Jurnal Crystal: Publikasi Penelitian Kimia dan Terapannya
Vol. 07, No. 02, Page. 306 – 315, 2025
e-ISSN 2685-7065

SPECTROSCOPIC CHARACTERIZATION AND UV-PROTECTIVE POTENTIAL OF ARCANGELISIA FLAVA EXTRACT

Tety Wahyuningsih Manurung[1]*, Rokiy Alfanaar[1], Mokhamat Ariefin[1], Marvin Horale Pasaribu[1], Eva Susanty Simaremare[2]

[1]Department of Chemistry, Faculty of Mathematic and Sciences, Universitas Palangka Raya, Palangka Raya and 73112, Indonesia
[2]Department of Pharmacy, Faculty of Mathematic and Sciences, Universitas Cenderawasih, Jayapura and 99358, Indonesia
*Email: tety.manurung@mipa.upr.ac.id

Article History
Received: 04 July 2025; Received in Revision: 25 September 2025; Accepted: 27 September 2025

Abstract

The increasing demand for natural UV-protective agents has led to the exploration of plant-based bioactive compounds. Yellow root (Arcangelisia flava) extract is traditionally used in medicine and contains flavonoids, alkaloids, and terpenoids with potential photoprotective properties. This study aimed to characterize the chemical composition of A. flava extract and evaluate its UV-absorbing properties using UV-Vis and FTIR spectroscopy. The extract was obtained through maceration with ethanol, followed by spectroscopic analysis. The UV-Vis spectrum (200–400 nm) revealed multiple absorption peaks, particularly at 270 nm, 292 nm, 306 nm, 340 nm, 354 nm, 360 nm, and 396 nm, indicating the presence of UV-absorbing compounds. FTIR analysis confirmed the presence of hydroxyl (-OH), carbonyl (C=O), and aromatic (C=C) functional groups, which are characteristic of flavonoids and other bioactive compounds. These findings suggest that A. flava extract has potential as a natural UV-protective agent. Further studies on compound isolation, fractionation, and photostability assessments are required to optimize its purity and effectiveness in sunscreen formulations.

Keywords: *Arcangelisia Flava*, UV-Vis Spectroscopy, FTIR Spectroscopy, Flavonoids, UV Protection

Abstrak

Permintaan yang meningkat akan agen pelindung UV alami telah mendorong eksplorasi senyawa bioaktif berbasis tanaman. Ekstrak akar kuning (Arcangelisia flava) secara tradisional digunakan dalam pengobatan dan mengandung flavonoid, alkaloid, dan terpenoid yang berpotensi memiliki sifat fotoprotektif. Penelitian ini bertujuan untuk mengkarakterisasi komposisi kimia ekstrak A. flava dan mengevaluasi sifat penyerap UV-nya menggunakan spektroskopi UV-Vis dan FTIR. Ekstrak diperoleh melalui makserasi dengan etanol, diikuti dengan analisis spektroskopi. Spektrum UV-Vis (200–400 nm) menunjukkan beberapa puncak penyerapan, terutama pada 270 nm, 292 nm, 306 nm, 340 nm, 354 nm, 360 nm, dan 396 nm, yang mengindikasikan keberadaan senyawa penyerap UV. Analisis FTIR mengkonfirmasi keberadaan gugus fungsi hidroksil (-OH), karbonil (C=O), dan aromatik (C=C), yang merupakan karakteristik flavonoid dan senyawa bioaktif lainnya. Temuan ini menunjukkan bahwa ekstrak A. flava memiliki potensi sebagai agen pelindung UV alami. Temuan ini menunjukkan bahwa ekstrak A. flava memiliki potensi sebagai agen pelindung UV alami. Studi lebih lanjut mengenai isolasi senyawa, fraksinasi, dan penilaian fotostabilitas diperlukan untuk mengoptimalkan kemurnian dan efektivitasnya dalam formulasi tabir surya.

Kata Kunci: Arcangelisia Flava, Spektroskopi UV-Vis, Spektroskopi FTIR, Flavonoid, Perlindungan UV

1. Introduction

Yellow root (Arcangelisia flava) is a plant widely found in Indonesia and has long been utilized in traditional medicine (Yoandri et al., 2022). The local community uses yellow root to treat various skin diseases such as itching, wounds, and ulcers. In the Kalimantan region, this plant is commonly used to treat fever, diarrhea, hepatitis, helminthiasis, digestive disorders, and mouth ulcers, as well as to maintain overall health (Rinaldi et al., 2017; Subiandono & Heriyanto, 2016).

Previous studies on the stems and roots of A. flava have demonstrated its potential activities as an antimalarial (Hapsari et al., 2019), antidepressant (Kolina et al., 2019), antioxidant (Suratno et al., 2019), antidiabetic (Karim et al., 2020), antibacterial (Kaharap et al., 2016), and anticancer agent (Pratama, 2016). Secondary metabolite analysis has revealed that yellow root contains compounds such as flavonoids, terpenoids, and protoberberine alkaloids, including berberine, jatrorrhizine, and palmatine (Tata et al., 2022).

