

**The 6th Engineering Science
and Technology International
Conference (ESTIC 2021)**
Applied Technology for Sustainable Development

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Editors • Burmawi, Maria Ulfah, Mulyanef, Dessi Mufti,
Yesmizarti Muchtiar and Budi Sunaryo



Preface: The 6th Engineering Science and Technology International Conferences 2021 (ESTIC 2021)

The 6th Engineering Science and Technology International Conference 2021 (ESTIC 2021) was held in Padang, West Sumatra, Indonesia from 27 October 2021. The conference was organized by Universitas Bung Hatta (UBH) and attended by academics, practitioners, researchers, postgraduates from Indonesia and several countries around the world.

In continuity from the implementation of ESTIC 2018 and ESTIC 2020, the conference is again an international platform that allows researchers, academics, and industry experts to share and discuss their latest research, ideas, and reports in theoretical and practical fields regarding all aspects of Technology and Applied Sciences. All submissions to the conference have gone through a reviewer review process by at least two independent peers. This conference provides an opportunity for readers to engage with a selection of papers that have been presented during the ESTIC 2021 conference.

73 contributors from local and international academics, Government and private institutions who contributed papers in Electrical Engineering, Mechanical Engineering, Chemical Engineering, Industrial Engineering, Civil Engineering, Information Communication and Technology (ICT), Computer Science, Materials Science, Engineering, Environment, and other interrelated fields have truly made this conference a unique platform for the exchange of interdisciplinary ideas among participants. Of all papers received, 49 have passed the academic peer review process and are included in the submission. An integral part of ESTIC's success 2021 is the hard work and perseverance of technical committee members, scientific committee members, our esteemed reviewers from an extensive list of universities around the world and also strong support from members of the Institute for Research and Community Service (LPPM). We would like to express our sincere gratitude to these extraordinary people for making ESTIC 2021 a success.

ESTIC 2021 participants are able to engage in great opportunities for presentation and academic discourse, which has strengthened collaboration between science and technology in academic and industrial fields that have been developed in previous conferences. Representatives from industry, academia and government research and development, professional practice, business, and management in the fields of science, and technology have become part of ESTIC 2021.

A conference that encourages and enables knowledge sharing and collaboration opportunities must be developed and maintained as it produces a wide variety of areas of knowledge that can be applied in the development of new ideas and technologies. We look forward to the exciting moments of the 7th Engineering Science and Technology International Conference (ESTIC 2022) in Bukittinggi, West Sumatra Indonesia next year.

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EVALUATION OF PRE-PURIFICATION EXTRACTORS OF CATECHIN ISOLATION FROM COMMUNITY GAMBIER (*Uncaria Gambiere Roxb*)

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Abstract. The pre-purification heat extraction process separates the catechins and tannins from the impurities present in the gambier. This process uses water as a solvent, at a ratio of 1: 7 to the sample, with a heating extractor, because at a temperature of 70°C, catechins and tannin dissolved in water. The solution is then filtered in a hot state. A cold process further extracted the catechins-tannin extract to separate the catechins and tannins, using a cooling extractor, to obtain sediment. A vacuum filter then filters the deposit to get pre-purification catechins with high levels of catechins. At the same time, the tannin passes from filtration and is accommodated in a tannin reservoir. Pre-purified catechins were dried in an oven at 50°C, then weighed and measured their catechins level using a spectrophotometer. This study aims to evaluate the prototype of catechins isolation extract from community gambier (*Uncaria Gambier*) since this extractor is newly designed and newly operated. The evaluation is done by varying the cooling temperature, the extractor cooling time by 3x washing onto the catechins yield. The highest sediment obtained from the 5°C temperature variation and 15 hours cooling time was 817.66 grams of 3 kg of dry gambier, at the highest catechins content of 96%. Thus it is concluded that the best performance of cooling extraction on gambier pre purification is still at 48.55%.

