration of 3 N

Execution of Research. Siamese Pumpkin Skin 100 gram of hallucinations were then

mixed with 100 ml of Hydrochloric Acid with several concentration variations of 1N, 1.5N, 2N, 2.5N, 3N. from the top concentration then produce acid powder. Then in filtration using a tight filter cloth, aiming to separate pectin filtrat. Pectins are moist in analysis to know, fertility, mectosis rate, water content, ash content, galacturonic acid, and pectin quality. Each treatment is repeated 4 times to obtain 20 units of experiment. Complete random design (ral) is used for treatment impact analysis.

Analysis of Data. The data obtained is analyzed statistically with exel software and then proceeds with fingerprint analysis. (ANOVA). If the F count is greater or equal to the F table then it is continued with the real difference test (BNJ) at the level of 5% AND 1%

RESULTS AND DISCUSSION

Rendement. The average yield of pectin produced after the test with BNJ 5% can be seen in Fig.1.

It is suggested that the discussion about the tables and figures should appear in the text before the appearance of the respective tables and figures. No tables or

figures should be given without discussion or reference inside the text.

Fig. 1 Concentrations of 1N HCl were 22.74%, but concentrations of HCl 1.5N, 2N, 2.5N and 3N increased to 23.10%, 25.13%, 32.15%, and 36.11%. According to Fig. 1. This shows that withdrawing the Hydrochloric Acid concentration had a significant impact on the yield of Siamese Pumpkin Skin pectin.

Based on the graph above, the yield of Siamese Pumpkin Skin pectin ranged from 22.74% - 36.11%. The highest yield of pectin was obtained at the concentration of 3N HCl solution with a yield value of 36.11%. This is due to the influence of the acid concentration used so that at a concentration of 3N, the pectin substance contained in the Siamese Pumpkin Skin has been completely absorbed resulting in the highest yield.

Hutomo, et al. 2016, the yield of pectin isolation results is heavily influenced by the extraction time and HCl concentration used. The higher the concentration of Hydrochloric Acid used in pectin extraction will increase the yield of pectin which is obtained.

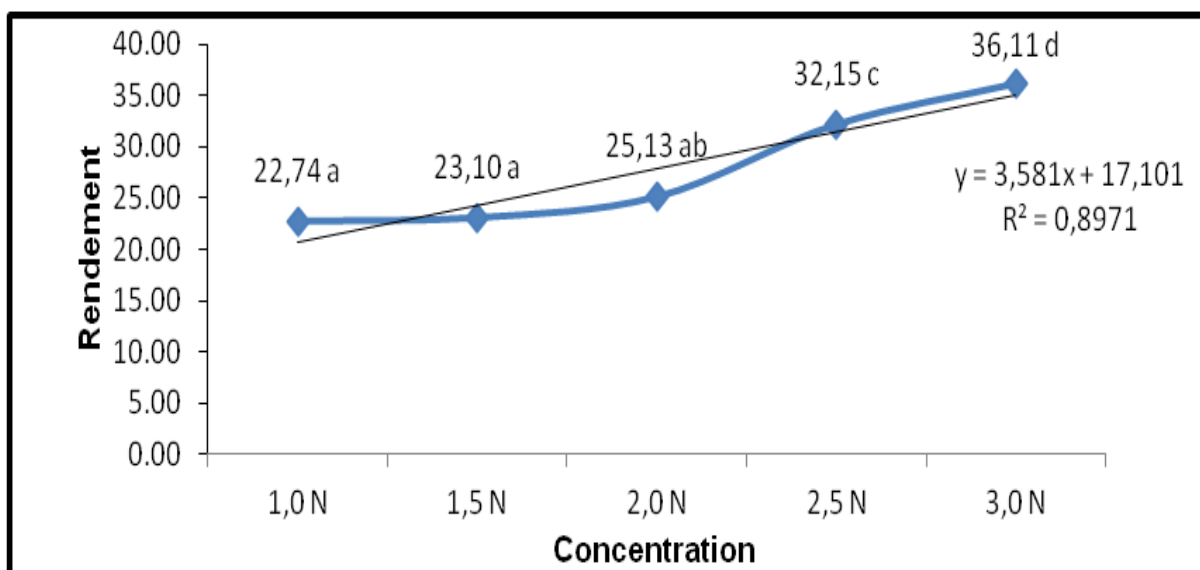


Fig. 1. The average yield of pectin produced after the test with BNJ 5%

Note: the average number followed by the same letter means that it is not significantly different at BNJ 0.05%