Tabel 1. Secondary Metabolite Composition of *Arcangelisia Flava*

Sample Type / Extract	Identified Secondary Metabolites / Classes	Value or Content	References
Methanol extract, stems	alkaloids, flavonoids, phenolics, tannins, steroids/triterpenoids, saponin and glycosides	Total phenolics: 81.61002 ± 0.248610176 mg GAE/g (99,8%); 68,8756 ± 0,24837736 mg GAE/g (70%); 57,7894 ± 0,13110763709 mg GAE/g (50%)	(Hasanah et al., 2024)
Methanol extract, stems	flavonoids, phenolics	Total phenolics: 12,33±1,24 mg GAE/g (n-Hexan fractions); 89,01±1,53 mg GAE/g (ethyl acetate fractions); 131.40±8.19 mg GAE/g (methanol fractions) and Total flavonoids: 101.70±9.35 mg QE/g (n-Hexan fractions); 11.16±0.47 mg QE/g (ethyl acetate fractions); 108.5±9.18 mg QE/g (methanol fractions).	(Bawika & Nurkhasanah, 2022)
Ethanol extract, stems	alkaloids, flavonoids, saponins, tannins, and steroids/triterpenoids	0,96882 ± 0,2157 mgQE/g (50%), 2,6693 ± 11,7041 mgQE/g (70%), 3,838 ± 1,3036 mgQE/g (96 %)	(Afrizani et al., 2023)

Flavonoids (2-phenylchromen-4-one) are a diverse group of polyphenolic compounds widely distributed in plants, known for their strong antioxidant properties. These compounds play a crucial role in protecting biological systems from oxidative stress by scavenging free radicals and reactive oxygen species (ROS) generated by environmental factors, including ultraviolet (UV) radiation exposure (Fitriansyah, 2023). Excessive exposure to UV radiation, particularly UVA (320–400 nm) and UVB (280–320 nm), can induce skin damage by triggering oxidative stress, inflammation, and degradation of structural proteins such as collagen and elastin. Over time, this damage can lead to premature skin aging, hyperpigmentation, and an increased risk of skin cancer, making UV protection an essential aspect of dermatological research. Consequently, natural compounds with potent antioxidant activity, such as flavonoids, have garnered significant attention for their potential role in mitigating UV-induced skin damage and serving as protective agents in skincare formulations (Nafiah et al., 2024). Given the growing interest in plant-based bioactive compounds, the evaluation of flavonoid-rich plant extracts, such as those derived from yellow root (Arcangelisia flava), is essential to explore their effectiveness in UV protection (Indriarini et al., 2021).

Spectrophotometric methods have been widely employed to analyze the chemical constituents of medicinal plant extracts, offering a reliable approach for assessing their bioactive properties (Mabry et al., 1970). UV-Visible (UV-Vis) spectrophotometry, in particular, is a commonly used technique to determine the presence of flavonoids and other phenolic compounds by measuring their characteristic absorption spectra at specific wavelengths (Sukmawati & Sembiring, 2021). Previous studies by Marpaung et al. and Wahyuni et al. demonstrated the application of UV-Vis spectrophotometry in identifying key bioactive compounds in yellow root extracts, highlighting its potential for qualitative and quantitative analysis (Marpaung & Wahyuni, 2018; Wahyuni & Marpaung, 2020) The absorption patterns observed in UV-Vis spectroscopy provide insight into the conjugated systems present in flavonoids, which contribute to their ability to absorb UV

radiation. This analytical approach, therefore, serves as an initial screening tool for assessing the photoprotective properties of plant extracts, providing valuable data for further investigation into their efficacy as UV-protective agents.

Additionally, infrared (IR) spectrophotometry is widely used due to its rapid chemical analysis capability with large sample throughput. It is commonly employed for qualitative determinations, especially in identifying chemical compounds (Wahyuningsih & Dessidianti, 2022). FTIR spectroscopy enables the identification of functional groups based on their unique vibrational frequencies, offering critical insights into the molecular composition of bioactive substances. The presence of characteristic functional groups, such as hydroxyl (-OH), carbonyl (-C=O), and aromatic rings, can be detected through specific absorption bands in the IR spectrum, providing a deeper understanding of the chemical interactions responsible for antioxidant and UV-protective activities (Mayuresh Dev & Madhura Mukadam, 2025). Given its efficiency in qualitative analysis, FTIR spectroscopy complements UV-Vis spectrophotometry by confirming the structural identity of flavonoids and other phenolic compounds in yellow root extracts. Therefore, integrating UV-Vis and FTIR spectrophotometric analyses is a comprehensive approach to evaluating the chemical composition and potential photoprotective properties of plant-derived extracts.

