CONSUMER ACCEPTANCE AND ECONOMIC VALUE OF *Cratoxylum formosum* ESSENTIAL OIL

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CONSUMER ACCEPTANCE AND ECONOMIC VALUE OF *Cratoxylum formosum* ESSENTIAL OIL. *Cratoxylum formosum* (Jack) Benth. & Hook.f. ex Dyer is one of the plant species that have the potential to be developed into an antibacterial and antioxidant essential oil product. This study was conducted to determine the value of organoleptic tests and the consumers' willingness to pay (WTP) for the three variants of *Cratoxylum formosum* essential oil products. For the parameters of colour, hedonic test values and score tests showed good results; panellists did not mind the pure and mixed *Cratoxylum formosum* essential oil colours. However, for fragrance parameters, the hedonic test showed a dislike score. Most panellists disliked the strong "scent of leaves" of pure *C. formosum* oil. The score test showed satisfactory values, the panellists accept the fragrance of *Cratoxylum formosum* essential oil, but it is necessary to add a more preferred scent mixture to reduce the strong original fragrance of the oil. The cost of production of Cratoxylum essential oil is Rp.7,259.23 (USD 0.48)/mL or Rp.72,592.30 (USD 4.84) for every 10 mL. Based on the cost of production, the appropriate selling value for every 10 mL of Cratoxylum essential oil is a minimum of USD 4.84.

Keywords: Cost of production, hedonic test, score test, essential oil

PENERIMAAN KONSUMEN DAN NILAI EKONOMI MINYAK ATSIRI Cratoxylum formosum. Cratoxylum formosum *(Jack) Benth. & Hook.f. ex Dyer merupakan salah satu jenis tumbuhan yang berpotensi untuk dikembangkan menjadi produk minyak atsiri antibakteri dan antioksidan. Penelitian ini dilakukan untuk mengetahui nilai uji organoleptik dan kesediaan membayar konsumen untuk ketiga varian produk minyak atsiri* Cratoxylum formosum. *Untuk parameter warna, nilai uji hedonis dan uji skor menunjukkan hasil yang baik, panelis tidak keberatan dengan warna minyak esensial* Cratoxylum formosum *baik yang masih murni maupun sudah dalam campuran. Namun untuk parameter aroma, uji hedonik menunjukkan skor tidak suka. Sebagian besar panelis tidak menyukai "aroma daun" yang kuat dari minyak* C. formosum *murni. Uji skor menunjukkan nilai yang memuaskan, panelis menerima aroma minyak atsiri* Cratoxylum formosum*, tetapi perlu menambahkan campuran aroma yang lebih disukai untuk mengurangi aroma asli minyak yang kuat. Harga pokok produksi minyak atsiri Cratoxylum adalah Rp7.259,23 (USD 0.48)/mL atau Rp72.592,30 (USD 4.84) untuk setiap 10 mL. Berdasarkan harga pokok produksi, nilai jual yang sesuai untuk setiap 10 mL minyak atsiri Cratoxylum minimal Rp72.592,30 (USD 4.84).*

Kata kunci: Uji hedonis, uji skor, minyak essential

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I. INTRODUCTION

Essential oils result from secondary metabolism that is widely obtained from the parts of the plant, such as flowers, leaves, seeds, bark, fruits, and roots or rhizomes (Rialita et al., 2015). The use of essential oils in Indonesia has been widely spread even becoming one of Indonesia's main export commodities (Pasaribu et al., 2014). Essential oils are commonly used as natural preservatives for foods, aromatherapy, cosmetics, and pharmaceutical products (Mawaddah, 2008; Pasaribu et al., 2014). The types essential oils that are being developed or have been circulating in the broad market are camphor oil (*Dryobalanops aromatica*), red ginger (*Zingiber officinale rar rubrum*), red galangal (*Alpinia purpurata*), Pucuk idat (*Cratoxylum glaucum*), and Pontianak orange peel (*Citrus nobilis*) (Deglas, 2019; Pasaribu et al., 2014; Rialita et al., 2015; Solarbesain & Pudjihastuti, 2019).

