RESEARCH ARTICLE | FEBRUARY 21 2024

Simple TLC-densitometric method for the quantification of asiaticoside in *Centella asiatica* from different origins for its standardization FREE

K. Kartini ✉; A. Rosidah; R. Budiono

AIP Conf. Proc. 3001, 030008 (2024)
https://doi.org/10.1063/5.0184233

Simple TLC-Densitometric Method for the Quantification of Asiaticoside in *Centella asiatica* from Different Origins for Its Standardization

K Kartini[1,a)], A Rosidah[1, b)] and R Budiono[2, c)]

[1]*Department of Pharmaceutical Biology, Faculty of Pharmacy, University of Surabaya, Jl. Raya Kalirungkut 60293 Surabaya, Indonesia*
[2]*Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Surabaya, Jl. Raya Kalirungkut 60293 Surabaya, Indonesia*

[a)] Corresponding author: kartini@staff.ubaya.ac.id
[b)] farmasi@unit.ubaya.ac.id
[c)] farmasi@unit.ubaya.ac.id

Abstract. Gotu kola (*Centella asiatica* (L.) Urb.) is one of the "Jamu Saintifik" ingredients that contains various active compounds, including asiaticoside. Asiaticoside content depends on several factors, such as the plant's origin, age, and harvesting season. This study was conducted to analyze the concentration of asiaticoside in gotu kola crude drug obtained from nine different planting locations using a TLC-densitometer. The TLC used silica gel 60 F_{254} as the stationary phase, ethyl acetate-methanol-water (10:2.5:1) as the mobile phase, and anisaldehyde sulfuric acid as a derivatizing agent. The developed method met the specificity parameters, as characterized by the identical visible spectrum of the asiaticoside in the sample extract to that of the asiaticoside standard, with a maximum wavelength of 594 nm. The standard curve showed good linearity in the concentration range of 1.05–10.5 µg/band with an r-value of 0.989437. The limits of detection (LOD) and quantification (LOQ) were 0.48820 and 1.47939 µg/band, respectively. This method was repeatable and precise, with relative standard deviations between 2.72 and 7.16% for intraday precision and 2.82% for interday precision. Except for two samples, all the asiaticoside concentrations were quantifiable and ranged between 0.53933 and 3.46866 mg/g of crude drugs. In conclusion, they vary across the *C. asiatica* samples collected from different origins in Indonesia. The gotu kola crude drugs obtained from Lombok Barat, Magelang, and Hulu Sungai Selatan have the highest asiaticoside content among the nine samples studied.

Keywords: Asiaticoside, *Centella asiatica,* Gotu Kola, TLC-Densitometer

INTRODUCTION

Centella asiatica (L.) Urban, also known as Gotu Kola, is a plant with herbaceous habitus belonging to the Apiaceae family. In Indonesia, it is known by various regional names, including *pegagan*, *kaki kuda*, and *antanan gede*. *C. asiatica* grows wild throughout the country and other tropical regions in general (India, Sri Lanka, China, Malaysia, Thailand, etc.) at varying altitudes, from lowlands to 2500 m above sea level [1]. *C. asiatica* is a perennial herb that is stemless but has short rhizomes and creeping stolons, 10–80 cm long, and has 2–10 single leaves arranged in a rosette.

Traditionally, *C. asiatica* is used to treat problems related to skin, nerves, and metabolic processes [2]. Previous research at the clinical trials level has also confirmed the effectiveness of *C. asiatica* and its compounds as anti-inflammatory, antioxidant, anti-apoptotic, and in improving mitochondrial function [3].

C. asiatica contains mainly pentacyclic triterpene compounds, such as asiatic acid, asiaticoside, madecassic acid, and madecassoside. It also contains flavonoids (quercetin and kaempferol), phytosterols (campesterol, sitosterol, and

International Conference on Environmental, Mining, and Sustainable Development 2022
AIP Conf. Proc. 3001, 030008-1–030008-10; https://doi.org/10.1063/5.0184233
Published by AIP Publishing. 978-0-7354-4850-6/$30.00

stigmasterol), gulonic acid, ferulic acid, and chlorogenic acid. However, the pharmacological activity of the herb and its derivative products is particularly ascribed to triterpenes, especially asiaticoside. Various standardized *C. asiatica* extracts traded in the market are also standardized with the concentrations of this marker compound [2]. Monograph of *C. asiatica* in various herbal pharmacopeias (Ayurvedic Pharmacopoeia of India, European Pharmacopoeia 9.0, Hong Kong Chinese Materia Medica Vol. 7, Indian Pharmacopoeia 2018, Malaysian Herbal Monograph 2009 Vol. 2, Pharmeuropa, Thai Herbal Pharmacopoeia 2018, USP41-NF36 S1, Vietnamese Pharmacopoeia 2017, and Indonesian Herbal Pharmacopoeia 2017) also use asiaticoside as a marker for analytical purposes.

Having a high-quality and uniform supply of raw materials is a problem faced by herbal medicine industries worldwide, including in Indonesia. It is in part because medicinal plants are grown or cultivated in various geographies across which temperature, humidity, rainfall, sunlight intensity, soil types, and other ecological factors may differ. These factors result in diverse biomass and concentration of chemical compounds in a plant. For instance, variations in asiaticoside contents of *C. asiatica* samples collected from locations with different geographical conditions have been previously reported [4–6]. Also, there have been accounts of variations in biomass due to different cultivation treatments [7]. However, variations in asiaticoside contents of *C. asiatica* samples from various locations in Indonesia remain under researched [8].

Several methods for detecting and measuring asiaticoside contents are TLC-densitometry [8–10], HPTLC-densitometry [4,11,12], and HPLC [13–15]. TLC is a separation method that has been used to analyze medicinal plants qualitatively and quantitatively for many years. Although other more sophisticated techniques have been developed, TLC remains the method of choice for herbal analysis and is adopted by many pharmacopeias because of its many advantages: multiple samples, including comparison samples, that can be analyzed simultaneously, selection of stationary and mobile phases that can be performed flexibly, simple equipment, ease of use, high reproducibility, and relatively low cost of analysis [16].

Considering the high industrial demand for raw *C. asiatica*, this research was conducted to develop and validate the TLC-densitometric method for identifying and measuring asiaticoside concentration of *C. asiatica* (i) and to determine the asiaticoside contents of *C. asiatica* samples from various locations in Indonesia using the validated TLC-densitometry (ii). It is expected that with a simple analytical method, as derived in this study, the standardization or quality control of *C. asiatica* as raw materials and their derivative products can be conducted easily.

MATERIAL AND METHODS

Chemicals and Reagents

The asiaticoside standard was obtained from Sigma-Aldrich (USA). Precoated TLC Si Gel 60 F_{254} and pro-analytical grade solvent were from Merck (Darmstadt, Germany).

Collection of Samples

Centella asiatica herbs were collected in July-September 2020 from four islands in Indonesia: Jawa (Tawangmangu, Batu, Probolinggo, and Magelang), Bali (Bangli), Lombok (Mataram, Lombok Barat, and Lombok Timur), and Kalimantan (Hulu Sungai Selatan). Details of the sampling locations are provided in Table 1. All the samples have been authenticated by the Center for Information and Development of Traditional Medicines (PIPOT), University of Surabaya.

TABLE 1. Locations of the *Centella asiatica* samples

Codes	Cities	Coordinates (Latitude, Longitude)	Elevation (masl)
a	Tawangmangu	7°39'49" S, 111°08'06" E	1,123
b	Batu	7°52'02" S, 112°31'11" E	895
c	Probolinggo	7°57'38" S, 113°23'00" E	550
d	Magelang	7°29'44" S, 110°08'10" E	714
e	Mataram	8°33'58" S, 116°07'27" E	33
f	Lombok Barat	8°34'17" S, 116°13'31" E	193
g	Lombok Timur	8°22'16" S, 116°32'09" E	1,166
h	Bangli	8°21'53" S, 115°20'44" E	850
i	Hulu Sungai Selatan	2°47'05" S, 115°15'37" E	23

Extraction

One gram of *C. asiatica* powder was first extracted with 7 ml of methanol using the ultrasonication method for 15 minutes at room temperature. Then, the extraction results were filtered and put into a 10 ml volumetric flask. The residue was rinsed with 3 ml of methanol and put into the same volumetric flask while filtered, then methanol was added until 10 ml.

Preparation of the Standard Solutions

To prepare the standard solutions, approximately 1.00 mg of asiaticoside standard was weighed, then put into a 1.5 ml microtube and added with 1000 µl of methanol using a micropipette.

TLC System

Samples of the *C. asiatica* extract and asiaticoside standard were spotted on the silica gel 60 F_{254} TLC plate in the form of 6 mm bands using a CAMAG 100-microliter sample syringe (Hamilton, Switzerland). The spotting was conducted automatically using a Linomat 5 sample applicator (CAMAG, Switzerland) with the help of N_2 gas. Then, elution was performed in a twin-through chamber (CAMAG, Switzerland) saturated with the mobile phase (ethyl acetate-methanol-water = 10:2.5:1 v/v/v) for 30 minutes. It was set in an ascending mode, with an elution distance of 80 mm from the spotting site. Afterward, the plate was dried in a fume hood, sprayed with anisaldehyde sulfuric acid reagent, and heated in an oven at 110°C for 10 minutes. Then, the TLC plate was documented in UV 254 nm, UV 365 nm, visible light and scanned using the TLC Scanner 4 (CAMAG, Switzerland) equipped with winCATS software, a scanning slit of 4 mm × 0.3 mm, and a data resolution of 1 nm/step at a scanning speed of 100 nm/s.