Key words: *Uncariagambier*, Catechins, Tannin

INTRODUCTION

Gambier is one of the economic potentials plants for the West Sumatra community, especially for gambier farmers, because gambier is much needed for industry and pharmaceuticals, among others: as an antioxidant to inhibit the occurrence of atherosclerosis (Yunarto, N et al. 1, 2015) and as anthelmintic, to inhibit the growth of worms. In addition, the ethyl acetate extract of gambier could act as a mixture-type inhibitor and serve as an effective mild steel corrosion inhibitor in aqueous solutions (Hussin, HM et al. 1, 2010). According to Bakhtiar (1991), the most widely used gambier chemical constituents are catechins and tannin. Catechin from gambier (*Uncaria gambier Roxb*) is a phenolic compound that has a potential as a natural antioxidant (Yeni, G et al, 2014). Gambier processing results in changes in the composition of the main content of gambier, namely catechins (Amos, 2010). A lot of research has been conducted to increase catechins content on the laboratory scale, among others:

From research Ferdinal, N (2014) and Nazir, N, (2000) that is. Purification of gambier is done by using water and activated charcoal of palm oil as absorbent. The levels of catechins obtained were only 72.4%, and a relatively high yield of 55, 25%. While Muchtar (2010) isolated catechins by using hot water at temperature 70°C, and several times of cold water wash, followed by drying at 50°C for 48 hours, to obtain 95% catechins, the yield is still low. However, can improve it the catechin level. Actually gambier with catechin levels above 90%, with prepurification method using water and extraction with etyl acetate has been obtained on a small scale (laboratory) (Rahmawati, N et al, 2012).

Furthermore, Rahman, E.D et al (2018) has conducted research about Determination of Catechins Extracting Process Condition from Gambier (*Uncaria Gambier Roxb*) Solok Bio Bio of Limapuluh Kota District, with prepurification method of various variations on the washing and solvent amount at catechins level. The results showed that the best solvent and material ratio was at 1: 7, with a water temperature of 70°C, 3 times washing, in cold temperature of 16°C.

During this time, the catechins pre-purification process is still on the laboratory scale. Therefore it is necessary to develop pre-purification technology on a pilot plant scale. Thus, it is required to make a prototype of a heating-cooling catechins extractor consisting of several processes, namely heating, extracting, cooling, filtration, and washing. Thus, it helps isolate the more considerable amount of catechins. The purpose of this research is to create a prototype of a pre-purification extractor and evaluate the tool's performance.

METHODOLOGY

Conducted this research through several stages: tool design, toolmaking, and tool performance testing.

A. Materials

1. The material used for the manufacture of a set of heating-cooling extractor prototypes is Stainless Steel 316 construction material (especially for food)
2. Added motor + pully + belt for motors stirrer

While the materials used in the extraction process are gambier, water, pure catechins (99%), and ethyl acetate as a solvent on a UV-Vis spectrophotometer.

B. Equipment

The primary tool used is a prototype of a heating-cooling extractor, while the supporting equipment used are: oven and a filter container to separate the solution from the impurities. The extractor is designed in a cylindrical shape; the extractor cover has ellipsoidal-shaped, while the bottom surface has cone-shaped, equipped with a stirrer for homogenizing material. The heater and cooling extension design circuit can be seen in Figure 1.