One of the essential oils that have the potential to be developed in Indonesia is made from the distillation of *Cratoxylum formosum* (Jack) Benth. & Hook.f. ex Dyer leaves. *Cratoxylum* is usually found in watersheds, mangroves, savannas, and swamps. *Cratoxylum* contains antibacterial polyphenol compounds that function as natural antiseptics (Putri et al., 2019). Its natural ingredients are flavonoids, tannins, anthraquinones, santons, and antioxidants inhibiting and binding free radicals (Mahardika et al., 2018). Free radicals are the source of several diseases, including cancer, atherosclerosis, rheumatism, coronary heart disease, and other degenerative diseases (Mahardika & Roanisca, 2018).

Cratoxylum formosum essential oil is unique because of its chemical content, colour, and fragrance, both as a pure essential oil or as a mixed ingredient. The potential acceptance of this natural oil is broad open because people tend to shift to using natural products (Widyasanti et al., 2017). *Cratoxylum formosum* essential oil also has the potential to be produced because it is a fast-growing species, so the leaves are relatively easy to obtain and regenerate fast.

Cratoxylum formosum belongs to the family Hypericaceae, classified as a flowering plant of Angiospermae. This species can be found in Sumatra, Java, Kalimantan, Sulawesi, Myanmar, Cambodia, Thailand, and the Philippines (Kebun Raya Bogor, 2022). *Cratoxylum formosum* is used by the community to treat scabies, burns, and stomach ache (Hidayat & Hardiansyah, 2013; Mulyadi et al., 2014). According to the Dictionary of Indonesian Language (KBBI), essential oils are "oils found in aromatic plants, volatile, used in perfumed oils, herbs, and medicines". Essential oils have various benefits such as for health treatment, cosmetics, air fresher, natural pesticides, antivirals, antifungals, and food preservatives (Almanea et al., 2019; Batish et al., 2008; Prakash et al., 2012; Sawamura, 2011).

Cratoxylum formosum plant has many benefits. Some of the benefits that can be obtained from the Cratoxylum are as antibacterial, anti-cancer, and antiviral (Iffah et al., 2020; Mahardika & Roanisca, 2018; Pratama et al., 2021). However, the discussions on the potential acceptance of humans using organoleptic testing and economic value of the *Cratoxylum formosum* essential oil have never been conducted. Organoleptic testing is a sensory assessment used to obtain results quickly and directly by using the sense of taste, such as appearance, smell, taste, and touch (Dalle et al., 2021; Lokaria & Susanti, 2018). It was carried out to determine the level of acceptance, use, and utilization of consumers of *Cratoxylum formosum* essential oil product before it was developed into a wide-scale product. Economic value can be conducted by calculating the cost of production and hedonic price by employing the willingness to pay (WTP) method. The economic value based on the cost of production and WTP will measure the acceptance of the product selling price as an important factor in marketing a commercial product. Thereby the development and utilization can be adjusted to the needs and tastes of consumers. This study will determine the value of organoleptic tests

and WTP of consumers of three kinds of mixed compositions of *Cratoxylum formosum* essential oils.

II. MATERIAL AND METHOD

A. Conceptual framework

Cratoxylum formosum essential oil is made by distilling the dried leaves. The process of distilling leaves by the steam-water distillation method is as follows:

1. The harvested leaves are crushed manually to make it easier to fill the distillation tube.
2. The steaming tube is filled with water; then, dry leaves are placed on a sieve. In each distillation, used ± 3 kg of dried leaves.
3. The tube is tightly closed; then, the distillation tube is installed on the exit hole of moisture.
4. The stove is turned on (medium heat), and the distillation process begins. After approximately 1 hour, the water vapour that has undergone condensation and the distilled oil drips on the distillation tube. The distillation process takes ±5 hours.
5. The final product of *Cratoxylum formosum* oil is then packed in a bottle of 10 ml, which is carried out by testing organoleptic on panellists.