Method Validation

Specificity Determination

First, 4 µl of the standard asiaticoside solution and 6 µl of the *C. asiatica* extract sample were spotted on the TLC plate and then eluted and documented according to the designed TLC system. Then, to determine the specificity of the method, the bands of the asiaticoside standard and sample were compared to observe their Rf values, the shape of the visible spectrum, and maximum wavelength value using a densitometer. In addition, the densitometer was also used to determine if the asiaticoside band contained only one compound or more by measuring the visible spectrum at the beginning, apex, and end of the peak [17].

Determination of Linearity, Limit of Detection (LOD), and Limit of Quantification(LOQ)

Linearity was determined by spotting the standard asiaticoside solution at various volumes (1, 2, 4, 6, 8, 10 µl). For each volume, spotting was replicated three times on different plates. After elution and derivatization, the asiaticoside band was scanned with a TLC-scanner at the maximum wavelength obtained in the previous step, specificity determination. Afterward, the derived asiaticocide area (as *y*) was plotted against the mass of the spotted

asiaticoside (as *x*) to create a standard curve. The curve's linearity was determined from the correlation coefficient (*r*-value) of the formed linear regression equation (y = bx + a). The limit of quantification (LOQ) and detection (LOD) was each calculated from the standard deviation (SD) of the mean intercept and slope ($\bar{x}$) in the linear regression equation of the standard curve. The equations used were LOD = 3.3 (SD/$\bar{x}$) and LOQ = 10 (SD/$\bar{x}$) [12].

Precision Determination

Intraday precision was determined by spotting 4 µl of the standard asiaticoside solution onto a plate six times, creating six replicates. The eluted TLC plate was analyzed using a densitometer, then the mean, standard deviation, and relative standard deviation (%RSD) of the asiaticoside area were calculated. To determine the interday precision, 4 µl of the standard asiaticoside solution was spotted onto three different plates on three days. Afterward, the eluted plate was analyzed using a densitometer, then the mean, standard deviation, and relative standard deviation (%RSD) of the detected asiaticoside area were calculated [17].

Determination of the Asiaticoside Contents of *C. asiatica* Samples

To calculate the asiaticoside concentration in the *C. asiatica* herbs from nine (9) different locations, 8 µl of each extract sample was spotted onto a TLC plate and analyzed by the validated method. The analysis was performed in three replications. For each sample, the asiaticoside area detected by the densitometer was substituted into the standard curve's regression equation, and the asiaticoside content was measured in mg/g dry weight.

Data Analysis

Statistical analyses were conducted to distinguish the asiaticoside concentration of the *C. asiatica* herbs obtained from various locations. One-way ANOVA (α= 0.05) and a post hoc Tukey test were processed in GraphPad Prism Version 5.01.

RESULTS AND DISCUSSION

Physical Characteristics of the Sample Powder

The *Centella asiatica* herbs investigated in this study were collected from four major islands in Indonesia to represent areas with varying geographical conditions at different elevations, from 33 to 1,166 masl. The crude drugs produced from the samples shared similar organoleptic properties: greyish-green, dry, and brittle leaves (easily crumbled when crushed). Pictures of the nine powdered crude drugs are shown in Fig. 1.

Specificity

Specificity was determined by comparing similarities in color and Rf value between the bands of the asiaticoside standard and sample. In addition, their visible spectra were also overlaid to see any shared similarities. In the specificity analysis, the maximum wavelength of the asiaticoside standard was scanned within the range of 200–700 nm.

The chromatograms of the asiaticoside standard and sample shows that the band of the suspected asiaticoside in the sample had the same color as that of the asiaticoside standard, i.e., greenish blue in visible light (Fig. 2). The position of the two compound bands was also parallel.

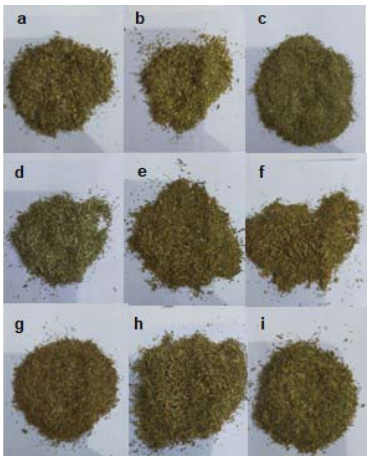

FIGURE 1. Organoleptic characteristics of the *Centella asiatica* powder from Tawangmangu (a), Batu (b), Probolinggo (c), Magelang (d), Mataram (e), Lombok Barat (f), Lombok Timur (g), Bangli (h), and Hulu Sungai Selatan (i)

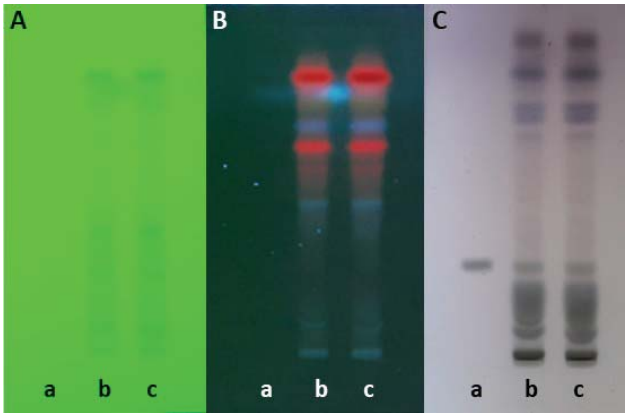

FIGURE 2. TLC chromatograms of the asiaticoside standard (a) and the *Centella asiatica* extract (b, c) with anisaldehyde sulfuric acid as the derivatization reagent, detected at 254 nm (A), 365 nm (B), and in visible light (C)

Results of specificity analysis shows the overlaid UV-vis spectra of the asiaticoside standard and the sample (Fig. 3). It indicates that the spectrum profile of the sample coincided with that of the standard, with a maximum wavelength of 594 nm. This result corresponds to a previous study that used maximum wavelengths of 595 nm [12] and 600 nm [4] for asiaticoside analysis.

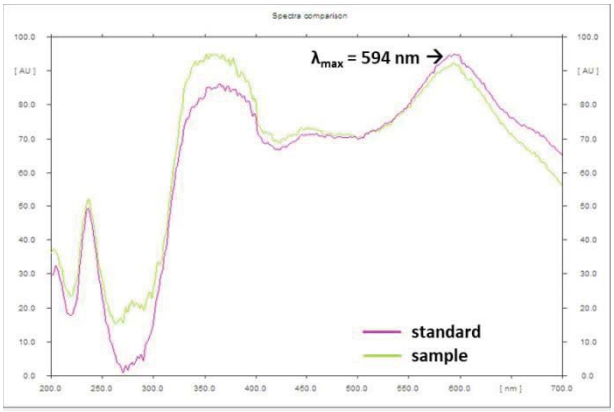

FIGURE 3. Overlaid UV-Vis spectra of the asiaticoside standard and the asiaticoside sample

Densitograms of the asiaticoside standard and sample shows that both of them had the same Rf value, 0.34 (Fig. 4). The peak purity of the sample (Table 2) is indicated by the values of r (s, m) and r (m, e), i.e., 0.998946 and 0.995208; both were > 0.99 [12]. From these data, it can be inferred that the TLC method designed for measuring the asiaticoside contents of *C. asiatica* has good specificity.

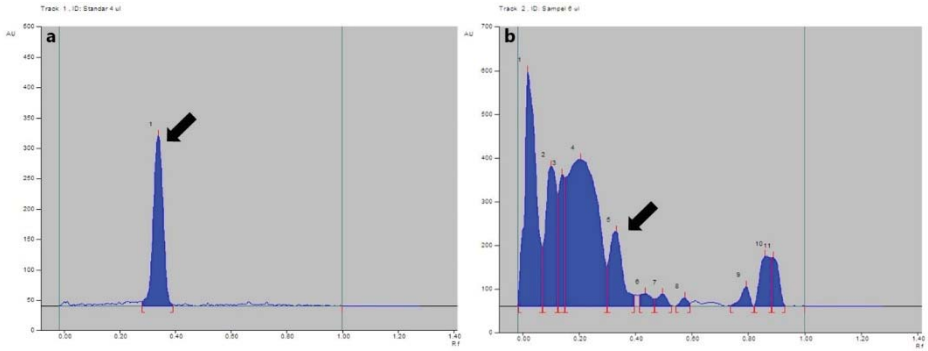

FIGURE 4. Densitograms of the asiaticoside standard (a) and *Centella asiaticosida* extract (b)

TABLE 2. Rf and peak purity parameter values of the asiaticoside standard and sample

Tracks	Identities	Assigned substances	Rf	r (s, m)	r (m, e)
1	Standard	Asiaticoside	0.34	0.999556	0.999006
2	Samples	Asiaticoside	0.34	0.998946	0.995208

Linearity, Limit of Detection (LOD), and Limit of Quantification (LOQ)

Linearity was determined by calculating the correlation coefficient (*r*) of the standard curve's linear regression equation. The standard curve was obtained from spotting different volumes of the standard asiaticoside solution (1.05 µg/µl), i.e., 1, 2, 4, 6, 8, and 10 µl or equivalent to 1.05, 2.1, 4.2, 6.3, 8.4, and 10.5 µg/band. The TLC chromatogram and two-dimensional densitogram of the standard asiaticoside solution are shown in Fig. 5, while the standard curve formed is in Fig. 6.