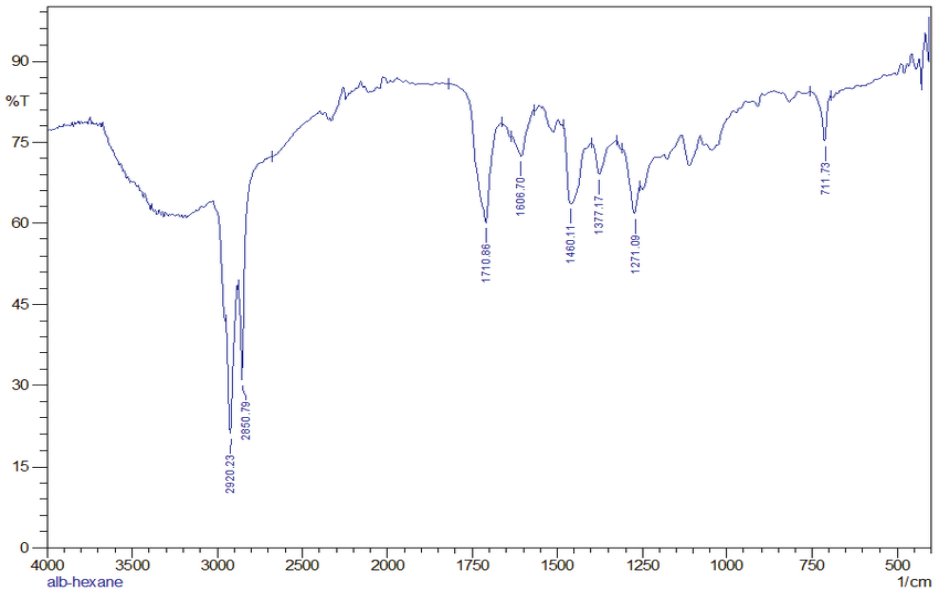


Figure 1. FTIR spectra of A. flava hexane extract (Delica et al., 2023)

Considering the increasing demand for natural and effective UV-protective agents, the exploration of plant-based antioxidants remains a promising research avenue. Yellow root (Arcangelisia flava), a medicinal plant traditionally used for its therapeutic properties, is rich in flavonoids and other bioactive constituents that may contribute to its photoprotective potential. However, scientific validation of its efficacy as an anti-UV agent requires a thorough investigation using advanced spectrophotometric techniques. By employing UV-Vis and FTIR spectroscopy, this study aims to characterize the chemical composition of yellow root extract and evaluate its potential as a natural UV-protective agent. These findings will provide valuable insights into the development of plant-based sunscreens and other dermatological applications, emphasizing the importance of natural compounds in skincare and photoprotection research.

2. Methodology

2.1 Materials and Tools

Yellow Root (Arcangelisia flava), etanol (Merck), filter paper Whatman No.40, test sieve 40 mesh, centrifugator, rotary evaporator, oven (Memmert), UV-Vis spectrophotometer (Thermo Scientific), Spektrofotomter FT-IR (Bruker).

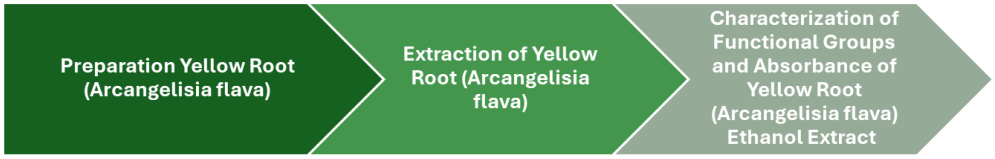


Figure 2. Flowchart of the Experimental Procedure

2.2 Preparation Yellow Root (Arcangelisia flava)

The yellow root (Arcangelisia flava) samples were washed with clean water to remove impurities and then dried in an oven at 65°C for 24 hours. Once dried, the samples were ground into a fine powder and sieved using a 40-mesh sieve for uniformity

2.3 Extraction of Yellow Root (Arcangelisia flava)

A total of 500 grams of the powdered sample was macerated in ethanol for three consecutive days (3 × 24 hours) to extract bioactive compounds. The macerated extract was then filtered using filter paper, followed by centrifugation to further separate solid residues. Finally, the solvent was evaporated using a rotary evaporator under reduced pressure, yielding a concentrated crude extract for further analysis.

2.4 Characterization of Functional Groups and Absorbance of Yellow Root (Arcangelisia flava) Ethanol Extract

The crude extract of yellow root (Arcangelisia flava) was characterized using FTIR spectroscopy within the wavenumber range of 500–4000 cm^{-1} to identify functional groups present in the extract. Additionally, the chromophore groups were analyzed using UV-Vis spectrophotometry at wavelengths between 200–400 nm to determine the presence of compounds with potential UV-protective properties.

3. Results and Discussion

3.1. Preparation and extraction of Yellow Root

The preparation of yellow root (*Arcangelisia flava*) is a critical step to ensure the integrity of bioactive compounds and the reliability of subsequent analyses. Proper handling of plant material reduces the risk of contamination, minimizes degradation, and preserves compound stability during storage. Standardization of particle size and moisture level contributes to more consistent extraction yields, which is essential for reproducibility in phytochemical studies. These considerations align with established protocols for plant material preparation, as emphasized in previous studies (Krakowska-Sieprawska et al., 2022). Ensuring adequate surface area and sample uniformity ultimately enhances the efficiency of bioactive compound extraction and supports more accurate characterization in later stages of analysis.