This research used behavioural economic approach by employing an organoleptic test and WTP approach in measuring potential consumers' acceptance rate of *Cratoxylum formosum* essential oil (Figure 1 and 2). Organoleptic testing is an instrument used in assessing a product based on panellist sensing assessments. This assessment uses the panellist's liking for the parameters of a product. Panellists are asked for their personal opinion on the liking or dislike of the parameters of a product. Five hedonic scales determine the opinions of these panellists: disliked very much = 1, disliked =2, neither like nor dislike =3, slightly like = 4, and like very much = 5. In organoleptic tests, there are generally three parameters, namely colour, aroma, and taste (Kumalasari et al., 2018; Yani Ambari & Suena, 2019). However, since Cratoxylum essential oil is only intended for aromatherapy or indoor air antibacterial agents, only the colour and fragrance parameters are tested using score value.

Price is an important part of marketing for its producers (Ricome & Reynaud, 2022; Tashpulatov, 2021; Udin et al., 2019). The pricing of the new product Cratoxylum essential oil in this study was obtained through a survey of WTP or buy the product. Price is also a parameter of economic value that is measured by calculating all expenses for producing a product (Fakhrina Fahma et al., 2012; Hermawan, 2020). This research used the cost of production (COP) method in determining the base price of Cratoxylum essential oil produced.

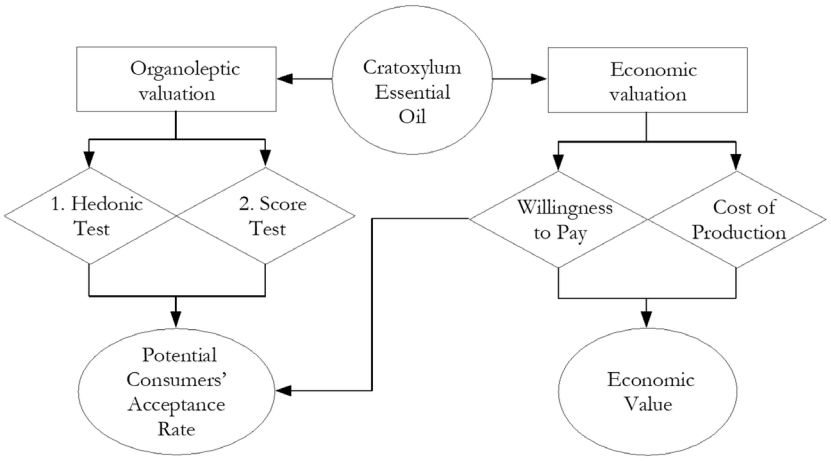

Figure 1. Research Framework

Figure 2. Panellists of Organoleptic Test of Essential Oil *Cratoxylum formosum*

B. Time and location

The study was carried out in November 2021 around the Samboja Special Purpose Forest Area (KHDTK), Kutai Kartanegera Regency, East Kalimantan province. Respondents who became panelists were the Samboja Natural Resources Conservation Technology Research and Development Center employees, village staff, and the elementary school teacher around KDHTK Samboja.

C.Data Collection

This research uses quantitative methods. The data collection technique uses structured interviews by filling out questionnaires. The selection of the panellist population was taken purposively with the criterion that respondents could understand and know about the essential oil of *Cratoxylum formosum*. The panellist criteria were selected to reduce data inaccuracy because the panellists did not understand or even never heard of the use of *Cratoxylum formosum* or other essential oils. 44 panellists were selected from the population of 150 panellists with criteria as adult and working respondents. The determination of the number of selected panellists' sample is taken based on the Lemeshow proportion formula (Stanley Lemeshow et al., 1997) as follows:

$$\frac{N.Z^2 1-\propto/2.p.q}{d^2\,(N-1)+Z^2 1-\propto/2.p.q} \quad \text{.....(1)}$$