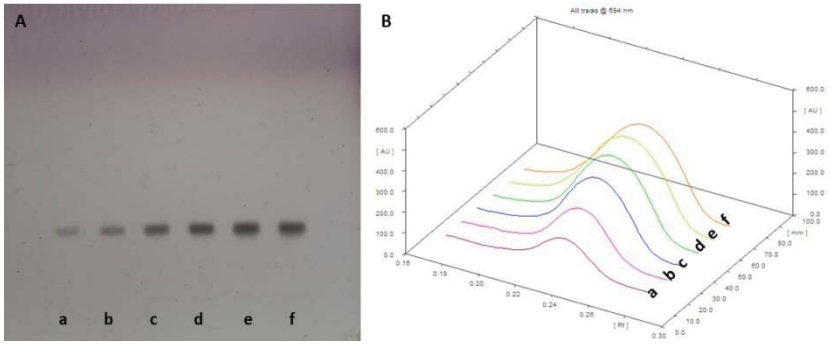

FIGURE 5. TLC chromatogram (A) and 2D densitogram (B) of the standard asiaticoside solution

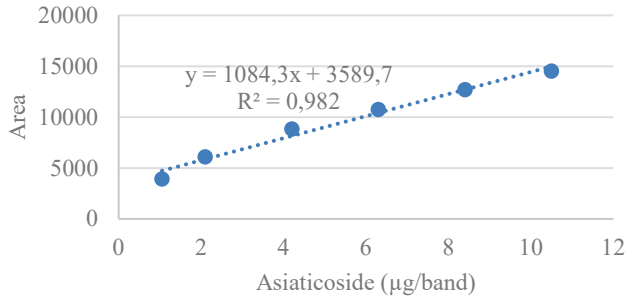

FIGURE 6. The curve of the linear regression equation between asiaticoside concentration and area

The final standard curve's equation, formulated from three replications, was y = 1084.3x + 3589.7. The LOD and LOQ calculated using the equation were 0.48820 µg/band and 1.47939 µg/band, respectively. The *r*-value obtained was 0.989437, indicating a linear relationship between concentrations in the range of 1.05–10.5 µg/band and each of the asiaticoside areas [4,12]. Previous research using a combination of TLC and densitometry also found LOD and LOQ nearly identical to the findings in this study, i.e., 0.72 µg and 1.2 µg [9]. However, in another study using HPTLC-densitometer, the derived LOD and LOQ of asiaticoside are lower [4,12,18]. LOD and LOQ are defined as the smallest amount of analyte that can be detected or quantified with reasonable statistical certainty, depending on the analytical method used. HPTLC is distinguished from TLC in that the former uses a stationary phase with a smaller particle size than the latter, thus providing better analytical performance, e.g., a smaller volume of the mobile phase, better precision, shorter analysis time, and increased sensitivity [19,20].

Precision

To determine intra- and interday precisions, the spotting of the asiaticoside standard onto the TLC plate was replicated six times and repeated on three different days. The asiaticoside areas read after the TLC-densitometer analysis are shown in Table 3.

TABLE 3. Intraday precision and interday precision test results

Replication	Areas		
	Day 1	**Day 2**	**Day 3**
1	13300.32	14416.70	13458.23
2	13683.41	13861.42	13748.83
3	13962.02	13588.83	13539.71
4	13327.32	13305.22	13683.28
5	12444.93	13085.16	13725.45
6	11433.20	12655.40	14505.11
Mean±SD	13025.20±932.63	13485.46±616.60	13776.77±374.25
RSD (%)	7.16	4.57	2.72
Intraday precision (%RSD, n = 6) = 2.72–7.16			
Interday precision (%RSD, n = 3) = 2.82			

Based on Table 3, it can be concluded that the TLC-densitometry method designed for detecting and measuring the asiaticoside contents of *C. asiatica* has good intra- and interday precision, with %RSD of 2.72–7.16 and 2.82, respectively [4,12].

Determination of Asiaticoside Concentration in *Centella asiatica* Samples

As seen in Table 4, the samples obtained from Lombok Timur and Bangli had minute asiaticoside contents (below the LOQ) that were not quantifiable. On the contrary, the other seven samples had varying concentration of asiaticoside, from 0.5393 to 3.4687 mg/g. Figure 8 shows that samples from Magelang, Lombok Barat, and Hulu Sungai Selatan had the highest asiaticoside content, while those from Batu, Probolinggo, and Mataram had the second-highest. The asiaticoside of the Tawangmangu sample was significantly lower than the *C. asiatica* collected from other regions ($p<0.05$), making it the smallest concentration detected in the study. However, although the samples from Tawangmangu, Lombok Timur, and Bangli had low asiaticoside, they contained other metabolites in a quite substantial or even higher amount than the other samples. These results are evident in the TLC profile shown in Fig. 7.

TABLE 4. Asiaticoside concentrations of the *Centella asiatica* samples obtained from nine locations

Sample codes	Sample origins	Asiaticoside concentration (mg/g)
a	Tawangmangu	0.5393±0.1172
b	Batu	1.0295±0.6675
c	Probolinggo	1.2104±0.3513
d	Magelang	3.2774±1.0630
e	Mataram	1.5700±0.6121
f	Lombok Barat	3.4687±0.9992
g	Lombok Timur	*
h	Bangli	*
i	Hulu Sungai Selatan	2.3390±1.2291

*: asiaticoside concentrations are not quantifiable (<LOQ); mean±SD (n = 3)

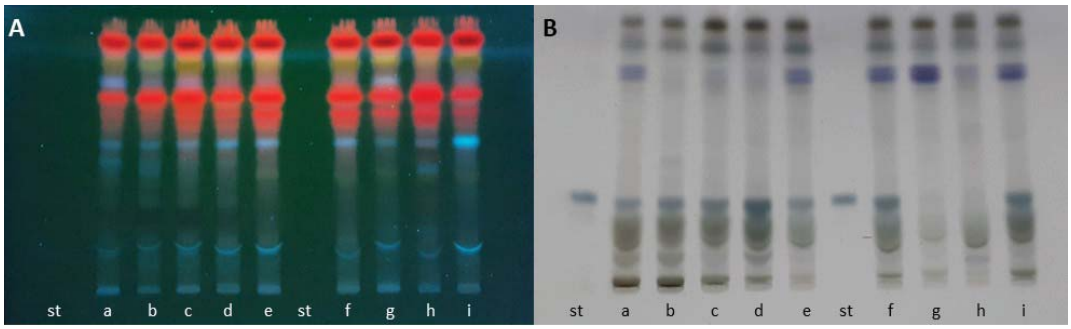

FIGURE 7. TLC chromatograms of the asiaticoside standard (st) and *Centella asiatica* samples from nine different locations (a-i), with anisaldehyde sulfuric acid as the derivatization reagent, detected in UV light at 365 nm (A) and visible light (B)

As seen in Table 4, the samples obtained from Lombok Timur and Bangli had minute asiaticoside contents (below the LOQ) that were not quantifiable. On the contrary, the other seven samples had varying concentration of asiaticoside, from 0.5393 to 3.4687 mg/g. Figure 8 shows that samples from Magelang, Lombok Barat, and Hulu Sungai Selatan had the highest asiaticoside content, while those from Batu, Probolinggo, and Mataram had the second-highest. The asiaticoside of the Tawangmangu sample was significantly lower than the *C. asiatica* collected from other regions ($p<0.05$), making it the smallest concentration detected in the study. However, although the samples from Tawangmangu, Lombok Timur, and Bangli had low asiaticoside, they contained other metabolites in a quite substantial or even higher amount than the other samples. These results are evident in the TLC profile shown in Fig. 7.

The study results proved that the asiaticoside concentration of the sampled *C. asiatica* are influenced by the plant's geographical location. However, whether the difference is due to the location's elevation or other factors remains unknown and, thus, requires further investigation. Therefore, before cultivating *C. asiatica*, it is necessary to consider the local geographical conditions so as to achieve harvests with a standard and consistent asiaticoside content.

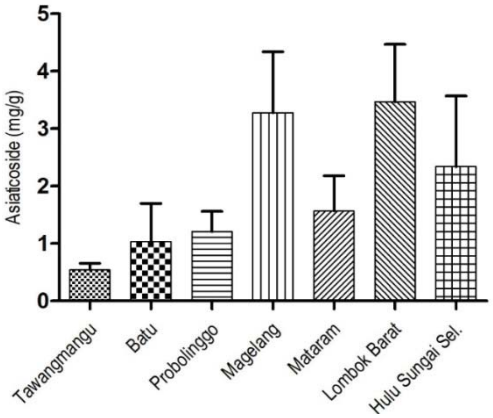

FIGURE 8. Asiaticoside concentrations of seven samples of *Centella asiatica*

CONCLUSION

The TLC-densitometry method designed is relatively simple but meets all the validation parameters. As a result, it can be used for analyzing asiaticoside in *Centella asiatica* both qualitatively and quantitatively. Furthermore, this study has found that the extracts of the *C. asiatica* collected from various locations and geographic characteristics in Indonesia contain different concentration of asiaticoside. In the future, the research can be developed to obtain data from unexplored regions in the country as well as other factors affected the different content of asiaticoside.

ACKNOWLEDGMENTS

The authors acknowledge the Indonesian Ministry of Education, Culture, Research and Technology for financially supporting this research under PDUPT Research Scheme with the grant number 063/SP-Lit/LPPM-01/KemendikbudRistek/Multi/FF/III/2022.