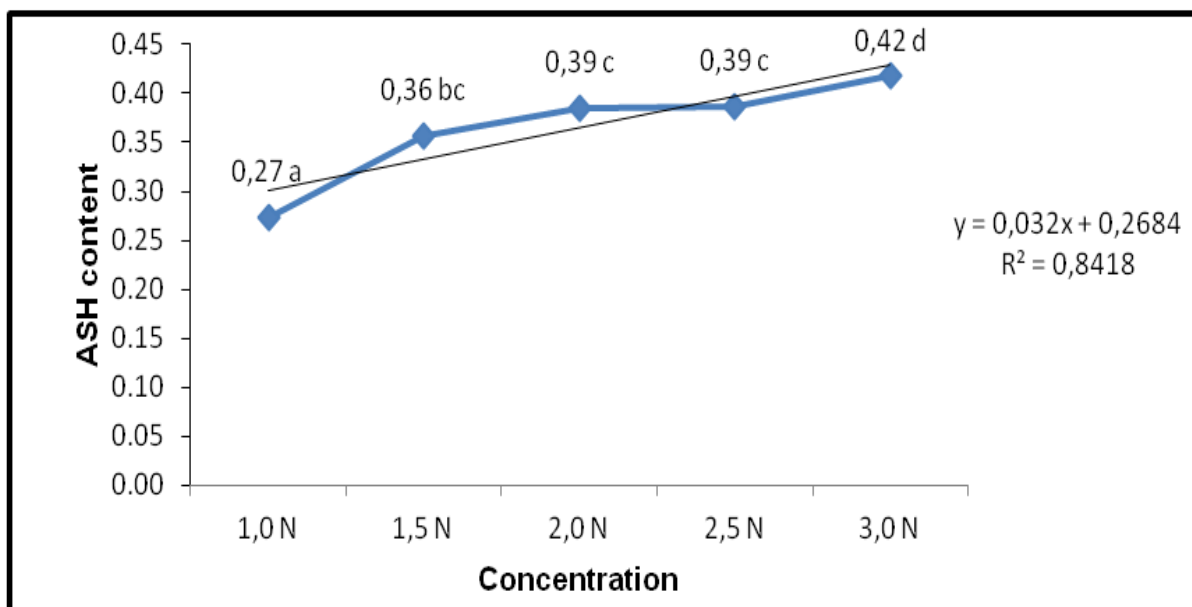


Fig. 2. Shows the average pectin ash levels produced after being tested with a BNJ of 5%
 Note: the average number followed by the same letter means that it is not significantly different at BNJ 0.05