Where:

n : Number of samplings
p : Approximate proportions (0.2)
q : (1-p)
d : Absolut Precision (10%)
Z1-α/2 : Statistics Z (Z= 1.96 for α = 0.05)
N : Number of Population

The testing referred to SNI 01-2345-2005, which contains organoleptic and sensory testing instructions, including hedonic and score tests. Hedonic testing was conducted based on the panellists' favourability level. The favourability varies depending on the specified quality range. The assessment can be changed into numbers and further analysed statistically to conclude. The score test is carried out by giving a value to the assessment sheet by the level of product quality. The essential oil tested were 3 types: Pure essential oil, mixed with DMSO (50:50), and Chamomile oil (50:50) The sample was randomly tested on 44 panellists from three institutions to obtain data heterogeneity. Previously, panellists were given explanations and information related to essential oils to be tested.

Respondents in the calculation of WTP are the same respondents as respondents who took the organoleptic test. Previously, respondents took an organoleptic test by observing Cratoxylum essential oil so that respondents knew the characteristics and benefits of Cratoxylum essential oil. Then respondents were asked questions related to WTP, namely respondents were given a choice of the appropriate price according to the respondent's WTP for a bottle of Cratoxylum essential oil with a size of 10 mL.

Following the method that was used to measure favorability and WTP of Cratoxylum essential oil, pricing was measured to the products prepared in those tests. One of the economic assessments of businesses related to the cultivation and processing of Cratoxylum essential oils uses the COP approach. This analysis uses the cost component with the full costing assessment method. This method calculates all costs incurred in the Cratoxylum leaf production business unit used in the processing process to produce antibacterial essential oils. The cost components include (F. Fahma et al., 2012; Hermawan, 2020; Hikmah, 2017):

1) Production costs, that is, the cost of raw materials, direct labour and equipment
2) Commercial costs, i.e., administrative costs and marketing costs
3) The cost of adjusting to the interest rate of money.

In this study, the components of expenses for every phase starting from harvesting the leaves up to the final phase of obtaining 10 mL essential oil were calculated so that the expenses were including the cost of manpower, equipment and fuels. All components cost then sum up become the total cost of production, as a parameter of the economic value of the oil.

D. Data analysis

1. Organoleptic testing

Miles and Huberman (1984) in Sugiyono (20The data obtained from organoleptic test then tabulated and determined their quality value by calculating the average results in each panellist at a confidence level of 95% using the following formula:

$$\bar{x} = \frac{\sum_{i=1}^{n}}{n}$$

$$S^2 = \frac{\sum_{i=1}^{n}(x1 - \bar{x})^2}{n}$$

$$S = \sqrt{\frac{\sum_{i=1}^{n}(x1 - \bar{x})^2}{n}}$$

$$P(\bar{x}-(1.96*s/\sqrt{n})) \leq \mu \leq P(\bar{x}+(1.96*s/\sqrt{n})) \quad ....(2)$$

Remark:

n	: The number of panellists;
S2	: The diversity of quality values;
1,96	: Coefficient of standard deviation at the level of 95 %;
$\bar{x}$	: The average quality value;
i x	: The quality value of the panellists to i, where i = 1,2,3.....n;
S	: Standard deviation of the quality value.

2. Willingness to Pay (WTP)

The calculation of WTP in this study used the median value of WTP. The median value of WTP has been used in many studies because of its simple calculation. (Al-Hanawi et al., 2018; Bhattarai et al., 2020). This study uses the median value of WTP from all respondents for one bottle of Cratoxylum essentials oil with a size of 10 mL. This value will be used as the WTP value of the respondent.

3. Comparison of COP with WTP

The COP is the sum of the three components: process of production costs, commercial and adjustments due to interest rates. The selling price of the products in this study is based on the willingness of potential consumers to pay for the product to be purchased, namely the product in the form of Cratoxylum essential oil in a 10 mL package. The respondent was given a Cratoxylum essential oil product, and then the respondent was asked to provide an offer against the product. The mode value generated from the respondent's response was used to determine the most representative selling price for the Cratoxylum essential oil product. Use mode values to determine the respondents' most accepted values based on the frequencies that appear most frequently or the respondent's answer choices (Herbst et al., 2020).