REFERENCES

1. U. G. Chandrika and P. A. A. S. Prasad Kumara, *Adv. Food Nutr. Res.* **76**, 125–157 (2015).
2. N. N. M. Razali, C. T. Ng, and L. Y. Fong, Planta Med. **85**, 1203–1215 (2019).
3. B. Sun, L. Wu, Y. Wu, C. Zhang, L. Qin, M. Hayashi, M. Kudo, M. Gao, and T. Liu, Front. Pharmacol. 1373 (2020).
4. S. Srivastava, S. Tiwari, N. Srivastava, S. Verma, and A. K. S. Rawat, Proc. Natl. Acad. Sci. India Sect. B Biol. Sci. **89**, 1057–1066 (2019).
5. D. Randriamampionona, B. Diallo, F. Rakotoniriana, C. Rabemanantsoa, K. Cheuk, A.-M. Corbisier, J. Mahillon, S. Ratsimamanga, and M. El Jaziri, Fitoterapia **78**, 482–489 (2007).
6. A. Devkota, S. Dall'Acqua, S. Comai, G. Innocenti, and P. K. Jha, Biochem. Syst. Ecol. **38**, 12–22 (2010).
7. N. S. Vinolina and R. Sigalingging, IOP Conf. Ser. Earth Environ. Sci. **782**, 032021 (2021).
8. S. Pramono and D. Ajiastuti, Maj. Farm. Indones. **15**, 119–123 (2004).
9. J. James and I. Dubery, J. Planar Chromatogr.-Mod. TLC **24**, 82–87 (2011).
10. S. E. Patel, S. A. Patel, L. Patel, and R. Patel, Planta Med. **80**, PPL37 (2014).
11. H. Ganse, F. Gbaguidi, P. O. Agbani, R. G. Josse, M. Moudachirou, B. A. Sinsin, J. Quetin-Leclercq, and T. Aminou, Int. J. Biol. Chem. Sci. **4**, (2010).
12. L. J. Patel, M. A. Raval, S. G. Patel, and A. J. Patel, J. AOAC Int. **102**, 1014–1020 (2019).
13. P. K. Jain and R. K. Agrawal, Chiang Mai J Sci **35**, 521–525 (2008).
14. H. Xing, B. Su, Y. Wang, Y. Yang, Q. Ren, W. Xiao, and X. Lu, J. Liq. Chromatogr. Relat. Technol. **32**, 1891–1900 (2009).
15. M. H. Rafamantanana, E. Rozet, G. E. Raoelison, K. Cheuk, S. U. Ratsimamanga, P. Hubert, and J. Quetin-Leclercq, J. Chromatogr. B **877**, 2396–2402 (2009).
16. M.-R. Shen, Y. He, and S.-M. Shi, J. Pharm. Anal. **11**, 155–162 (2020).

17. B. Spangenberg, C. F. Poole, and C. Weins, *Quantitative Thin-Layer Chromatography: A Practical Survey* (Springer Science & Business Media, Germany, 2011).
18. A. Gupta, S. Verma, P. Kushwaha, S. Srivastava, and R. Aks, Indian J. Pharm. Educ. Res. **48**, 75–79 (2014).
19. M. Srivastava, *High-Performance Thin-Layer Chromatography (HPTLC)* (Springer Science & Business Media, Berlin, 2010).
20. A. Zlatkis and R. E. Kaiser, *HPTLC-High Performance Thin-Layer Chromatography* (Elsevier, Amsterdam, 2011).

AIP Conference Proceedings

AIP Publishing

Volume 3001

International Conference on Environmental, Mining, and Sustainable Development 2022

Padang, Indonesia • 25 May 2022

Editors • Eri Barlian, Indang Dewata, Rahadian Zainul, Safiah Muhammad Yusoff and Robbi Rahim

MDPI
MEDIA DIGITAL PUBLIKASI INDONESIA

Available Online: pubs.aip.org/aip/acp

Conference Proceedings Team

For journal related inquiries, please contact:

confproc@aip.org

Editorial Assistant: Francesca Tangreti

Manager, Conference Proceedings: Emily Prendergast

Director, Publishing Development: Bridget D'Amelio

PRELIMINARY

Preface: International Conference on Environmental, Mining and Sustainable Development 2022

AIP Conf. Proc. 3001, 010001 (2024) https://doi.org/10.1063/12.0022251

View article | PDF

BIO FUEL ENGINEERING

Experimental study on bio-oil recovery from biobased building insulation materials and its upgrading

Ayik Abdillah; Christelle Rabbat; Sary Awad; Audrey Villot; Cindy Rianti Priadi; Yves Andres

AIP Conf. Proc. 3001, 020001 (2024) https://doi.org/10.1063/5.0185966

Abstract | View article | PDF

CHEMISTRY AND CHEMICAL SCIENCE

Preliminary study of measurement of maturity level of mining work environment safety management performance

Jerri Mapanta; Riso Sari Mandeli; Arief Aminuddin; Raden Haris Handayana; Nurhasan Syah; H. Heldi; Nasfryzal Carlo

AIP Conf. Proc. 3001, 030001 (2024) https://doi.org/10.1063/5.0184247

Abstract | View article | PDF

ZnO's effect on Portland cement's antibacterial properties

Randy Trafino; Muhammad Thoriq Albari; Muhammad Arya Ghifari; Muhammad Raffi Ghifari; Devi Purnamasari; Riso Sari Mandeli

AIP Conf. Proc. 3001, 030002 (2024) https://doi.org/10.1063/5.0184160

Abstract | View article | PDF

Effect of adding CuO as antibacterial to Portland cement

Rida Oppi Ramadhani; Muhammad Thoriq Albari; Muhammad Arya Ghifari; Muhammad Raffi Ghifari; Devi Purnamasari; Riso Sari Mandeli

AIP Conf. Proc. 3001, 030003 (2024) https://doi.org/10.1063/5.0184162

Abstract | View article | PDF

The antibacterial properties of paint with the addition of ZnO nanoparticles

Wulandari Agustin; Muhammad Thoriq Albari; Muhammad Arya Ghifari; Muhammad Raffi Ghifari; Devi Purnamasari; Riso Sari Mandeli

AIP Conf. Proc. 3001, 030004 (2024) https://doi.org/10.1063/5.0184163

Abstract | View article | PDF

MgO's effect on wall paint's antibacterial properties

Sintia Noveliza; Muhammad Thoriq Albari; Muhammad Arya Ghifari; Muhammad Raffi Ghifari; Devi Purnamasari; Riso Sari Mandeli

AIP Conf. Proc. 3001, 030005 (2024) https://doi.org/10.1063/5.0184164

Abstract | View article | PDF

The impact of the home environment and community behavior of dengue hemorrhagic fever (DHF) in Rimbo Tengah district, Bungo Regency in 2022

Naldi Candra; Eri Barlian; Abdul Razak; Linda Handayuni; Aidil Onasis; Cica Ramadani

AIP Conf. Proc. 3001, 030006 (2024) https://doi.org/10.1063/5.0184152

Abstract View article PDF

Ongoing attempt on the incorporation of pyrazine as pillar in the construction of Zn(II)-tartrate polymeric complex for renewable porous materials

Yana Yunita; Rachmat Triandi Tjahjanto; Danar Purwonugroho; Yuniar Ponco Prananto

AIP Conf. Proc. 3001, 030007 (2024) https://doi.org/10.1063/5.0184577

Abstract View article PDF

Simple TLC-densitometric method for the quantification of asiaticoside in *Centella asiatica* from different origins for its standardization

K. Kartini; A. Rosidah; R. Budiono

AIP Conf. Proc. 3001, 030008 (2024) https://doi.org/10.1063/5.0184233

Abstract View article PDF

Variation on native *Amorphophallus muelleri* blume in Malang, East Jawa, Indonesia

M. Afiyanti; E. L. Arumingtyas; R. Azrianingsih; S. Indriyani

AIP Conf. Proc. 3001, 030009 (2024) https://doi.org/10.1063/5.0184949

Abstract View article PDF

Study of *Phytoene synthase 1* (*PSY1)* and *capsanthin-capsorubin synthase* (*CCS)* gene profile in chili peppers (*Capsicum frutescens* L.) Cakra Hijau, G1/M8 line, and HV-149

A. S. Zakiyah; D. Siswanto; E. L. Arumingtyas

AIP Conf. Proc. 3001, 030010 (2024) https://doi.org/10.1063/5.0189450

Abstract View article PDF

The effect of auxin 2,4-dichlorophenoxyacetic acid and explant type on red spinach (*Amaranthus gangeticus*. Sp) callus induction

Alif Rofiqotun Nurul Alimah; Estri Laras Arumingtyas; Retno Mastuti

AIP Conf. Proc. 3001, 030011 (2024) https://doi.org/10.1063/5.0185965

Abstract View article PDF

Mycelium-based leather potential for sustainability: A review

N. R. Ariyani; S. P. Wijayanti; N. G. Putra; M. B. Kusumawati; A. A. R. Setiawan; F. Isharyadi; N. Widyastuti; I. N. Djarot; T. Handayani

AIP Conf. Proc. 3001, 030012 (2024) https://doi.org/10.1063/5.0184187

Abstract View article PDF

The potential use of *Arbuscular mycorrhizal Fungi* (AMF) to improve cocoa seedlings growth performance under environmental stress

conditions

F. Rohman; S. Anggraini; E. Prastowo; A. Munawarti

AIP Conf. Proc. 3001, 030013 (2024) https://doi.org/10.1063/5.0192887

Abstract View article PDF

The effect of potential and time stability on the electrochemical synthesis of gold nanoparticles

Q. Fardiyah; A. F. Assomadi; S. Suyanta; Suprapto; F. Kurniawan

AIP Conf. Proc. 3001, 030014 (2024) https://doi.org/10.1063/5.0185111

Abstract View article PDF

Effect of sucrose concentration on porang (*Amorphophallus muelleri* Blume) in vitro micro tubers induction

A. Rahma; A. S. P. Pratama; M. N. Fikri; R. Azrianingsih

AIP Conf. Proc. 3001, 030015 (2024) https://doi.org/10.1063/5.0197055

Abstract View article PDF

Breeding of drought tolerant soybean varieties adaptable to rainfed area of Indonesia

Rudy Soehendi; Suhartina; Made J. Mejaya; Purwantoro; Trustinah; Nuryati

AIP Conf. Proc. 3001, 030016 (2024) https://doi.org/10.1063/5.0184506

Abstract View article PDF

Effect of benzyl amino purine (BAP) on shoot multiplication using peeled bulbil explants

N. Harijati; M. Rosyidah

AIP Conf. Proc. 3001, 030017 (2024) https://doi.org/10.1063/5.0189572

Abstract View article PDF

Profile of omega acid from kenari oil (*Canarium zeylanicum*) found in Makean Island North Maluku