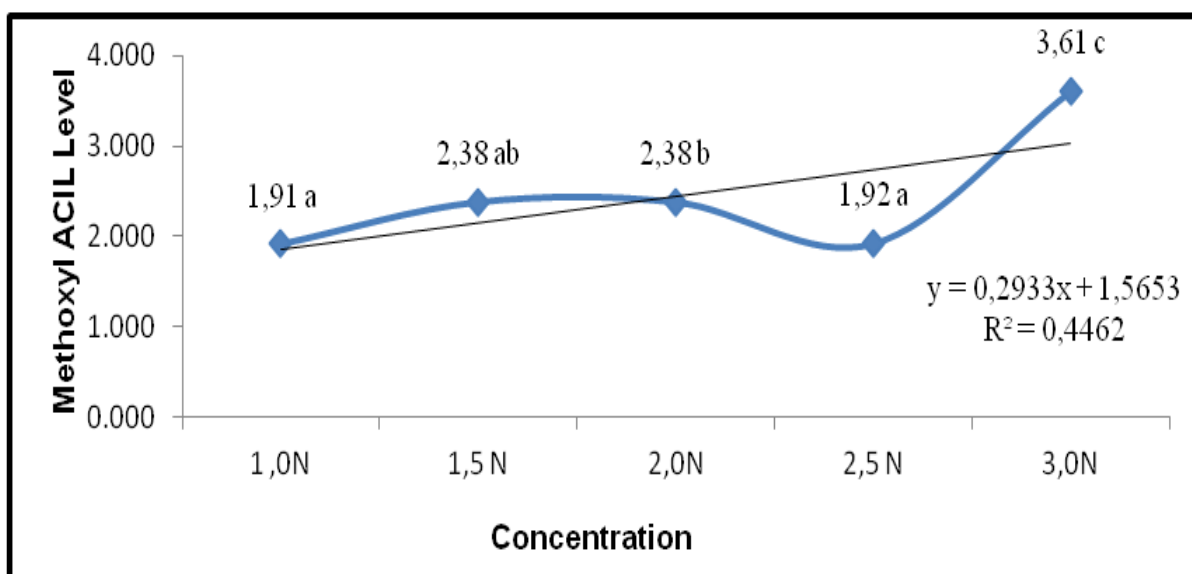


Fig. 3. Shows the average pectin methoxyl acid levels produced after being tested with 5% BNJ
 Note: the average number followed by the same letter means that it is not significantly different at BNJ 0.05%

Changes in Hydrochloric Acid concentration are caused by pectin extraction. This is due to the hydrolysis of protopectin into pectin that can be soluble in water, organic compounds, alkaline compound, and acid causing changes in pectin fertilization (Hanum F, et.,al, 2015).

Then Denia et., al, 2023 stated that the yield of pectin produced by extraction using hydrochloric acid was higher, compared to citric acid

ASH Content. Fig. 2. shows that the treatment of Hydrochloric Acid concentration at Hydrochloric Acid 1N concentration is 0.27%. Subsequently, the concentrations of Hydrochloric Acid 1,5N, 2N, 2,5N, and 3N increased to 0.36%, 0.39%, 0,39%, and 0.42%, respectively.

Based on the graph above, the pectin ash content of Siamese Pumpkin Skin ranges between 0.27% and 0.42%, with the highest concentration being 0.42% in 3N

Hydrochloric Acid solution. The higher the concentration of Hydrochloric Acid solvent, the more ash is produced. This is in line with the research of Maulana, s., 2015, who reported that acid has the ability to dissolve the natural minerals the hydrolysis reaction of protopectin by the acid would increase, thereby increasing the Ca and Mg components in the extract solution.

(Hanum, et al. 2015) stated that protopectin in fruits and vegetables exists in the form of calcium-magnesium pectate and when mixed with acid it will hydrolyze the pectin from its calcium and magnesium bonds. The Ca^{2+} and Mg^{2+}

components will be dissolved in the extract solution and precipitate if the protopectin hydrolysis reaction is increased, so the pectin ash content will also be high.

Methoxyl Acid Levels. Fig. 3. showed that the average methoxyl pectin content of Siamese Pumpkin Skin was 1.91% at a concentration of 1N; however, the concentrations of Hydrochloric Acid 1.5N and 2N increased optimally to 2.38% and 2.38%, while the concentration of 2.5N decreased by 1.92%, but the concentration of 3N increased optimally to 3.61.

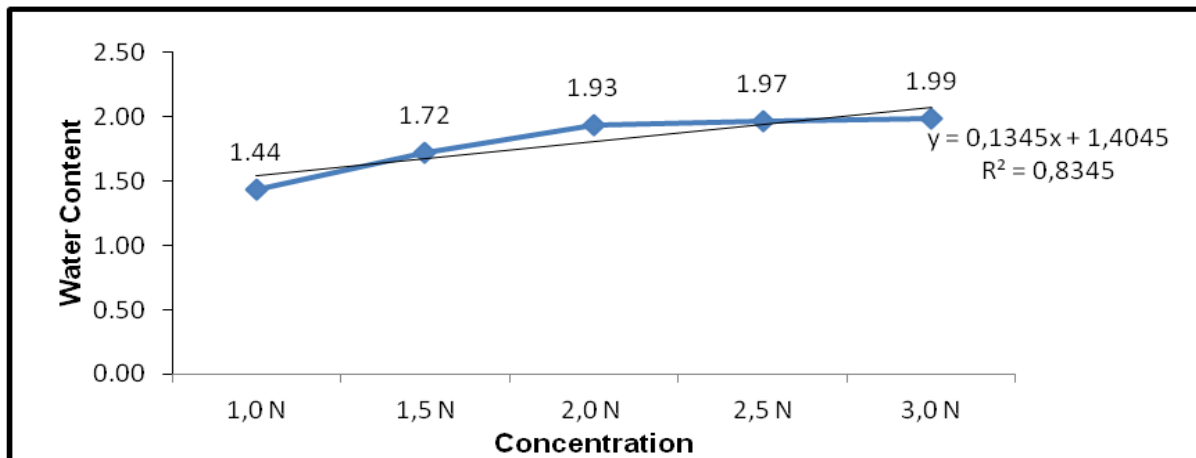


Fig. 4. Shows the average water content of the pectin produced after being tested with 5% BNJ