III. RESULTS AND DISCUSSION

A. Panellist Age and Occupation

The age distribution of panellists ranged from 21 to 58 years (Figure 3). This suggests that the selected panellists are categorized as adults and working. Most of the panellists were 36 years old, while the number of panellists of other age classes was relatively similar. The major part of panellist occupations is Civil Servants (45%), followed by teachers (40%) and others (Private Employees, Students, Honoraries), each was 5% (Figure 4). The panellists involved are mostly residents who come from outside the region but have been living for a long time and understand the characteristics of the region, this is because the area is a development area that in the future will be part of the prospective capital of Indonesia.

B. Organoleptic Test

B.1. Colour

The average value ($\bar{x}$) is almost similar (>3), which is categorized as neutral, as we seen on Table 1, pure Cratoxylum oil (A), the mixture with DMSO (B), or chamomile oil mixture (C). It is indicated that the panellist's assessment of the mixture of Cratoxylum products is almost uniform. The respondent's degree of favourability for the product still requires additional prerequisites. Panellists suggest that the product will be more accepted if an improvement in quality can increase the panellist's assessment of colour parameters. The presence of additional inputs in a product will be an added value that can increase panellists' assessment (Daeng & Laitupa, 2019).

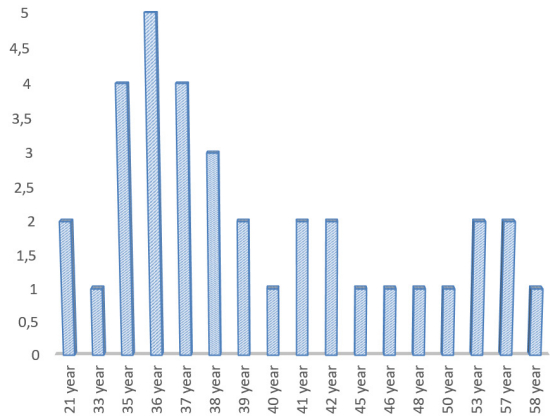

Figure 3. Panellist age class distribution

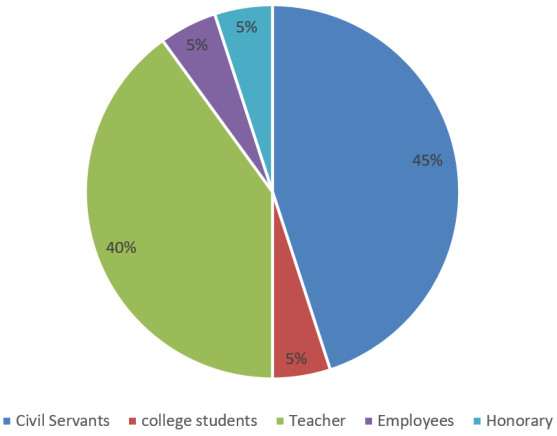

Figure 4. Distribution of panellist occupation

Table 1. Organoleptic test results based on colour parameters

	Colour			
	Hedonic Test			Score Test
Sample	A	B	C	
$\bar{x}$	3.28	3.78	3.22	3.43
S^2	0.70	0.73	0.92	0.30
S	0.84	0.86	0.96	0.55
Value	3	3	3	3
Criteria/categories	Neutral	Neutral	Neutral	Neutral

Table 2. Organoleptic Results based on fragrance

	Fragrance			
	Hedonic Test			Score Test
Sample	A	B	C	
$\bar{x}$	2.56	3.03	3.44	3.01
S^2	0.87	0.72	0.56	0.31
S	0.93	0.85	0.75	0.56
Value	2	3	3	3
Criteria/categories	Dislike	Neutral	Neutral	Neutral

Source: primary data processing, 2021

Colour is the first visible sensory parameter that determines the acceptability of the product (Asy'ari & Sidin, 2019). The colour indicates the level of quality of a product.