Sundari; A. R. Tolangara; Yusnaini; Abdu Mas'ud

AIP Conf. Proc. 3001, 030018 (2024) https://doi.org/10.1063/5.0198028

Abstract View article PDF

Screening the potential lactic acid bacteria isolated from the cecum of kampung chicken cultivated in Sambi village NTT

E. Lengur; Y. D. Jatmiko; E. Arisoesilaningsih; E. Widodo

AIP Conf. Proc. 3001, 030019 (2024) https://doi.org/10.1063/5.0184040

Abstract View article PDF

Perception and appreciation of sasak tribe toward of *Schizostachyum lima* (Blanco) Merr. in Lombok Island

E. Aryanti; S. Indriyani; E. Arisoesilaningsih; R. Azrianingsih

AIP Conf. Proc. 3001, 030020 (2024) https://doi.org/10.1063/5.0183952

Abstract View article PDF

Propagation of *Habenaria beccarii* Schltr. by in vitro culture in purwodadi botanic garden

E. E. Ariyanti; D. Mudiana; N. D. Yulia

AIP Conf. Proc. 3001, 030021 (2024) https://doi.org/10.1063/5.0183879

Abstract | View article | PDF

The fish diversity in code river, Bantul Regency, Yogyakarta special region

A. Budiantoro; L. R. Sari; N. Suwartiningsih

AIP Conf. Proc. 3001, 030022 (2024) https://doi.org/10.1063/5.0189449

Abstract | View article | PDF

Screening of mung bean genotypes for their resistance against legume pod borer, *Maruca testulalis*

N. Nuryati; T. Trustinah; M. S. Y. I. Bayu

AIP Conf. Proc. 3001, 030023 (2024) https://doi.org/10.1063/5.0184828

Abstract | View article | PDF

Ecosystem assessment of several springs in UB forest (UBF) based on phytoplankton and vegetation community

V. Vidayanti; C. Retnaningdyah; E. Arisoesilaningsih

AIP Conf. Proc. 3001, 030024 (2024) https://doi.org/10.1063/5.0184966

Abstract | View article | PDF

Studies on the yield rate, nutrient composition, and simple bulk handling methods to maintain the nutritional value of stored rice straw

Khalil; Roni Pazla; Andri; Hermon

AIP Conf. Proc. 3001, 030025 (2024) https://doi.org/10.1063/5.0183885

Abstract | View article | PDF

Relationship between geographical factors and feed carrying capacity with the existence of the endemic butterfly *Ornithoptera croesus* on Bacan Island

A. Mas'ud; A. R. Tolangara; B. K. Lahati; Sundari

AIP Conf. Proc. 3001, 030026 (2024) https://doi.org/10.1063/5.0198958

Abstract | View article | PDF

Structure and carbon stock of vegetation in the arboretum area of the Purwodadi Botanic Garden

F. Fauziah; Muhammad Fuad Fajrushobah; Deva Eka Ramadhani; Titut Yulistyarini; Abban Putri Fiqa

AIP Conf. Proc. 3001, 030027 (2024) https://doi.org/10.1063/5.0184039

Abstract | View article | PDF

Isolation and characterization of *Salmonella* typhimurium lytic bacteriophages from fermented shrimp paste (*Terasi*)

A. Gaffar; Y. D. Jatmiko; A. A. Prihanto

AIP Conf. Proc. 3001, 030028 (2024) https://doi.org/10.1063/5.0183898

Abstract View article PDF

Orchid diversity in Kayan Mentarang National Park, North Kalimantan

A. R. U. Wibowo; R. K. Wati; G. A. E. Oktavia; D. Lestari; I. K. Toya; I. G. Tirta

AIP Conf. Proc. 3001, 030029 (2024) https://doi.org/10.1063/5.0184101

Abstract View article PDF

Preliminary investigation of buried caves in Alas Kasinan, Pesanggrahan village, East Java based on Georadar

S. Maryanto; G. Al-Atqiya; R. P. H. Sari

AIP Conf. Proc. 3001, 030030 (2024) https://doi.org/10.1063/5.0189706

Abstract View article PDF

Efforts for selection of the *Lenggek* crowing number of Kokok Balenggek chicken based on qualitative phenotypic characteristics

F. Arlina; Rusfidra; Y. Safitri; T. Rafian

AIP Conf. Proc. 3001, 030031 (2024) https://doi.org/10.1063/5.0185980

Abstract View article PDF

Computational study *Catharanthus roseus* L. essential oil extract as potential pan-PI3K inhibitor

A. H. Ahkam; N. M. Maghfiroh; F. N. Sari; M. Rifa'i

AIP Conf. Proc. 3001, 030032 (2024) https://doi.org/10.1063/5.0189093

Abstract View article PDF

Comparative morphology of cerithioidean radula (Mollusca: Gastropoda) observed using scanning electron microscope

Y. Apriyanti; N. R. Isnaningsih

AIP Conf. Proc. 3001, 030033 (2024) https://doi.org/10.1063/5.0186326

Abstract View article PDF

Effect of *Trichoderma asperellum* application on growth and total phenolic content in soybean seedlings

E. Yusnawan; E. Uge; A. Inayati

AIP Conf. Proc. 3001, 030034 (2024) https://doi.org/10.1063/5.0184209

Abstract View article PDF

Comprehensive application to grow *Calliandra calothyrsus* by using cow dung biochar and solid waste from silica sand purification on critical mining land

Bernadetha Susianti; I. D. A. A. Warmadewanthi; Bieby Voijant Tangahu

AIP Conf. Proc. 3001, 030035 (2024) https://doi.org/10.1063/5.0194966

Abstract View article PDF

Interaction of epiphyte *Polysiphonia sp* with *Kappaphycus alvarezii* host based on anatomical structure and phytochemical profile

Mursal Ghazali; Wahyu Widoretno; Catur Retnaningdyah; Estri Laras Arumingtyas
AIP Conf. Proc. 3001, 030036 (2024) https://doi.org/10.1063/5.0184452

Abstract | View article | PDF

Germplasm screening of castor bean (*Ricinus communis* L) for resistance to fusarium wilt (*Fusarium oxysporum f.* ricini)

R. Aikmelisa; B. Waluyo; D. Saptadi
AIP Conf. Proc. 3001, 030037 (2024) https://doi.org/10.1063/5.0184806

Abstract | View article | PDF

Potential plants for wreathed hornbill (*Rhyticeros Undulatus*) feed in the Mendiro forest preserve, East Java

Erfan Kriswanto; Ramadhanu Pratama; Raden Nurifani Khairunnisa; Nirmala Ayu Aryanti
AIP Conf. Proc. 3001, 030038 (2024) https://doi.org/10.1063/5.0183876

Abstract | View article | PDF

Durio kutejensis (Hassk.) Becc., the potential species of Kalimantan endemic Durian as non-timber forest products: A review

T. R. Yusnikusumah; U. K. Sari; B. S. Sitepu; A. W. Nugroho; Mukhlisi
AIP Conf. Proc. 3001, 030039 (2024) https://doi.org/10.1063/5.0184205

Abstract | View article | PDF

Relationship of sweetpotato (*Ipomoea batatas* L.) clones based on morphological characteristics

Nuryati; F. C. Indriani; M. J. Mejaya; R. Krisdiana
AIP Conf. Proc. 3001, 030040 (2024) https://doi.org/10.1063/5.0185609

Abstract | View article | PDF

RAPD analysis to reveal the genetic diversity among closely related *Etlingera* species of *Achasma* group, Zingiberaceae

Trimanto; R. T. Probojati; D. Wahyudi; L. Hapsari
AIP Conf. Proc. 3001, 030041 (2024) https://doi.org/10.1063/5.0184487

Abstract | View article | PDF

Pollen characters of species from Leguminosae-Caesalpinioideae: Significance in identification and reproductive biology

S. Mas'udah; L. Hapsari; J. Damaiyani
AIP Conf. Proc. 3001, 030042 (2024) https://doi.org/10.1063/5.0184780

Abstract | View article | PDF

Chromosomal analysis of *Vanda celebica*, *V. dearei,* and their hybrids orchid

S. Hartati; Sukaya; Samanhudi; B. Agatha
AIP Conf. Proc. 3001, 030043 (2024) https://doi.org/10.1063/5.0184489

Abstract | View article | PDF

Morphological characterization of *Phalaenopsis* spp. for the conservation

morphological characterization of *Phalaenopsis* spp. for the preservation of germplasm

S. Hartati; Samanhudi; O. Cahyono; A. Wibowo; I. R. Manurung; N. N. Firdaus

AIP Conf. Proc. 3001, 030044 (2024) https://doi.org/10.1063/5.0184491

Abstract View article PDF

Bamboo forest management practices and local wisdom in Tana Toraja and North Toraja Regency, South Sulawesi

Markus Kudeng Sallata; Merryana Kiding Allo; Fajri Ansari

AIP Conf. Proc. 3001, 030045 (2024) https://doi.org/10.1063/5.0184455

Abstract View article PDF

Spore germination and gametophyte development of *Cyathea contaminans* (Hook.) Copel (Cyatheaceae) under different culture media

Y. Isnaini; A. Salamah; T. Ng Praptosuwiryo; D. Darnaedi

AIP Conf. Proc. 3001, 030046 (2024) https://doi.org/10.1063/5.0198936

Abstract View article PDF

Study on utilization of ash from incineration process of hazardous and toxic waste Pt. Kawasan Industri Makassar

M. F. Nabila; I. Warmadewanthi; A. Hadiasyah

AIP Conf. Proc. 3001, 030047 (2024) https://doi.org/10.1063/5.0185683

Abstract View article PDF

The application of Universitas Indonesia organic waste compost on eggplant (*Solanum melongena* L. cv. Black beauty) generative growth