The extraction of bioactive compounds from yellow root was carried out using ethanol as the solvent, a method widely recognized for its effectiveness in extracting a broad range of phytochemicals, including alkaloids and flavonoids. Maceration for three consecutive days allowed for thorough penetration of the solvent into the plant matrix, ensuring maximum extraction of target compounds. Filtration and centrifugation were employed to separate the liquid extract from solid residues, a step critical for obtaining a clear and concentrated extract. The use of a rotary evaporator under reduced pressure for solvent evaporation not only concentrated the extract but also minimized the risk of thermal degradation of heat-sensitive compounds. This method aligns with best practices in phytochemical extraction, as noted in studies emphasizing the importance of gentle solvent removal to preserve the integrity of bioactive compounds (Fotsing Yannick Stéphane et al., 2022). The resulting crude extract, rich in potential bioactive compounds, was thus prepared for further analytical characterization, setting the stage for subsequent investigations into its UV-protective properties.

3.2. FT-IR Characterization of Yellow Root Extract

The FTIR spectrum of the Yellow Root ethanol extract showed distinct absorption bands corresponding to various functional groups as shown in figure 1. presents the peak assignments and the functional groups identified from the A. flava ethanol extract. A broad absorption peak was observed around 3400 cm^{-1}.

The FT-IR spectroscopy analysis of the yellow root extract revealed absorption peaks indicative of bioactive compounds such as alkaloids and flavonoids. Based table 1, a prominent absorption peak at 3400 cm−1 corresponds to the O–H stretching vibration, characteristic of phenolic compounds and flavonoids, which are known for their antioxidant and UV-protective properties (DEGÁSPARI & WASZCZYNSKYJ, 2004). The absorption peak at 2920 cm−1 indicates the presence of C–H stretching, commonly found in alkaloids and other organic compounds (Mushin M Shami, 2016). Additionally, the peak at 1650 cm−1 is attributed to C=O stretching, a functional group often present in flavonoids and alkaloids, which contributes to their UV-absorbing capabilities (Baranović & Šegota, 2018). Further peaks at 1350 cm−1 and 1100 cm−1 suggest the presence of C–N and C–O bonds, respectively, which are also integral to the structure of these bioactive compounds (Sahib et al., 2019).

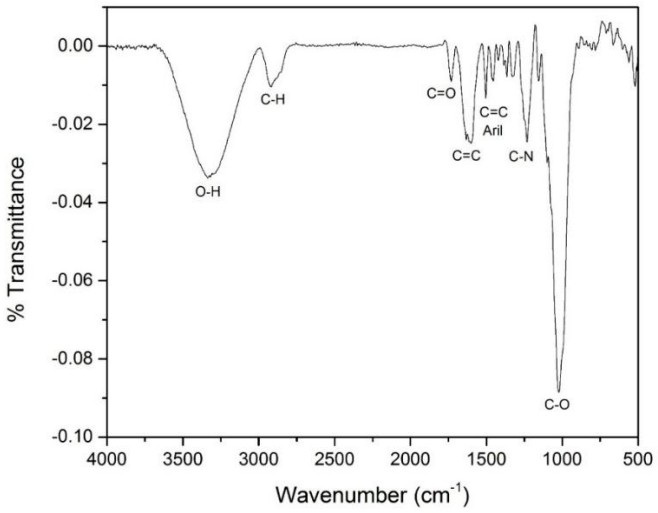


Figure 3. FTIR spectrum of Yellow Root extract

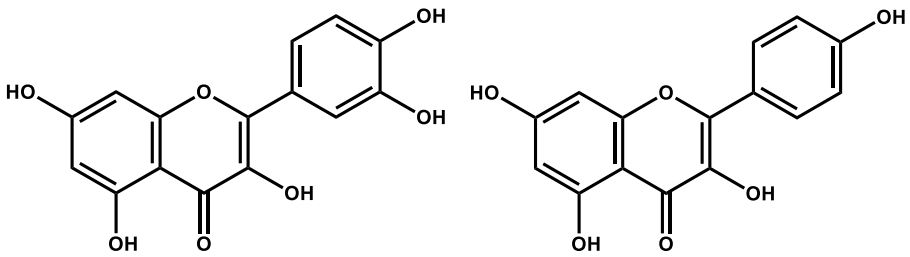
Tabel 2. Comparative analysis of FTIR absorption bands of Yellow Root

FTIR Absorption Bonds	Yellow Root (cm^{-1})	References (cm^{-1})	
O–H stretching	3400	3200-3700	(Wöhlecke & Kovács, 2001)
C–H stretching	2920	2500-3300	(Hari & Nair, 2018)
C=O stretching	1650	1703	(Hamid et al., 2012)
C=C stretching	1600–1500	1700–1500	(de Oliveira et al., 2002)
C–N stretching	1350	1240–1461	(Mergbi et al., 2023)
C–O stretching	1100	1300-1000	(Smith, 2022)

These findings align with previous studies demonstrating that flavonoids and alkaloids possess significant UV-absorbing properties, making them effective agents for skin protection (Milutinov et al., 2024). The presence of these functional groups supports the hypothesis that yellow root extract has potential as a natural UV-protective agent. Moreover, the observed absorption patterns are consistent with reference spectra reported in the literature, further validating the results (Mayuresh Dev & Madhura Mukadam, 2025b).