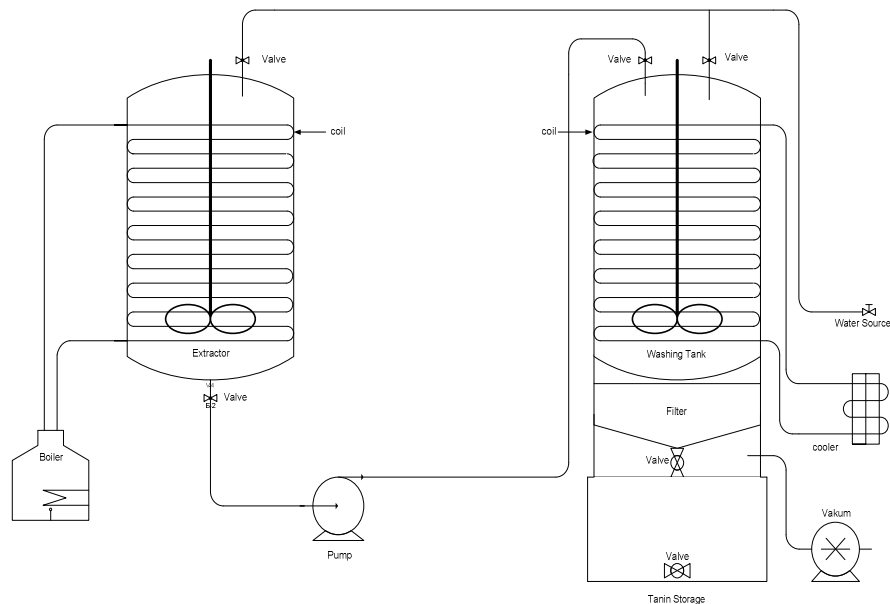


FIGURE 1. Extractor design circuit

The heating extractor designed has a diameter of 26 cm and a height of 60 cm. The liquid level and extractor diameter ratio is 2.3. The theory states, if the ratio of liquid level to extractor diameter > 1.4 then more than one impeller must be installed. Therefore, a 3-level stirrer is installed in this extractor. The extractor is also equipped with a coil that serves as a heater at a temperature of 70°C . The result of heating extractor design can be seen in Figure 2.

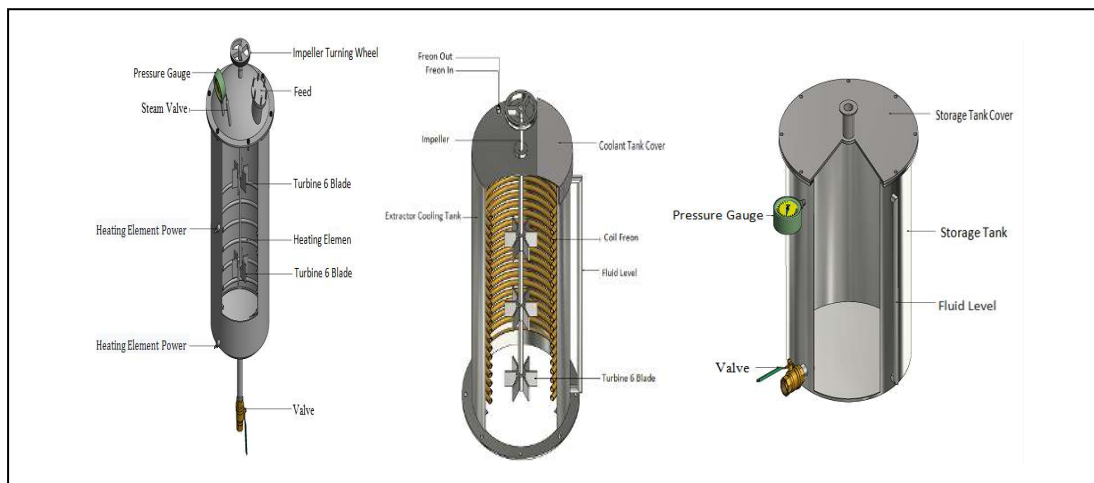


FIGURE 2. Design. Heater Extractor Coolant and tannin container

The cooling extractor is also designed with a diameter of 26 cm and a height of 60 cm, with a ratio of liquid level and diameter of extractor 2.3. In accordance with the theory that, if the liquid level to extractor diameter ratio > 1.4 then it must be installed more than one impeller, therefore this cooling extractor is also installed with 3 level of stirrer.

The cooling extractor is also equipped with a cooling coil that serves as a cooling at temperature of $5-16^{\circ}\text{C}$, and a filter at the bottom to separate tannins with catechins. The results of cooling ,filter extractor and the tannin container design can be seen in Figures 2. This study will evaluate the performance of a heating and a cooling extractor on the catechins levels and other parameters following the results data (Rahman ED, et al 2018) on a laboratory scale with an initial sample catechins level of 57.7%

The catechins extraction process from gambier is done through two treatments, namely prepurification and purification process (Youfa, R et al, 2006). From the prepurification process the initial catechin will be obtained, thereby facilitate the further process, ie the purification process to obtain higher quality catechins, from gambier as raw material and water as solvent. Analysis of catechins content using UV-Vis spectrophotometer, conducted at Laboratory of University of Andalas Padang and Laboratory of Kopertis Region X Padang

RESULT AND DISCUSSION

This research is reviewed from 2 points of view, first is the tool design in the form of a heating-cooling extractor prototype, and second is the performance evaluation of heating-cooling extractor prototype. The prototype form of heating-cooling extractor can be seen in Figure 4 and Figure 5.