R. D. Delphia; N. Nisyawati

AIP Conf. Proc. 3001, 030048 (2024) https://doi.org/10.1063/5.0198935

Abstract View article PDF

Genetic variation of *Eucalyptus urophylla* at seedling stage from provenances of East Nusa Tenggara, Indonesia

H. S. Nuroniah; Darwo; Yulianti; N. E. Lelana; K. P. Putri; U. W. Darmawan; Danu; N Mindawati; B. Herdiyantara; Y. Kusuma

AIP Conf. Proc. 3001, 030049 (2024) https://doi.org/10.1063/5.0184655

Abstract View article PDF

A systematic review on *Streptomycetes* mediated green synthesis gold nanoparticles and their application in nanomedicine

A. Rosyidah; S. Kerdtoob; N. Gustini; R. D. Pratiwi; S. El-Muttaqien; G. Syahputra; W. I. Yudhistyra; A. W. Munfadlila

AIP Conf. Proc. 3001, 030050 (2024) https://doi.org/10.1063/5.0183883

Abstract View article PDF

Analysis of microplastic abundance in Brantas river, East Java

A. T. Yanuar; A. Kurniawan; D. Yona; S. Sudaryanti; A. Darmawan; N. H. Anggoro; A. A. Amin; L. N. Salamah; Z. Pramudia; Y. A. D. Susanti

AIP Conf. Proc. 3001, 030051 (2024) https://doi.org/10.1063/5.0186529

Abstract View article PDF

Sahyadrassus malabaricus (Moore) stem borer attacks on *Trema orientalis* L. Blume plant

U. W. Darmawan; Y. Lisnawati

AIP Conf. Proc. 3001, 030052 (2024) https://doi.org/10.1063/5.0189417

Abstract View article PDF

Leaf sheaths micromorphology of four *Glomera* species from new Guinea

R. K. Wati; I. A. Fijridiyanto

AIP Conf. Proc. 3001, 030053 (2024) https://doi.org/10.1063/5.0184085

Abstract View article PDF

CIVIL ENGINEERING

Hospital interior design with healing environment approach

Firmansyah Rangga; Nazlina Shaari; Sumarni Ismail; Nensi Golda Yuli; Dinda Salmarisha

AIP Conf. Proc. 3001, 040001 (2024) https://doi.org/10.1063/5.0184126

Abstract View article PDF

The effect of El-Nino on drought distribution patterns in the irrigation area of Batujai Dam

I. Wayan Yasa; Suryawan Murtiadi; Fika Septiana Pangaribuan

AIP Conf. Proc. 3001, 040002 (2024) https://doi.org/10.1063/5.0184056

Abstract View article PDF

Utilization of flood peak discharge data in preparing disaster mitigation programs in Bengkulu city

Gusta Gunawan

AIP Conf. Proc. 3001, 040003 (2024) https://doi.org/10.1063/5.0184305

Abstract View article PDF

COMPUTER SCIENCE

Developing a real-time detection and visualization of landslide hazards using web-GIS: A case study in Pacet, Mojokerto, East Java, Indonesia

Listyo Yudha Irawan; Widodo Eko Prasetyo; Melinda Meganagatha; Rosbella Devy; Damar Panoto; Irfan Helmi Pradana; Dicky Arinta

AIP Conf. Proc. 3001, 050001 (2024) https://doi.org/10.1063/5.0184132

Abstract View article PDF

EDUCATIONAL TECHNOLOGY

Promoting environmental awareness through language learning: A study on the integration of environmental education in the classroom

V. Indriyani; A. Atmazaki; S. Ramadhan

AIP Conf. Proc. 3001, 060001 (2024) https://doi.org/10.1063/5.0184170

Abstract View article PDF

Students attitudes toward research methodology courses

Heny Narendrany Hidayati

AIP Conf. Proc. 3001, 060002 (2024) https://doi.org/10.1063/5.0184249

Abstract View article PDF

ENVIRONMENTAL ENGINEERING

Geochemical characterization of coal mine overburden and fly ash – A case study in simpang belimbing mine–mouth coal-fired power plant, Muara Enim

Atikah Damayanti; Setyo S. Moersidik; Sandyanto Adityosulindro

AIP Conf. Proc. 3001, 070001 (2024) https://doi.org/10.1063/5.0184134

Abstract View article PDF

ENVIRONMENTAL SCIENCE

Comparison of slope stability analysis results with rock mass classification: Case study of the slope of Ende - Lianunu highway STA 16+878, East Nusa Tenggara Province

Tien Veny Vera; Singgih Saptono; Ardya Pramesti Putri Arindry; Muhammad Cholid

AIP Conf. Proc. 3001, 080001 (2024) https://doi.org/10.1063/5.0184158

Abstract View article PDF

The utilization of 100 % waste oil content on Himex70 product at Petrosea Pit, Pt Kideco Jaya Agung

Raden Haris Handayana; Jerri Mapanta; Milia Putri; Jihan Lubis; Eri Barlian; Nasfryzal Carlo; Hamdi

AIP Conf. Proc. 3001, 080002 (2024) https://doi.org/10.1063/5.0184144

Abstract View article PDF

Geological and hydrogeological identification data in disaster mitigation effort in regional development planning of IKN to realize sustainable development

Ujang Sudiartono; Dedi Hermon; Nurhasan Syah

AIP Conf. Proc. 3001, 080003 (2024) https://doi.org/10.1063/5.0183877

Abstract View article PDF

Ambient dust levels in the paths that are passed and not passed by barges on the Mahakan river – East Kalimantan

Nur Efendi; Eri Barlian; Indang Dewata; Nurhasan Syah; Mulya Gusman

AIP Conf. Proc. 3001, 080004 (2024) https://doi.org/10.1063/5.0184148

Abstract View article PDF

The impact of the coal stockpile plan at Lokutuan Port – Bont[illegible] on the

The impact of the coal stockpile plan at Loktuan Port - Bontang on the environment and public health levels

M. Musharyanto; Eri Barlian; Heldi; Mulya Gusman

AIP Conf. Proc. 3001, 080005 (2024) https://doi.org/10.1063/5.0185867

Abstract View article PDF

Comparison of the environmental impacts of aquaponics and hydroponics using the LCA method in Bogor, Indonesia

Fikri Dinegoro; Djoko M. Hartono; Dwica Wulandari; Dwi Ajeng Sarasputri; Dasi Agung Ospaman

AIP Conf. Proc. 3001, 080006 (2024) https://doi.org/10.1063/5.0184149

Abstract View article PDF

Study of carrying capacity and capacity of Lawai river and Kiahan river, Muara Enim Regency

Yulkar Pramilus; Eri Barlian; Iswandi Umar

AIP Conf. Proc. 3001, 080007 (2024) https://doi.org/10.1063/5.0184142

Abstract View article PDF

Evaluation of the water environment quality of several rivers in Lahat Regency based on plankton composition

Andri Wijaya Kesuma; Muhammad Agus; Rahman Arif; Raja Muhammad Faisal; F. Firmansyah

AIP Conf. Proc. 3001, 080008 (2024) https://doi.org/10.1063/5.0185864

Abstract View article PDF

The role of extrinsic and intrinsic factors on successful tuberculosis treatment that impacts on sustainable development in Bukittinggi

A. Athosra; M. Maisyarah; Indang Dewata; Iswandi Umar

AIP Conf. Proc. 3001, 080009 (2024) https://doi.org/10.1063/5.0184141

Abstract View article PDF

The analysis management and potential cultural tourism objects (case study of Makam Syuhada Lapan cultural tourism object in Bireuen distric, Aceh Province, Indonesia)

M. Jamil Husen; Rahmi Novalita; Sri Wahyuni

AIP Conf. Proc. 3001, 080010 (2024) https://doi.org/10.1063/5.0184168

Abstract View article PDF

Health environmental policy formulation in overcoming the impact of forest and land fires in the city of Payakumbuh, West Sumatra

Linda Handayuni; Ririn Afrima Yenni; Eri Barlian; Abdul Razak; Ratna Wilis

AIP Conf. Proc. 3001, 080011 (2024) https://doi.org/10.1063/5.0184958

Abstract View article PDF

Sustainability analysis of Rumah Gadang in Nagari Tuo Pariangan, Tanah Datar Regency using multidimensional scaling (MDS)

Titin Nofita Handa Puteri; H. Heldi; Iswandi Umar; Siti Fatimah

AIP Conf. Proc. 3001, 080012 (2024) https://doi.org/10.1063/5.0184181

Abstract View article PDF

The population explosion: Indonesian's dilemma amid limited resources

W. Wagianto; Nurhasan Syah; Indang Dewata; Iswandi Umar; Aprizon Putra

AIP Conf. Proc. 3001, 080013 (2024) https://doi.org/10.1063/5.0184169

Abstract View article PDF

Analysis of the development of floating cages in Lake Maninjau

Y. Yusnani; Indang Dewata; Nurhasan Syah; Aldri Frinaldi; Randi Permana Putra

AIP Conf. Proc. 3001, 080014 (2024) https://doi.org/10.1063/5.0184253

Abstract View article PDF

Modelling traffic noise level and estimated population exposure in Padang city

Deded Chandra; Eri Barlian; Heldi; Hamdi; Vauzia; Ratna Wilis

AIP Conf. Proc. 3001, 080015 (2024) https://doi.org/10.1063/5.0184146

Abstract View article PDF

Coal quality analysis at CV Bara Mitra Kencana Sawahlunto West Sumatera

Heri Prabowo; Eri Barlian; Nurhasan Syah; Deni Riski Ramadan

AIP Conf. Proc. 3001, 080016 (2024) https://doi.org/10.1063/5.0184135

Abstract View article PDF

Indmira product review as a post-mining environmental improvement technology

Raja Muhammad Firmansyah; Threo Wanda Marten; Andri Wijaya Kesuma

AIP Conf. Proc. 3001, 080017 (2024) https://doi.org/10.1063/5.0185823

Abstract View article PDF

Ecological study of the influence of mining workers on mining area communities

Dadan M. Hamdani; Eri Barlian; Indang Dewata; Mulya Gusman; Aprizon Putra; H. Heldi