Further research indicates that flavonoids, such as quercetin and kaempferol, can stabilize free radicals generated by UV radiation, thereby protecting skin cells from oxidative damage. This is reinforced by the detection of O–H and C=O groups in the FT-IR analysis, which are critical

components of flavonoid structures responsible for their UV-protective activity (Fahlman & Krol, 2009). Thus, the FT-IR characterization not only identifies the presence of bioactive compounds but also provides a scientific basis for their potential application in cosmetic and sunscreen formulations.



a. b.

Figure 4. (a) Quercetin, (b) Kaempferol

3.3. UV-Vis Spectral Peak Characterization

The UV-Vis absorption spectrum of the yellow root extract, measured within the 200–400 nm range, exhibits multiple distinct peaks, indicating the presence of bioactive compounds with potential UV-absorbing properties.

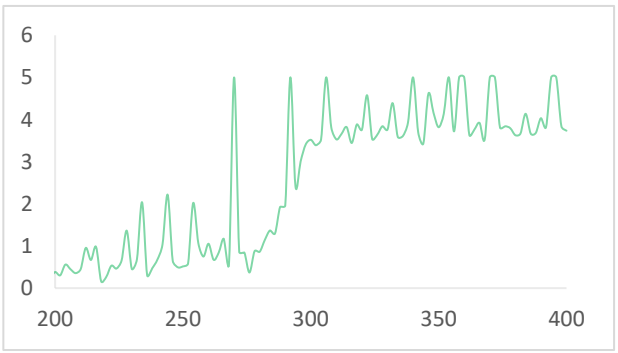


Figure 5. UV spectrum of Yellow Root extract

Based on figure 2 and table 2. The UV-Vis spectral analysis of the yellow root extract revealed absorption peaks in both the UV-A (320-400 nm) and UV-B (290-320 nm) ranges. Peaks at 270 nm and 292 nm indicate the presence of compounds of flavonoids and alkaloids capable of absorbing UV-B radiation, which is primarily responsible for skin damage such as sunburn. Absorption peaks at 306 nm and 340 nm suggest the extract's ability to absorb UV-A radiation, which contributes to skin aging and DNA damage (Nunes et al., 2018). Additionally, peaks at 354 nm and 360 nm further confirm the presence of compounds effective in absorbing UV-A radiation, consistent with previous findings on the UV-protective properties of flavonoids (Verdaguer et al., 2017).

Tabel 2. Maximum absorption of Yellow Root extract in the UV-B and UV-A regions

No.	Yellow Root (nm)	References Another Study (nm)	
1.	270	267,4	(Pratama et al., 2018)
2.	292	290	(Aguilera et al., 2021)
3.	306	310	(Panyakaew et al., 2021)
4.	340	345,2	(Pratama et al., 2018)
5.	354	359	(Butnariu, 2023)
6.	360	367	(Butnariu, 2023)
7.	372	370	(Butnariu, 2023)
8.	396	390	(Lante et al., 2016)

These results are supported by studies showing that flavonoids and alkaloids can effectively absorb UV radiation, making them suitable as active ingredients in sunscreen formulations. The observed absorption patterns in the UV-Vis spectrum are consistent with reference data, indicating that yellow root extract has significant potential as a UV-protective agent. Furthermore, the presence of absorption peaks in both UV-A and UV-B ranges suggests that the extract can provide comprehensive protection against UV radiation.

Previous studies have also demonstrated that flavonoids such as luteolin and apigenin can simultaneously absorb UV-A and UV-B radiation, making them ideal for use in sunscreen formulations. The UV-Vis analysis suggests that yellow root extract contains these compounds, offering dual protection against UV radiation. Therefore, the extract not only prevents sunburn but also protects the skin from premature aging caused by UV-A radiation (José et al., 2016).

4. Conclusion

The spectroscopic characterization of Arcangelisia flava extract confirms the presence of flavonoids, terpenoids, and alkaloids with significant UV-absorbing properties. UV-Vis analysis demonstrates absorption in both UV-A and UV-B ranges, suggesting the extract's potential as a natural UV-protective agent. FTIR findings further support the presence of bioactive functional groups associated with antioxidant and photoprotective activity. The integration of these results highlights the extract's potential application in cosmetic and dermatological formulations. Future studies should focus on compound isolation, quantitative analysis, and photostability assessments to enhance its efficacy for sunscreen development. Additionally, further research on the purified extract or its fractionation is necessary to optimize sample purity and maximize its function as an anti-UV agent.