The results of the hedonic test for the colour parameters showed sufficient criteria, although types B and C added with other mixtures create another colour composition from the original colour condition and show an improvement in product quality from the initial colour (Efendi & Rahmayuni, 2014). Colour affects the assessment of a material's quality and is the attraction of consumers whether they like it or not (Kumalasari et al., 2018; Wijayanti & Lukitasari, 2016). Pure or mixed Cratoxylum essential oil did not significantly differ for the panellists. The panellists tend to accept the colour.

B.2. Fragranc

Information was obtained for fragrance parameters that the average quality value ($\bar{x}$) for the hedonic test varied from 2.56 – 3.44. This shows the non-uniformity of the panelists in terms of the assessment of the three mixtures. Solution A is disliked, while solutions B and C are categorized as neutral. The score test shows that the average quality value ($\bar{x}$) is 3.01 (Enough). The panellist's preference concealed that the panellist's prefer the scent of the other samples than that of sample A.

Respondents dislike sample A because of the lingering aroma of plants. The respondent stated that it was neutral for types B and C because there was another fragrance mixture. The original fragrance of the plant is already blurred by the presence of other fragrances

mixed in the essential oils of type B and C. Respondents dislike sample A because of the strong "leafy" scent. In accordance with this study, essential oil of Salvia officinalis that has strong aroma was unacceptable by the panellists (Hayouni et al., 2008). The respondent stated that it was neutral for sample B and C because there was another fragrance added. The original fragrance of the plant is indistinct by the presence of other fragrances mixed in the essential oils of B and C. Another study that mixed oregano (Origanum vulgare) and rosemary (Rosmarinus officinalis) essential oils also obtained "like slightly" and "neither like nor dislike" acceptability (De Azeredo et al., 2011). Lavender and orange essential oils were commonly blend with other essential oil to enhance the mixture aroma (Ahmady et al., 2019; Guo & Wang, 2020; Velmurugan et al., 2017).

These results indicated that the panellists tolerate the aroma of *Cratoxylum formosum* essential oil generally, but it is necessary to put the additional mixture on for enhancing the aroma. It is because many panellists still do not familiar with the plant's aroma.

C. Willingness to Pay (WTP)

The price of Cratoxylum essential oil in this study was determined through a WTP survey to buy the product. The survey of WTP in this study was conducted to obtain an estimate of the market price accepted by the general public for *Cratoxylum formosum* essential oil. Respondents' WTP is a response from potential consumers to the appropriate price and as an alternative to the demand price elasticity when the market price is not yet available (Alphonce & Alfnes, 2017; Le Gall-Ely, 2009). Based on a survey conducted on 44 respondents, the results were found as presented on Table 3.

Respondent's response to the WTP for new products in the form of Cratoxylum essential oil was at most priced at less than USD 2. (59.09%) or 26 respondents were willing to pay at a price of less than USD 2 (Table 3). Value the WTP for it to get the essential oil Cratoxylum natural packaging 10 ml.

D. Cost of Production

Calculating the COP is important in determining the right and reasonable selling price of products (Helmina, 2013; Maitah et al., 2016; Setiadi et al., 2014). The costs incurred in each component of the processing stage of a product starting from obtaining raw materials, processing, packaging, and finally distribution to consumers (product sales) are variables that are taken into account in the calculation of the COP. Calculating COP in *Cratoxylum formosum* essential oil processing can determine product prices if they are ready to be commercialized in the essential oil market. Furthermore, the COP value can be used to determine the margin (profit) to be taken (Testa et al., 2014).