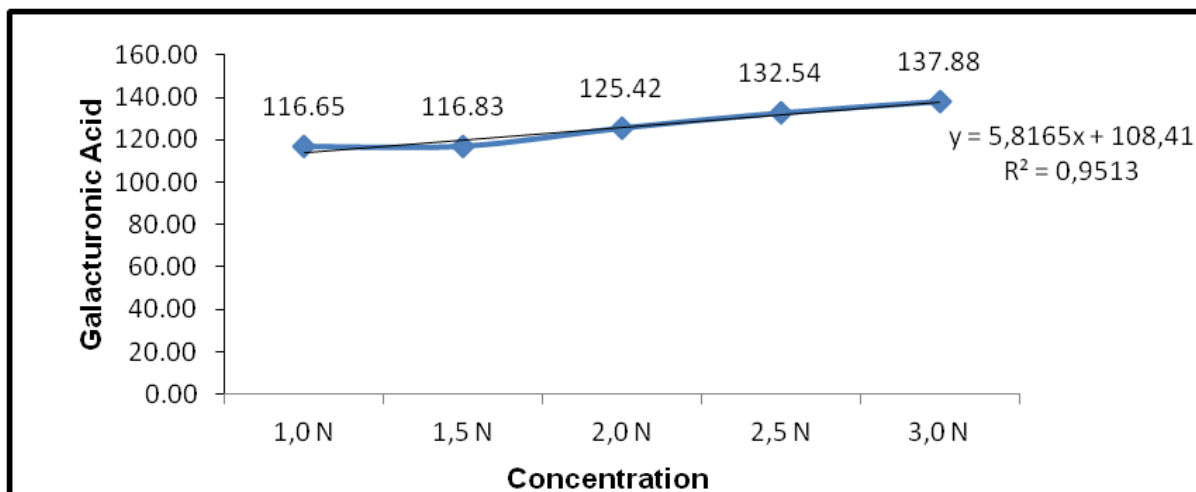


Fig. 5. Shows the average galacturonic acid of the pectin produced after being tested with 5% BNJ

Based on the graph above, the methoxyl content in Siamese Pumpkin Skin pectin ranges from 1.91% to 3.61%. The highest concentration of methoxyl was obtained at the concentration of 3N Hydrochloric Acid with a value of 3.615%. This indicates According to (Erika,2013) methoxyl pectin levels can affect the texture and structure of pectin gels and play an important role in determining the functional properties of pectin solutions.

This is in line with the report by Hanum, et al. (Hanum, et al. 2015) that the more hydrogen ions in the acid used to hydrolyze propectin to dissolved pectin, the more carboxyl groups are esterified in the pectin, increasing the methoxyl content.

(Dwi Dariyono and Elvianto, 2013) found that, with a longer extraction time, the levels of methoxyl pectin increased with higher Hydrochloric Acid concentrations. However, there are ideal conditions where methoxyl pectin levels actually drop, causing pectin degradation.

Pectin can form gels, which are the basic ingredients for preserving fruit and making jelly. Therefore that the pectin obtained in this study was the concentration of 3N Hydrochloric Acid. Including pectin which has a high methoxyl, however, pectin with a high methoxyl must go through a demethylation process for further production pectin is widely used in the food industry.

Water Content. Fig. 4 showed that the Hydrochloric Acid concentration treatment had no significant effect on the pectin water content of Siamese Pumpkin Skin. Results of water content (Fig. 4) After the concentration of 1N Hydrochloric Acid was 1.44%, the Hydrochloric Acid concentrations of 1.5N, 2N, 2.5N, and 3N increased gradually to 1.72%, 1.93%, 1.97% and 1.99%

Based on the graph above, the water content in the dry pectin of Siamese Pumpkin Skin ranges between 1.44% and 1.99%. The results showed that the

concentration of 3N Hydrochloric Acid showed the highest water content, which means that the higher the acid concentration used, the better the pectin extraction process. According to (Febriyanti, et al., 2018), the water content of pectin produced using hydrochloric acid is higher than citric acid. This is because hydrochloric acid has a higher equilibrium constant (K) so the number of hydrogen ions is higher.