References

Afrizani, Anny Sartika, D., Ridwanto, & Rahman, F. (2023). ORIGINAL ARTICEL JOURNAL OF PHARMACEUTICAL AND SCIENCES Electronic The determination of the total flavonoid content of yellow wood extracts, from Samarkilang, Central Aceh with various concentrations ethanol using visible spectrophotometry method. Journal of Pharmaceutical and Sciences, 1.

Aguilera, J. et al. (2021) 'Booster Effect of a Natural Extract of Polypodium leucotomos (Fernblock®) That Improves the UV Barrier Function and Immune Protection Capability of Sunscreen Formulations', Frontiers in Medicine, 8. Available at: https://doi.org/10.3389/fmed.2021.684665.

Baranović, G. and Šegota, S. (2018) 'Infrared spectroscopy of flavones and flavonols. Reexamination of the hydroxyl and carbonyl vibrations in relation to the interactions of flavonoids with membrane lipids', Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 192, pp. 473–486. Available at: https://doi.org/10.1016/j.saa.2017.11.057.

Bawika, S. P., & Nurkhasanah. (2022). Penelusuran Fraksi Ekstrak Kayu Akar (Arcangelisia flava L.) Sebagai Antioksidan Beserta Penetapan kadar Fenolik Dan Flavonoid Total. Media Farmasi: Jurnal Ilmu Farmasi (Journal of Pharmaceutical Science), 19(1). http://journal.uad.ac.id/index.php/Media-Farmasi/index

Butnariu, M. (2023) 'Physical Properties and Identification of Flavonoids by Ultraviolet-Visible Spectroscopy', International Journal of Biochemistry & Physiology, 8(2). Available at: https://doi.org/10.23880/ijbp-16000239.

DEGÁSPARI, C.H. and WASZCZYNSKYJ, N. (2004) 'PROPRIEDADES ANTIOXIDANTES DE COMPOSTOS FENÓLICOS', Visão Acadêmica, 5(1). Available at: https://doi.org/10.5380/acd.v5i1.540.

Delica, K., Balagot, K. W., & Lapuz, R. (2023). Investigation of Chemical Components of Hexane Extract from the Stem of Arcangelisia flava via Phytochemical Test, GC-MS Analysis, FTIR Fingerprinting, and In Vitro Antioxidant Activity. Philippine Journal of Science, 152(5). https://doi.org/10.56899/152.05.32

Fahlman, B.M. and Krol, E.S. (2009) 'UVA and UVB radiation-induced oxidation products of quercetin', Journal of Photochemistry and Photobiology B: Biology, 97(3), pp. 123–131. Available at: https://doi.org/10.1016/j.jphotobiol.2009.08.009.

Fitriansyah, S.N. (2023) Antioxidant Activity and Sun Protection Factor of Different Parts of Sawo Walanda (Pouteria Campechiana (Kunth.) B.) Extract, Indonesian Journal of Pharmaceutical Science and Technology Journal Homepage. Available at: http://jurnal.unpad.ac.id/ijpst/.

Fotsing Yannick Stéphane, F. et al. (2022) 'Extraction of Bioactive Compounds from Medicinal Plants and Herbs', in Natural Medicinal Plants. IntechOpen. Available at: https://doi.org/10.5772/intechopen.98602.

Hamid, S. et al. (2012) 'Comparative analysis of n-hexane and ethyl acetate extracts of Arisaema propinquum via Fourier Transform Infrared Spectroscopy (FTIR)', International Journal of Food and Nutritional Sciences, 11(1), p. 2022. Available at: www.ijfans.org.

Hapsari, Y. et al. (2019) 'Chemical Constituent and Antimalarial Activity based on Inhibition of Heme Polymerization from Water Extract of Yellow Root (Arcangelisia flava L. Merr)', Chimica et Natura Acta, 7(3), p. 102. Available at: https://doi.org/10.24198/cna.v7.n3.26264.

Hari, N. and Nair, V.P. (2018) 'FTIR Spectroscopic Analysis of Leaf Extract in Hexane in Jasminum Azoricum L', International Journal of Scientific Research in Science and Technology, 4(8), pp. 170–172. Available at: www.ijsrst.com.

Hasanah, Q., Sartika Daulay, A., & Munandar Nasution, H. (2024). PENETAPAN KADAR FENOLIK TOTAL EKSTRAK METANOL KAYU KUNING (Arcangelisia flava (L.) Merr.) DENGAN BERBAGAI KONSENTRASI METANOL DETERMINATION OF TOTAL PHENOLIC CONTENT OF YELLOW WOOD (Arcangelisia flava (L.) Merr.) Methanol EXTRACT WITH VARIOUS METHANOL CONCENTRATIONS. MEDIC NUTRICIA 2024, 8(3), 25–31. https://doi.org/10.5455/mnj.v1i2.644xa

Indriarini, L. et al. (2021) 'AKTIVITAS PERLINDUNGAN UV DAN ANTIOKSIDAN EKSTRAK KULIT JERUK (Citrus sinensis (L.) Osbeck) DALAM NANOGEL TABIR SURYA', Jurnal Farmagazine, 8(2), p. 20. Available at: https://doi.org/10.47653/farm.v8i2.550.