The assumptions used in the calculation of the COP of *Cratoxylum formosum* essential oil were:

1. Preparation of Simplisia: leaves harvesting (81.87 kg) was carried out in 1 day, with a labour requirement of 4 people.
2. The wages of on-site workers are USD 6,67/day (8 hours worked). The labour and wages are converted according to the labor

Table 3. Willingness to pay (WTP) of **Cratoxylum** essential oil

Price range (USD)	Number of Respondents	Percentage
< 2,00	26	59.09%
2,00-4,00	14	31.82%
4,00-6,00	2	4.55%
>6,00	2	4.55%
Sum	44	100.00%

Source: primary data processing, 2021

required to process and produce 28 ml of essential oil for 5 days.

3. Distillation work: for 5 days, that is, drying the leaves (from 81.87 kg of wet leaves to 40.40 kg of dry leaves, with the result of distilling 28 ml of oil).
4. The distillery's capacity is 3 kg of dry leaves per 5 hours, with 3 ml of oil yield.
5. The cost of distilled equipment (stove, gas cylinder, water pump and drum) = USD 1.333,33, in the calculation, is converted by the tool's depreciation value approach, which assumes an economic life of 5 years. The calculation is converted then to depreciation tools per distillation process.

Based on the calculation of COP, the economic value of Cratoxylum essential oil for each millilitre is USD 0,48 or USD 4,84 for every 10 ml. The value is the cost incurred to obtain each millilitre of Cratoxylum essential oil. The COP value is still relatively high compared to the COP value of some essential oil products such as clove oil, betel leaf oil, and eucalyptus oil (Aryanny and Teak 2021; Setyaningsih, Nuabdi, and Muna 2019; Wiratama and Dewi 2021).

E. *Cratoxylum formosum* Essential Oil Product Price

Based on the cost of production, the appropriate selling value for every 10 mL of Cratoxylum essential oil is a minimum of USD 4,84. So, producers will benefit if the products produced or sold are at a price greater than the cost of production. Meanwhile, the selling price of eucalyptus oil for 1,000 ml is USD 4,67 or USD 0,05 for every 10 ml (Indrajaya et al., 2013). Thus, the selling price of *Cratoxylum formosum*

Table 4. Processing cost of *Cratoxylum formosum* essential oils

No	Activities	Cost Classification		
		Raw Material Cost (USD)	Labour Costs (USD)	Overhead Costs (USD)
1.	Preparation of simplisia	1,33		
2.	Simplisia processing			
	a. Labour costs		0,83	
3.	Distillation			
	a. Oil holding containers			1,32
	b. Labour costs		4,17	
	c. The cost of depreciation of distillation tools			0,73
	d. Gas			5,17
	The total of each component of the cost	1,33	5,00	7,22

Source: primary data processing, 2021; USD 1 = IDR 15.000

Table 5. Production cost of *Cratoxylum formosum* essential oils

No	Activities	Cost (USD)
1.	Raw Materials	1,33
2.	Labour costs	5,00
3.	Fixed Overhead Costs	0,73
4.	Variable Overhead Costs	6,49
	Total Production Costs	13,55
	Essential Oil Results	28 ml
	COP of essential oils/ml	0,48

Source: primary data processing, 2021

essential oil is much higher when compared to eucalyptus oil. Consumers will accept the potential of essential oils if they have benefits or properties that other essential oils do not have. In general, essential oils have economic value because they have special compounds in each type (Silalahi & Lumbantobing, 2021). The potential uses and properties of Cratoxylum essential oil require more in-depth studies to place the oil as an essential oil with important value so that the high production costs will be covered by the value of the uses or benefits of *Cratoxylum formosum* essential oil.