AIP Conf. Proc. 3001, 080018 (2024) https://doi.org/10.1063/5.0184175

Abstract View article PDF

Threats of mining activities and karst landscape management strategies in Indonesia

Rahman Arif; Riso Sari Mandeli; Dian Ayu Lestari; Ririn Hanriesta

AIP Conf. Proc. 3001, 080019 (2024) https://doi.org/10.1063/5.0184145

Abstract View article PDF

Developing strategies to promote Pantai Lango "the boat craftsmanship" village as a destination of Balikpapan Bay integrated ecotourism

Karnila Willard; Marlon Ivanhoe Aipassa; Mustofa Agung Sardjono; Rujehan; Yosep Ruslim; Rochadi Kristiningrum; Wulan I. R. Sari

AIP Conf. Proc. 3001, 080020 (2024) https://doi.org/10.1063/5.0184123

Abstract | View article | PDF

Riparian landscape conditions of Batang Agam river to improve land quality index in Payakumbuh city

Lisa Anisa; Ardinis Arbain; Yori Hendra

AIP Conf. Proc. 3001, 080021 (2024) https://doi.org/10.1063/5.0184147

Abstract | View article | PDF

Visual interpretation of land use and land cover changes based on ESRI land cover time series data in sitiung, West Sumatra (a preliminary study)

Dian Ayu Lestari Alifa Putri; Eri Barlian; Iswandi Umar; Nurhasan Syah

AIP Conf. Proc. 3001, 080022 (2024) https://doi.org/10.1063/5.0183961

Abstract | View article | PDF

Analysis of the content of lead compounds (Pb) on typed paper as wrapping Sala Bulek on body health

Aulia Asman; Eri Barlian; Siti Fatimah; Indang Dewata; Dedi Hermon; Abdul Razak; Serly Mutia Sari; Auzia Asman; Ilham Zamil

AIP Conf. Proc. 3001, 080023 (2024) https://doi.org/10.1063/5.0184124

Abstract | View article | PDF

The united nations sustainable development goals (UN SDGs) in dealing with the VUCA (volatility, uncertainty, complexity, Ambiguity) of post COVID-19 pandemic: Is it the best derivation?

Ebill Fuji Edison; Ribka Ankashima Sembiring; Pudia M. Indika; Nurhasan Syah; Abdul Razak; Indang Dewata

AIP Conf. Proc. 3001, 080024 (2024) https://doi.org/10.1063/5.0184137

Abstract | View article | PDF

Supporting capacity of water resources in fulfilling the target of sustainable development goals in Payakumbuh city

Betha El Sherra; Indang Dewata; Lisa Anisa

AIP Conf. Proc. 3001, 080025 (2024) https://doi.org/10.1063/5.0184176

Abstract | View article | PDF

Construction of a plastic waste management policy model in the coastal city of Padang

Riso Sari Mandeli; Indang Dewata; Dasman Lanin; Nafrizal Carlo

AIP Conf. Proc. 3001, 080026 (2024) https://doi.org/10.1063/5.0184165

Abstract | View article | PDF

Analysis of tourism development based on good environmental governance in the Muaro Batang Arau integrated area

Aldri Frinaldi; Nora Eka Putri; Boni Saputra; Adil Mubarak; Rizki Syafril; Ratna Willis; Irvan Renaldi; Hafifah Humaida

AIP Conf. Proc. 3001, 080027 (2024) https://doi.org/10.1063/5.0184172

Abstract | View article | PDF

Abstract View article PDF

Analysis of health vulnerability to climate change in West Sumatra, Indonesia

Muchsin Riviwanto; A. Afrizal; Eri Barlian; Yuniar Lestari

AIP Conf. Proc. 3001, 080028 (2024) https://doi.org/10.1063/5.0184133

Abstract View article PDF

The effect of community perceptions on ecoto urism development: Study at Pesawaran protected forest area, Lampung Province, Indonesia

Samsul Bakri; Shinta Dewi Marcelina; Zainal Abidin; Febriarti E. Prasmatiwi

AIP Conf. Proc. 3001, 080029 (2024) https://doi.org/10.1063/5.0184129

Abstract View article PDF

Preventing stunting in children under five: The intersection of energy and protein consumption, infectious diseases, and environmental health in Padang, Indonesia

Defriani Dwiyanti; Muchsin Riviwanto; E. Edmon

AIP Conf. Proc. 3001, 080030 (2024) https://doi.org/10.1063/5.0184139

Abstract View article PDF

Land use change effect on river discharge of the way Pengubuan watershed, Sumatra_Indonesia

Samsul Bakri; Dian Aprianto; Zainal Abidin; Melya Riniarti

AIP Conf. Proc. 3001, 080031 (2024) https://doi.org/10.1063/5.0184130

Abstract View article PDF

Model of revisit intention as the basis for tourism object development planning in South Lampung

Samsul Bakri; Desy Rahmawati Romlah; Agus Setiawan; Nina Yudha Aryanti

AIP Conf. Proc. 3001, 080032 (2024) https://doi.org/10.1063/5.0184131

Abstract View article PDF

The role of an ecosystem restoration company in reducing carbon emission in the perspective of the carbon pricing scheme in Indonesia

Sandy Leo; Muthia F. Hakim; Priyaji A. Pambudi; Andreas Pramudianto

AIP Conf. Proc. 3001, 080033 (2024) https://doi.org/10.1063/5.0192586

Abstract View article PDF

Society education based on environmental accessibility

Aprizon Putra; Dedi Hermon; Indang Dewata; Eri Barlian; Genius Umar; Malisa Putri Sari; Nirmawana Simarmata

AIP Conf. Proc. 3001, 080034 (2024) https://doi.org/10.1063/5.0184143

Abstract View article PDF

The correlation among air pollution exposure to incidence of under-five pneumonia in Jakarta Province 2017-2019

Gilang Anugerah Munggaran; Haryoto Kusnoputranto

AIP Conf. Proc. 3001, 080035 (2024) https://doi.org/10.1063/5.0185294

Abstract View article PDF

Conflict of fishermen vs tin miners in Rebo Beach, Bangka Island: Dispute in the Sungailiat special economic zone

H. Purnaweni; Kismartini; B. Prabawani; D. P. Rahayu; A. Putra

AIP Conf. Proc. 3001, 080036 (2024) https://doi.org/10.1063/5.0184251

Abstract View article PDF

Climatic factors affecting the incidence rate of-dengue haemorrhagic fever(DHF) in west Jakarta during 2015-2019

Nisrina Rihadatul Aisy; Haryoto Kusnoputranto

AIP Conf. Proc. 3001, 080037 (2024) https://doi.org/10.1063/5.0185295

Abstract View article PDF

Spatial analysis of environmental risk to transmission dengue hemorrhagic fever (DHF) in Lubuk Tarok district, Sijunjung Regency

Naldi Candra; Aidil Onasis; Eri Barlian; Abdul Razak; Indang Dewata

AIP Conf. Proc. 3001, 080038 (2024) https://doi.org/10.1063/5.0184154

Abstract View article PDF

Analysis of filling room physical environment conditions on the performance of medical recording officers in some hospitals

Linda Handayuni; Berly Nisa Srimayarti; Y. Yola; Eri Barlian; Abdul Razak

AIP Conf. Proc. 3001, 080039 (2024) https://doi.org/10.1063/5.0184957

Abstract View article PDF

Development food agriculture area basic land capability in Dharmasraya Regency, West Sumatra Province

Ratna Wilis; Eri Berlian; Nurhasan Syah; Aldri Frinaldi; Deded Chandra; Linda Handayuni

AIP Conf. Proc. 3001, 080040 (2024) https://doi.org/10.1063/5.0184174

Abstract View article PDF

Community nurse strategy to realize resilient communities in COVID-19 outbreak towards a new normal era

Aulia Asman; Eri Barlian; Siti Fatimah; Indang Dewata; Dedi Hermon; Abdul Razak; Aprizon Putra; Deded Chandra; Auzia Asman

AIP Conf. Proc. 3001, 080041 (2024) https://doi.org/10.1063/5.0184127

Abstract View article PDF

Mitigation of flood hazard areas in Antokan watershed

Eri Barlian; Iswandi Umar; Syafri Anwar; Dasman Lanin; Aprizon Putra

AIP Conf. Proc. 3001, 080042 (2024) https://doi.org/10.1063/5.0192510

Abstract View article PDF

Bio insecticide of dayak onion extract (*Eleutherine palmifolia* (L.) Merr) against the mortality of hair lice (*Pediculus humanus capitis*) on the

against the mortality of hair lice (*Pediculus humanus capitis*) on the incidence of pediculosi capitis at orphanages in Palembang city, Indonesia

Jhon Riswanda; Chairil Anwar; Mohammad Zulkarnain; Rico Januar Sitous

AIP Conf. Proc. 3001, 080043 (2024) https://doi.org/10.1063/5.0184128

Abstract | View article | PDF

Species diversity and time of occurrence of butterflies at various observation points in the educational Forest-Universitas Hasanuddin

R. I. Maulany; E. Y. Mangnga; A. S. Hamzah; P. O. Ngakan

AIP Conf. Proc. 3001, 080044 (2024) https://doi.org/10.1063/5.0184602

Abstract | View article | PDF

Tree species composition in the habitat of *Taxus sumatrana* in the sibuaton protected forest, Karo Regency, North Sumatra Province: Implication for conservation

G. Pasaribu; E. Widyati; R. S. B. Irianto; A. Susilo

AIP Conf. Proc. 3001, 080045 (2024) https://doi.org/10.1063/5.0184950

Abstract | View article | PDF

Distribution of the old individual of *Coffea liberica* in Kalipuro district: A preliminary survey for coffee landscape preservation in Banyuwangi Regency