José, M.T. de A.F. et al. (2016) 'Flavonoids as photoprotective agents: A systematic review', Journal of Medicinal Plants Research, 10(47), pp. 848–864. Available at: https://doi.org/10.5897/JMPR2016.6273.

Kaharap, A.D. et al. (2016) Uji efek antibakteri ekstrak batang akar kuning (Arcangelisia flava Merr.) terhadap bakteri Staphylococcus aureus dan Escherichia coli, Jurnal e-Biomedik (eBm).

Karim, F. et al. (2020) 'UJI AKTIVITAS ANTIDIABETES AKAR KAYU KUNING (ARCANGELISIA FLAVA)', Jurnal Kedokteran dan Kesehatan Publikasi Ilmiah Fakultas Kedokteran Universitas Sriwijaya, 7(3), pp. 35–40. Available at: https://doi.org/10.32539/JKK.V7I3.10190.

Kolina, J., Sumiwi, S.A. and Levita, J. (2019) 'MODE IKATAN METABOLIT SEKUNDER DI TANAMAN AKAR KUNING (Arcangelisia flava L.) DENGAN NITRAT OKSIDA SINTASE', FITOFARMAKA: Jurnal Ilmiah Farmasi, 8(1), pp. 45–52. Available at: https://doi.org/10.33751/jf.v8i1.1171.

Krakowska-Sieprawska, A. et al. (2022) 'Modern Methods of Pre-Treatment of Plant Material for the Extraction of Bioactive Compounds', Molecules, 27(3), p. 730. Available at: https://doi.org/10.3390/molecules27030730.

Lante, A., Tinello, F. and Nicoletto, M. (2016) 'UV-A light treatment for controlling enzymatic browning of fresh-cut fruits', Innovative Food Science & Emerging Technologies, 34, pp. 141–147. Available at: https://doi.org/10.1016/j.ifset.2015.12.029.

Marpaung, M.P. and Wahyuni, R.C. (2018) 'Identifikasi Dan Penetapan Kadar Flavonoid Total Ekstrak Akar Kuning (Fibraurea chloroleuca Miers)', Talenta Conference Series: Tropical Medicine (TM), 1(3), pp. 095–098. Available at: https://doi.org/10.32734/tm.v1i3.269.

Mayuresh Dev and Madhura Mukadam (2025a) 'Functional group profiling of medicinal plants using FTIR spectroscopy', World Journal of Biology Pharmacy and Health Sciences, 21(1), pp. 243–249. Available at: https://doi.org/10.30574/wjbphs.2025.21.1.0039.

Mayuresh Dev and Madhura Mukadam (2025b) 'Functional group profiling of medicinal plants using FTIR spectroscopy', World Journal of Biology Pharmacy and Health Sciences, 21(1), pp. 243–249. Available at: https://doi.org/10.30574/wjbphs.2025.21.1.0039.

Mergbi, M. et al. (2023) 'Fast g-C3N4 sonocoated activated carbon for enhanced solar photocatalytic oxidation of organic pollutants through Adsorb & Shuttle process', Ultrasonics Sonochemistry, 99, p. 106550. Available at: https://doi.org/10.1016/j.ultsonch.2023.106550.

Milutinov, J. et al. (2024) 'The Potential of Natural Compounds in UV Protection Products', Molecules, 29(22), p. 5409. Available at: https://doi.org/10.3390/molecules29225409.

Mushin M Shami, A. (2016) 'Isolation and Identification of Alkaloids extracted from Local Plants in Malaysia', Annals of Chromatography and Separation Techniques, 2(1), pp. 1–3. Available at: https://doi.org/10.36876/acst.1016.

Nafiah, S.R. et al. (2024) 'Pengaruh Paparan Sinar Ultraviolet terhadap Kesehatan Kulit dan Upaya Pencegahannya : Tinjauan Literatur', Scientific Journal (SCIENA), 3(3), pp. 185–1954. Available at: https://doi.org/https://doi.org/10.56260/sciena.v3i3.147.

Nunes, A.R. et al. (2018) 'Use of Flavonoids and Cinnamates, the Main Photoprotectors with Natural Origin', Advances in Pharmacological Sciences, 2018, pp. 1–9. Available at: https://doi.org/10.1155/2018/5341487.

de Oliveira, L.F.C. et al. (2002) 'Vibrational spectroscopic study of brazilin and brazilein, the main constituents of brazilwood from Brazil', Vibrational Spectroscopy, 28(2), pp. 243–249. Available at: https://doi.org/10.1016/S0924-2031(01)00138-2.