Performance Evaluation of the Heating and Cooling Extractor

Performance evaluation of heating and cooling extractors are reviewed from several points:

1. Amount of heating extraction content
2. Amount of cooling extraction content, using 3 times washing treatment in various cooling temperatures
3. Catechins levels

The performance evaluation of a heating extractor is a series of the prepurification process; gambier weighed as much as 3 kg, dissolved in 21 liters of water, at a ratio of 1: 7. at 70°C for 1 hour. The solution is then filtered to separate with the impurities. The heating extractor tool used can be seen in Figure 4. Heating extraction aims to dissolve all the catechins in the gambier, filtered, so as to obtain filtrate and impurities.

The filtrate is then fed into the cooling extractor. The gambier extract is cooled from a temperature of 30°C to 5°C , with a variations of cooling time at 5, 10 and 15 hours. The gambier extract was washed 3 times in this process, with a sample and water ratio of 1: 7, thus produced sediment and liquid. Sediment and liquid obtain

then separated by vacuum filtration at a pressure of 0.8 to 0.2 atm. The purpose of this cooling extraction is to purify the earliest acquisition of catechins.

The results and data performance of the heating extractor on the catechins obtained can be seen in Table 1.

TABLE 1. The Heating Extractor output, the impurities and catechins content

Sample Number	Filtrate		Impurities		% Impurities Content
	Weight (gr)	% catechins	Weight (gr)	% catechins	
Sample 1	23802	83	50	6	0,21
Sample 2	23820	85	45	7	0,19
Sample 3	23790	72	48	5	0,20

Table 1 shows the heating extraction process, with variations of samples 1, 2, and 3 at processing temperature of 70°C. This process produces filtrate containing tannins and catechins, with catechins content about 72-85%, and filtration impurities of 0.19 to 0.21%. The catechins percentage in the impurities is relatively small, ie between 5 - 7%. This shows that all the catechins already dissolved in the heating extract. The form of liquids, sediment, and impurities from heating extraction can be seen in Table 2.

TABLE 2. The picture of filtrate, catechin sediment, and impurities on heating extraction

Process	Filtrate	Katechin sediment	Impurities
Heating Extraction			

Table 2 shows that heating extraction process after cooling to a temperature of 5°C resulting a sediment and filtrate. The light brown sediments is catechins, while the solid red filtrate is tannin, as shown in Table 1. The impurities are blackish red, with a rather coarse particle size. The amount of impurities can affect many levels of catechins, if not separated (Portier, G, 2010)







The catechins quality from heating extraction is still low, so it needs to be washed. The washing process at the laboratory scale has been done by Rahman, E.D, et al (2003). This method is further applied to the cooling extraction prototype. The results of cooling extractor performance with variation of cooling time to the output and catechins content at temperature 30-5°C can be seen in Table 3.

TABLE 3 Variations of cooling Temperature on the output and catechins levels

Washing Number	Sample 1 (5 hours)		Sample 2 (7 hours)		Sample 3 (15 hours)	
	gr	% katechin	gr	% katechin	gr	% katechin
Washing 1	798	72	867	85	798	83
Washing 2	702	68	566	88	702	88
Washing 3	477	61	406	81	477	96
Extractor efficiency	18,1 %		28,70 %		48,55 %	

From Table 3 it can be seen that cooling extraction performance has an effect on cooling duration. The longer the cooling time, the more efficient the appliance works. This can be seen from the weight of the sediment in each wash. The highest efficiency was seen in 15 hours cooling time, which was 48.55%. This result is still not optimal yet, because the filter process has not functioned optimally. In the cooling extraction process there is a separation between the solvent-shaped tannins and the sediment-shaped catechins at low temperature (30 to 5°C). The solution is then filtered and the catechins levels in the sediment are measured. Thus it can be concluded that the cooling extraction filtering process is still not optimal to obtain maximum sediment. The form of liquid and sediment on washing in the cooling extraction process can be seen in Table 4

TABLE 4. The Picture of filtrate, catechinsediments, and impurities on heatingextraction process

Washing number	Filtrate	Sediments
Washing 1		
Washing 2		
Washing 3		

From Table 4 can be seen the form of filtrate and sediment catechins obtained in each washing. The observation on the filtrate liquid color show, the more frequently washed, the higher the purity level of catechins received; nevertheless, more catechins are carried out in the washing liquid. Sousa, A., et al. (2008), in comparison, the sediment catechins color getting brighter than light brown in the heating extract.