(Astuti, et al., 2022) reported that the extraction of pectin from lemons using Hydrochloric Acid solvent produced the highest water content in the 4-concentration treatment and the lowest water content in the 2.5-concentration treatment. This is in line with the report of (Fakhrizal, et al., 2015), showing that the higher the concentration of Hydrochloric Acid solvent, the higher the yield of pectin produced.

Based on these results the water content of the pectin produced in this study ranged from 1.44% -1.99%. According to the pectin quality standard, pectin is declared of good quality if it contains water with a moisture content of <12%. Referring to the description above, it can be stated that the water content of chayote fruit pectin as a result of this study has met the quality standards.

The water content produced can be affected by the yield of pectin, the higher the yield of pectin, the higher the water content produced, (Lumbantoruan et al., 2014) Stating the water content in foodstuffs also determines the level of consumer acceptance and durability of food ingredients, (Lisa, et al., 2015).

Galacturonic Acid. Fig. 5. showed that the concentration of Hydrochloric Acid treatment had no significant effect on galacturonic levels of pectin in Siamese Pumpkin Skin. The results of galacturonic content (Fig. 5) showed that the 1N Hydrochloric Acid concentration was 116.65%, then it increased successively at the optimum Hydrochloric Acid concentration of 1.5N, 2N, 2.5N, and 3N

to 116.83%; 125.42%; 132.54% and 137.88%.

Based on the above graphite, the galacturonic content of Siamese Pumpkin Skin pectin ranged from 116.65% - 137.88%. The optimum concentration is found in 3N Hydrochloric Acid concentration with a value of 137.88%. This is in line with research conducted by (Kesuma, et al., 2018) pectin galacturonic levels increase with increasing acid concentration which is due to increased hydrolysis reaction of protopectin to pectin, whose component is basically D-galacturonic. This means that the higher the concentration of Hydrochloric Acid, the higher the level of galacturonic acid produced. This is because the reaction rate of protopectin hydrolysis increases or the bond breaking of the galacturonic pectin component with other compounds such as cellulose increases, so the levels of galacturonic pectin produced increase.

Higher concentrations result in increased galacturonic acid levels, this is because the higher the concentration, the more H⁺ ions which function to break protopectin bonds with fruit peel cell wall compounds and also unite one pectin molecule with a pectin molecule (Hatimah HG, et, al., 2019).

Based on these results, the levels of pectin galacturonic acid produced in this study ranged from 116.65% - 137.88%. According to the pectin quality standards, pectin is declared to be of good quality if it

contains galacturonic acid levels with a minimum content of 35%. Referring to the description above, it can be stated that the galacturonic acid content of pumpkin siamese fruit pectin from this study has met the quality standards.

The galacturonic content and molecular charge of pectin have an important role in determining the functional properties of pectin solutions. Galacturonic levels can affect the structure and texture of the pectin gel (Munir, M, et, al., 2018).

Pectin Quality. Table 1 By using the chemical characteristics calculated based on methoxyl content, ash content, we can find out the pectin extraction of Siamese pumpkin skin with various concentrations of Hydrochloric Acid correlates with quality standards and pectin quality.

The physical properties of pectin, which are influenced by the chemical properties of pectin, include color, taste, solubility, degree of gel, and speed of freezing, and that pectin does not contain ingredients or substances that are harmful to health (Haryati MN, et, al., 2006).

He often uses the term setting time to standardize pectin. Setting time is the time it takes for a gel to form since the gelling ingredients are added. The speed of gel formation is determined by the quality of the gel. Pectin for industrial use is evaluated and adjusted to pectin quality standards (Rahayu, 2017).

Table 1. Results showing pectin quality standards

Characterization	Pectin Research Results	Pectin Quality Standards
Rendement (%)	22,74-36,11%	-
Water Content (%)	1,44-1,99%	Maks 12%
ASH Content (%)	0,27-0,42%	Maks 10%
Methoxyl Acid Levels (%)	1,918% - 3,615%.	2,5-7,12%
Galacturonic Acid (%)	116,65-137,88%	Min 35%

CONCLUSION

Based on the results of the research that has been done, it can be concluded that: the concentration of Hydrochloric Acid solvent in the extraction of Siamese Pumpkin Skin pectin is best at a concentration of 3N. The concentration of 3N Hydrochloric Acid extracted from Siamese Pumpkin Skin has physical characteristics, namely a yield of 36.11%, while the chemical properties are 1.99% water content, 0.42% ash content, 3.615% methoxyl content, and 137.88% galacturonic acid.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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