Panyakaew, J. et al. (2021) 'Kaempferia Sp. Extracts as UV Protecting and Antioxidant Agents in Sunscreen', Journal of Herbs, Spices & Medicinal Plants, 27(1), pp. 37–56. Available at: https://doi.org/10.1080/10496475.2020.1777614.

Pratama, M.R.F. (2016) 'AKAR KUNING (Arcangelisia flava) SEBAGAI INHIBITOR EGFR : KAJIAN IN SILICO', Jurnal Farmagazine, 3(1), pp. 6–16. Available at: https://doi.org/http://dx.doi.org/10.47653/farm.v3i1.1.

Pratama, M.R.F., Suratno, S. and Mulyani, E. (2018) 'Profile of Thin-Layer Chromatography and UV-Vis Spectrophotometry of Akar Kuning Stem Extract (Arcangelisia flava)', Borneo Journal of Pharmacy, 1(2), pp. 72–76. Available at: https://doi.org/10.33084/bjop.v1i2.367.

Rinaldi, S.E., Suryanto, S. and Widuri, S.A. (2017) 'Informasi Perdagangan Akar Kuning di Pasar Tradisional Martapura dan Pasar Tradisional Rantau, Kalimantan Selatan', Jurnal Sains dan Kesehatan, 1(8), pp. 434–439. Available at: https://doi.org/10.25026/jsk.v1i8.58.

Sahib, A.H.A., Al-Shareefi, E. and Hameed, I.H. (2019) 'Detection of Bioactive Compounds of Vitex agnus-castus and Citrus sinensis Using Fourier-transform infrared spectroscopic profile and Evaluation of Its Anti-microbial Activity', Indian Journal of Public Health Research & Development, 10(1), p. 954. Available at: https://doi.org/10.5958/0976-5506.2019.00184.0.

Smith, B.C. (2022) 'The Infrared Spectra of Polymers, VI: Polymers With C-O Bonds', Spectroscopy, pp. 15-19,27. Available at: https://doi.org/10.56530/spectroscopy.ly3071f5.

Subiandono, E. and Heriyanto, N.M. (2016) 'Kajian Tumbuhan Obat Akar Kuning (Arcangelisia flava Merr.) di Kelompok Hutan Gelawan, Kabupaten Kampar, Riau', Buletin Plasma Nutfah, 15(1), p. 43. Available at: https://doi.org/10.21082/blpn.v15n1.2009.p43-48.

Sukmawati, D.A.N. and Sembiring, Y.S. (2021) 'Determination of Mefenamic Acid and Dexametashone in Instant Pegal Linu Herbal Medicine in Kediri by Using UV-Vis Spectro', ALKIMIA : Jurnal Ilmu Kimia dan Terapan, 5(2), pp. 181–187. Available at: https://doi.org/10.19109/alkimia.v5i2.11275.

Suratno, S., Rizki, M.I. and Pratama, M.R.F. (2019) 'In-Vitro Study of Antioxidant Activities from Ethanol Extracts of Akar Kuning (Arcangelisia flava)', Jurnal Surya Medika, 4(2), pp. 66–71. Available at: https://doi.org/10.33084/jsm.v4i2.594.

Tata, H.L. et al. (2022) 'Propagation of Bajakah and Akar Kuning to Support Bioprospecting of Traditional Medicine from Peat Swamp Forests: Prospect and Challenges', Jurnal Manajemen Hutan Tropika (Journal of Tropical Forest Management), 28(2), pp. 112–118. Available at: http://dx.doi.org/10.7226/jtfm.28.2.112.

Verdaguer, D. et al. (2017) 'UV-A radiation effects on higher plants: Exploring the known unknown', Plant Science, 255, pp. 72–81. Available at: https://doi.org/10.1016/j.plantsci.2016.11.014.

Wahyuni, S. and Marpaung, M.P. (2020) 'PENENTUAN KADAR ALKALOID TOTAL EKSTRAK AKAR KUNING (Fibraurea chloroleuca Miers) BERDASARKAN PERBEDAAN KONSENTRASI ETANOL DENGAN METODE SPEKTROFOTOMETRI UV-VIS', Dalton : Jurnal Pendidikan Kimia dan Ilmu Kimia, 3(2). Available at: https://doi.org/10.31602/dl.v3i2.3911.

Wahyuningsih, E. and Dessidianti, R. (2022) 'Aplikasi FT-IR ATR Spektroskopi untuk Identifikasi Parasetamol pada Jamu Sediaan Serbuk', Jurnal Camellia, 1(2), p. 56.

Wöhlecke, M. and Kovács, L. (2001) 'OH− ions in Oxide Crystals', Critical Reviews in Solid State and Materials Sciences, 26(1), pp. 1–86. Available at: https://doi.org/10.1080/20014091104161.

Yoandri, J. et al. (2022) 'VALUASI TUMBUHAN AKAR KUNING (Arcangelisia flava Merr) DI DESA GOHONG KABUPATEN PULANG PISAU KALIMANTAN TENGAH', Jurnal Hutan Tropika, 17(1), pp. 68–74. Available at: https://e-journal.upr.ac.id/index.php/JHT.