Naila Izzatul Mukhoyyaroh; Luchman Hakim; Rodiyati Azrianingsih

AIP Conf. Proc. 3001, 080046 (2024) https://doi.org/10.1063/5.0184519

Abstract | View article | PDF

Genetic diversity, heritability and path analysis of sweet cassava promising clone

Sholihin

AIP Conf. Proc. 3001, 080047 (2024) https://doi.org/10.1063/5.0198941

Abstract | View article | PDF

Distribution of the vulnerable Langur Javan fuscous leaf monkey (*Presbytis fredericae*, Sody 1930) in the central parts of Java Island

P. Karyanto; A. R. Bagasta; A. Setiawan; S. Cheyne

AIP Conf. Proc. 3001, 080048 (2024) https://doi.org/10.1063/5.0186512

Abstract | View article | PDF

Evaluation of community structure, diversity and carbon stock of mangrove vegetation on the South Coast of East Java, Indonesia

Catur Retnaningdyah; Achmad Dadang Burhanuddin; Satria Cahya Febriansyah; P. Purnomo; Luchman Hakim

AIP Conf. Proc. 3001, 080049 (2024) https://doi.org/10.1063/5.0184451

Abstract | View article | PDF

Land suitability of palm oil (study case in Tanjung Kemuning district, Kaur Regency, Bengkulu Province)

T. Wahyuni; H. B. Astuti; T. Rahman; S. Rosmanah; A. Alfayanti; M. Miswarti

AIP Conf. Proc. 3001, 080050 (2024) https://doi.org/10.1063/5.0184088

Abstract | View article | PDF

Integrating ecological landscape and local culture to overview potential areas for local plant conservation in Bali

I. D. P. Darma; S. F. Hanum; W. S. Lestari; A. Rahayu; M. B. Atmaja; N. K. E. Undaharta

AIP Conf. Proc. 3001, 080051 (2024) https://doi.org/10.1063/5.0183931

Abstract | View article | PDF

The road shade plants composition and morphology profile in Malang city, East Java-Indonesia

T. Wijayanti; D. Setiawati

AIP Conf. Proc. 3001, 080052 (2024) https://doi.org/10.1063/5.0183969

Abstract | View article | PDF

Tree health assessment and risk management of *Hura crepitans* L. in Purwodadi botanical garden

Linda Wige Ningrum; Apriyono Rahadiantoro; Hendra Helmanto; Mahmuddin Rahmadana; Nirmala Ayu Aryanti; Ramli Ramadhan

AIP Conf. Proc. 3001, 080053 (2024) https://doi.org/10.1063/5.0186200

Abstract | View article | PDF

New locality record of *Tikusnema javaense* Hasegawa, Shiraishi & Rochman, 1992 (Acuariidae: Nematoda) from Papua, Indonesia

K. Dewi; E. Rahardiningtyas; R. A. Wigati; Y. Apriyanti; A. Ardanto; G. Animalesto; Ristiyanto; A. Mulyono; L. Susanti; D. B. W. Putro; A. P. Pratiwi

AIP Conf. Proc. 3001, 080054 (2024) https://doi.org/10.1063/5.0186211

Abstract | View article | PDF

Sweet potato pests and their natural enemies on tidal land in South Kalimantan

S. W. Indiati; M. S. I. Bayu; Yusmani

AIP Conf. Proc. 3001, 080055 (2024) https://doi.org/10.1063/5.0185381

Abstract | View article | PDF

Contributions of Indonesian biosphere reserves to *in-situ* conservation of a rare folk medicinal plant *Euchresta horsfieldii* (fabaceae)

Arief Priyadi; I. Putu Agus Hendra Wibawa

AIP Conf. Proc. 3001, 080056 (2024) https://doi.org/10.1063/5.0183880

Abstract | View article | PDF

Typology of natural sacred sites in non-indigenous communities and its implications for local plant conservation

Purnomo; J. Batoro; H. Riniwati; A. S. Leksono

AIP Conf. Proc. 3001, 080057 (2024) https://doi.org/10.1063/5.0183999

Abstract | View article | PDF

Birds species in coffee-based agroforestry for avitourism development in Kalipuro, Banyuwangi Regency

J. R. Hariyati; A. Nurrofik; D. Siswanto; E. Arisoesilaningsih; L. Hakim

AIP Conf. Proc. 3001, 080058 (2024) https://doi.org/10.1063/5.0184023

Abstract View article PDF

An ethnomedicinal research of medicinal plants used against gastrointestinal complaints by “Kaili Ledo ethnic” in Central Sulawesi, Indonesia

R. Pitopang; Y. Pratama; Yusran; P. A. S. Banilai; S. R. Mertosono

AIP Conf. Proc. 3001, 080059 (2024) https://doi.org/10.1063/5.0197937

Abstract View article PDF

The resilience of indigenous natural resources management amidst Covid-19 pandemic in East Nusa Tenggara, Indonesia

G. N. Njurumana; D. Octavia; O. Hidayat; T. Basuki; Y. Ngongo

AIP Conf. Proc. 3001, 080060 (2024) https://doi.org/10.1063/5.0183962

Abstract View article PDF

How is the condition of Sumber Nagan - Singosari?

Viky Vidayanti; Catur Retnaningdyah; Endang Arisoesilaningsih

AIP Conf. Proc. 3001, 080061 (2024) https://doi.org/10.1063/5.0184015

Abstract View article PDF

An ethnobotanical aspect of nature-based recreation sites in Banyuwangi, East Java

Luchman Hakim; Jehan R. Haryati; Laila Nur Habibah; Muhammad Yusuf

AIP Conf. Proc. 3001, 080062 (2024) https://doi.org/10.1063/5.0185449

Abstract View article PDF

Forest management and community development with special reference of the area in adjacent to Mt. Arjuno-Mt. Welirang, East Java

Iwan; Luchman Hakim; Qomariyatus Sholihah; Marjono

AIP Conf. Proc. 3001, 080063 (2024) https://doi.org/10.1063/5.0184811

Abstract View article PDF

GEOMATICS ENGINEERING

Comparative analysis of reflectance values on sentinel-2A image with field spectroradiometer in mangrove forest on East Coast Lampung

Nirmawana Simarmata; Ketut Wikantika; Trika Agnestasia Tarigan; Muhammad Aldyansyah; Rizki Kurnia Tohir; Aprizon Putra

AIP Conf. Proc. 3001, 090001 (2024) https://doi.org/10.1063/5.0184159

Abstract View article PDF

MINING ENGINEERING

Slope stability analysis at disposal mine area using Morgenstern price method

Heri Prabowo; Irma Suryani; Insani Sabilillah

AIP Conf. Proc. 3001, 100001 (2024) https://doi.org/10.1063/5.0184136

Abstract View article PDF

Analysis stability of slope in BMK 35 to prevent avalanche

Refky Adi Nata; Gaofeng Ren

AIP Conf. Proc. 3001, 100002 (2024) https://doi.org/10.1063/5.0183901

Abstract View article PDF

INFORMATICS ENGINEERING

Using support vector machines for classification datamining on international trade price index data

Erni Febrina Harahap; A. Heri Iswanto; Delipiter Lase; Rizqi Putri Nourma Budiarti; Sritrusta Sukaridhoto

AIP Conf. Proc. 3001, 110001 (2024) https://doi.org/10.1063/5.0183902

Abstract View article PDF

Using a naive bayes classifier on goods sales data to optimize marketing strategy

Muhammad Amir; Muhamad Fuat Asnawi; Ana Rusmardiana; Renil Septiano; Laynita Sari

AIP Conf. Proc. 3001, 110002 (2024) https://doi.org/10.1063/5.0184121

Abstract View article PDF

Datamining clustering in grouping adolescents and adults with information technology and computer skills by profession

Ahmad Tohir; Tri Kristianti; Meithiana Indrasari; Jokhanan Kristiyono; Ucup Supriatna

AIP Conf. Proc. 3001, 110003 (2024) https://doi.org/10.1063/5.0183891

Abstract View article PDF

K-nearest neighbors method prediction of the anti-corruption behavior index by region of residence

Rizkan Zulyadi; S. Surjanti; Ardhana Januar Mahardhani; Sardjana Orba Manullang; Albertus Dwiyoga Widiantoro; S. Suprihatin

AIP Conf. Proc. 3001, 110004 (2024) https://doi.org/10.1063/5.0184125

Abstract View article PDF

Improving foreign language proficiency in society by decision tree classification

Nanda Saputra; Rivi Antoni; Arif Widodo; Everhard Markiano Solissa; Ilham Arief

AIP Conf. Proc. 3001, 110005 (2024) https://doi.org/10.1063/5.0183888

Abstract View article PDF

Support vector machine classification datamining on the predicted value of construction completed by construction companies

Hamid Wijaya; I. Indriyani; Abu Muna Almaududi Ausat; S. Saludin; Evi Yuliawati

AIP Conf. Proc. 3001, 110006 (2024) https://doi.org/10.1063/5.0183926

Abstract View article PDF

Mapping evaluation using data mining in the number of villages with sports fields

Alex Wenda; Heri Purwanto; Muhammad Najamuddin Dwi Miharja; Ratna Puspita Sari; Riesta Ayu Oktarina

AIP Conf. Proc. 3001, 110007 (2024) https://doi.org/10.1063/5.0183924

Abstract View article PDF

Comparative analysis of algorithm C4.5 and naïve bayes in classifying adolescent domestic violence

Brivian Florentis Yustanta; Tri Mulyatno Budhi Hartanto; Ilham Khairi Siregar; Soetji Andar; Mochammad Arkansyah; Dwi Prasetyo

AIP Conf. Proc. 3001, 110008 (2024) https://doi.org/10.1063/5.0185301

Abstract View article PDF