CONCLUSION

1. The research of pre purification process using a heating-cooling extractor prototype obtained the highest catechins sediments as 817,66 gram from 3 kg of dried gambier, with the highest rate of catechins of 96%, at 15 hours cooling process.
2. Cooling extractor efficiency performance on gambier pre-purification is still 48.55%.

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REFERENCES

1. Amos, "Kandungan Catechin Gambier Sentra Produksi Di Indonesia", (Pusat Pengkajian Teknologi Agroindustri Badan Pengkajian dan Penerapan Teknologi, 2010), Journal Standarisasi, Vol.12 No. 3, pp. 149-155.
2. Bakhtiar, A., "Manfaat Tanaman Gambier (Makalah Penataran Petani dan Pedagang Pengumpul Gambier di Kecamatan Permasalahan Gambier di Sumatera Barat dan Alternatif Pemecahannya)", (Azmi Dhalimi) 59 Pangkalan Kab. 50 Kota, Padang, 29-30 November 1991). FMIPA Unand pp 23
3. Ferdinal, Norman, *A Simple Purification Methode of Gatechin from Gambier* (International Journal Edvanded Science Engineering Information Technology. Vol.4, 2014) No. ISSN 2088-5334.
4. Yeni, Gustri., Syamsu, K., Ono Suparno., Mardiyati, E., Muchtar, H., "Repeated Extraction Process of Raw Gambiers (*Uncaria gambier Roxb*) for the Catechin Production as an Antioxidant" (International Journal of Applied Engineering Research. Volume 9 Number 24, 2014) ISSN 0973-4562, pp.24565-24578.
5. Hussin, H. Mohd, Kassim, Jain. Mohd., "Electrochemical Studies of Mild Steel Corrosion Inhibition in Aqueous Solution by *Uncaria gambier Extract*" (Journal of Physical Science, Vol. 21(1), 2010), pp, 1-13.
6. Muchtar, H., Yeni, G., Wilsa Hermianti, Diza, Y.H., "Pembuatan Konsentrat Polifenol Gambir (*Uncaria Gambir Roxb*) sebagai Bahan Antioksidan Pangan", Jurnal Riset Industri, IV, 2010.71-82. Pardeike, J., Hommos, A., Müller, R.H., 20
7. Nazir, Novizar, "Gambir : Budidaya, Pengolahan, dan Prospek Diversifikasinya" (Yayasan Hutanku, Padang, 2000)

8. Portier, G., *Extrasyntese* (Natural Product. BP 62-69726 Genay Cedex , France, 2010)
9. Rahman E,D.et al, “*Pengaruh Temperatur dan Waktu Pemanasan Dalam Pemurni Gambier Terhadap Kandungan Khatechin* (Buletin Ilmiah Ekasakti Vol. VIII No. I, 2003)
10. Rahman E.D.et al,”*Determination of Extraction Process Conditions of Gambier Catechin (Uncaria Gambier Roxb) from Solok Bio Bio Lima Puluh Kota District – West Sumatera,*”, *IOP Conf. Ser.: Mater. Sci. Eng.* **316** 012022, 2018, Doi. [10.1088/1757-899X/316/1/012022](https://doi.org/10.1088/1757-899X/316/1/012022)
11. Rahmawati, Noveri., Bakhtiar, Amri., Putra, Dedi Prima., *Isolasi Katechindari Gambier (Uncaria gambier (Hunter) Roxb) untuk Sediaan Farmasi dan Kosmetik* (Jurnal Penelitian Farmasi Indonesia 1(1), 2012), pp, 6-10
12. Sousa, A., dkk., *Effect Of Solvent And Extraction Temperatures On The Antioxident Potential Of Traditional Stoned Table Olives Alcaparras*, Vol (41):739-745, Di alih bahasakan oleh Liris Mahadewi Rachimullah. Universitas Muhamadiyah, Surakarta, 2008.
13. Youfa , R dan Rahman E,D., *Isolasi Cyanidol, -3 (D-Catechin) Dari Gambier* (Majalah Ilmiah Teknologi Industri SAINTI, ISSN : 1829-7404 Vol. 3 No. 2, 2006)
14. Yunarto, N., Aini, N., “*Effect of purified gambier leaves extract to prevent atherosclerosis in rats*” (Health Science Journal of Indonesia Vol. 6, No. 2, 2015), pp,105-110.