In this study, the potential economic value based on WTP simulation is lower than the selling price according to the COP for two reasons. The first factor is that the respondents are unfamiliar with the Cratoxylum essential oil, which is still in pure form. WTP was calculated for a bottle of 10 mL of Cratoxylum essential. Respondents tended to value the oil below the price of marketed other essential or anti-bacterial oils. The other oil has already been enriched with other aromas, no longer pure like the Cratoxylum essential oil. The second reason is that the respondent will not use pure essential oils directly. Further processing phases will be carried out by the manufacturer, such as using the essential oil as a base note for air purifiers, disinfectants, soaps, or other health treatment products. A higher price for products made from Cratoxylum essential oil still has the potential to be obtained. It is potentially sufficient to cover the COP since the 10 mL essential oil can be mixed with other ingredients, such as aroma enhancers or diluents. In comparison, some of the essential oils on the market have been added with other ingredients to provide their attractiveness to their consumers (Ahmady et al., 2019; De Azeredo et al., 2011; Guo & Wang, 2020; Velmurugan et al., 2017). The organoleptic tests in this study also suggested that Cratoxylum essential oil needs to be enriched according to consumers' preferences before it is sold to the market. The WTP of Cratoxylum essential oil in this study indicated the potential price for the end consumer, while COP is based on the cost of producing pure essential oil. Potential producers can adjust the indicative prices based on the WTP so that processed essential oil products can be feasible for market entry.

The economic potential based on the selling price shows that Cratoxylum essential oil potential to be accepted economically by consumers. However, the selling price received by the community certainly considers the production costs needed to obtain each litre of oil. If it is ready to sell, Cratoxylum essential oil is not sold in a 100 percent concentration. It should be enhanced by adding additional mixture to reduce volatility, improve stability and water solubility, and improve therapeutic efficacy (Bilia et al. 2021) so that the right dose of concentration between components will provide optimal economic benefits. Considering that the pure oil of Cratoxylum need to be enhanced by adding some mixture, this process will important in determining the feasible price of the oil based on the WTP value.

The prospect of this product in the future market is reasonable, since the population of East Kalimantan province will grow significantly, in line with national policy to move the capital of Indonesia from Jakarta to the region. The population growth will reduce air quality so the population will need organic preservative to increase air quality. In other words, there will be an increasing demand for clean air. The growth rate of air pollution in developing countries has accelerated the degrading environmental quality and placed an economic burden on affected communities (Almond et al. 2016). Using indoor air purifiers can significantly reduce viral particles and bacteria to reduce the exposure of viruses or bacteria spread through the air (Burgmann & Janoske, 2021; Zhao et al., 2021). The potential for an increase in air purifiers demand will have a very reasonable market for essential oils such as Cratoxylum essential oil.

IV. CONCLUSION

The potential of Cratoxylum essential oil to be produced and marketed in the future air purifier market is indicated to be feasible considering the behavioural preference based on organoleptic test and followed by its economic value using WTP and COP. This research concluded that the panellists in this study showed neutral responses when examined using hedonic and score tests as part of the organoleptic assessment of Cratoxylum essential oil. In general, panellists have a neutral judgment towards the colour of all variants of essential oil used in this study, both the pure and the mixed modifications. However, the panellists had negative responses to the fragrance of the pure oil (type A) but showed moderate responses either to the oil that was mixed with DMSO (type B) or chamomile (type C). This finding indicated that the panellists accept the aroma of *Cratoxylum formosum* essential oil, but adding a mixture to camouflage the original fragrance is necessary.

The Cratoxylum essential oil also has potential economic value based on the WTP and COP calculation. The respondents will pay the oil as high as USD 2 per 10 mL as a result of this study. Although this price is below the COP price (USD 4,84/10 mL), this oil is still prospective to be developed since the price was for the pure oil, without enhancement with other mixture. The organoleptic test proved that prospective consumers prefer the fragrance of mixed oil, either with DMSO or chamomile. Although a different mixture is also needed to moderate volatility, strengthen stability and water solubility, and intensify the therapeutic ability, this oil is still feasible to be developed. The growing demand for air quality due to the increasing population in East Kalimantan, as it is proposed to be the capital of Indonesia, will open the prospect of this oil. The nature of *Cratoxylum formosum* as a fast-growing species will support the availability of raw material when this oil needs to be manufactured based on its economic scale.

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