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A Comprehensive Review on Lagerstroemia speciosa

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KEYWORDS

Lagerstroemia speciosa, Corosolic Acid, HPLC, Antidiabetic, HPTLC, RP-HPLC.

ABSTRACT:

Introduction: This review delves into the method development, validation, and identification of phytoconstituents from Lagerstroemia speciosa, a plant known for its medicinal properties. The study focuses on the extraction techniques, isolation methods, and analytical approaches utilized to identify the bioactive compounds present in Lagerstroemia speciosa.

Objective: To provide a comprehensive summary of the extraction methods, analytical techniques, and bioactivities of phytoconstituents found in Lagerstroemia speciosa. It aims to highlight both conventional and advanced extraction techniques.

Method: The methodology of the review paper focuses on various extraction techniques used to isolate phytoconstituents from plants and also demonstrates the effective use of Reverse Phase High-Performance Liquid Chromatography (RP-HPLC), High-Performance Liquid Chromatography (HPLC), and High-Performance Thin-Layer Chromatography (HPTLC) in analyzing bioactive compounds in Lagerstroemia speciosa.

Result: The RP-HPLC method showed excellent precision and accuracy, with recovery rates between 98.14% and 100.97%, and a correlation coefficient of 0.9990, indicating strong linearity. Similarly, the HPLC method displayed a correlation coefficient of 0.9981. The HPTLC method was validated for precision, showing satisfactory repeatability with %RSD values

Conclusion: The review presents a comprehensive list of identified phytoconstituents from Lagerstroemia speciosa, detailing their chemical structures and potential bioactivities. The findings underscore the importance of method validation in ensuring the credibility of results and the significance of identifying phytoconstituents for potential pharmacological applications.

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1 Introduction: -

Phytochemical analysis plays an important function in the exploration and utilization of plant-derived compounds for various applications, particularly in the domain of drug discovery and development. Plants are rich reservoirs with varied structural types and biologically active compounds, many of which have been the basis for numerous medicinal agents (1). Comprehensive Analysis of phytochemicals is necessary for elucidating the chemical composition of plants, identifying their bioactive constituents, and understanding the relationship between their structures and biological activities.

The significance of phytochemical analysis extends beyond drug discovery. It is also essential for standardising and ensuring the quality of herbal items, ensuring batch-to-batch consistency, detecting adulterants or contaminants, and establishing appropriate dosages and formulations (2). Furthermore, phytochemical analysis contributes to the sustainable utilization of medicinal plant resources by enabling the identification of active compounds, which can lead to the advancement of semi-synthetic or synthetic analogs, reducing the need for extensive plant material extraction (3).

Phytochemical analysis is crucial for understanding the pharmacological properties and mechanisms of action of plant-derived compounds. By identifying and characterizing the chemical constituents present in plants, researchers can gain insights into their potential therapeutic effects, toxicity, and interactions with other compounds (4). This knowledge is invaluable when creating new drugs, as well as in the optimization and improvement of existing natural product-based therapies.

Moreover, phytochemical analysis plays an essential part in the authentication and identification of medicinal plants. Many plant species share similar morphological characteristics, making it challenging to distinguish them accurately. Phytochemical profiling can provide a reliable means of identifying and differentiating plant species, ensuring the correct use of medicinal plants, and preventing adulteration or substitution (5).

In addition to its applications in pharmaceuticals, phytochemical analysis is also relevant in various other industries, such as food, cosmetics, and agriculture. For instance, it can help identify natural antioxidants, preservatives, and colorants, as well as compounds with potential applications in crop protection and pest management (6).

Furthermore, phytochemical analysis contributes to the preservation and environmentally friendly use of biodiversity by providing valuable information on the chemical diversity and potential financial worth of plant species. This knowledge can guide efforts in preserving and cultivating medicinal plants, ensuring their availability for future generations (7).

Lagerstroemia speciosa, commonly known as Crape Myrtle or Queen's Crape Myrtle, is a flowering tree pertaining to the family Lythraceae. It is native to Southeast Asian regions, including Indonesia, Philippines, and Malaysia (8). This plant has been widely utilized in traditional medicine systems of these regions for treating various ailments.

In Indonesian traditional medicine, the bark and leaves of L. speciosa been identified as astringents, diuretics, and with the purpose of treating dysentery, diarrhea, and diabetes (9). The plant's extracts have also been used to alleviate inflammation, fever, and skin diseases. Similarly, in Malaysian traditional medicine, the bark and leaves of L. speciosa been identified as treatment for dysentery, diarrhea and as a general tonic (10).

Despite its widespread traditional use, the composition of phytochemicals and bioactive substances responsible for the therapeutic effects of L. speciosa remain largely unexplored. This highlights the need for comprehensive phytochemical analysis and characterization to identify and understand the plant's active constituents, which could potentially lead to the creation of fresh therapeutic agents or the validation of its traditional uses. Primary objective this analysis is to offer a thorough summary of the various methodologies employed for the extraction, identification, and quantification of phytoconstituents from Lagerstroemia speciosa. It aims to critically evaluate and compare the different extraction techniques, both conventional and advanced, utilized for obtaining bioactive compounds from this plant material.

Furthermore, the review will examine the analytical techniques, including chromatographic and

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spectroscopic methods, employed for the characterization and quantification of these phytochemicals. Particular emphasis will be placed on the validation of the analytical methods, discussing essential validation parameters such as specificity, linearity, accuracy, precision, and detection limits, as well as the regulatory guidelines and best practices for method validation in phytochemical analysis. This review will also highlight the reported Potential uses and bioactivities of the identified phytoconstituents from L. speciosa, including their antioxidant, antimicrobial, anticancer, anti-inflammatory, and other pharmacological activities. This information will be crucial in understanding the therapeutic potential of this plant and guiding future research and development efforts. Additionally, this review will address the challenges and prospects within the domain of phytochemical analysis of L. speciosa. Aspects such as standardization and quality control issues, bioavailability and toxicity concerns, and opportunities for future research will be discussed. This will provide valuable insights and recommendations for researchers and industry stakeholders working in this area. Overall, this analysis seeks to serve as a comprehensive resource for researchers, scientists, and professionals involved in the study of Lagerstroemia speciosa and its phytochemical constituents, facilitating the advancement of knowledge and possible uses in a range of industries, such as pharmaceuticals, cosmetics, and nutraceuticals

1 Lagerstroemia speciosa

Lagerstroemia speciosa, commonly known as Crape Myrtle or Queen's Crape Myrtle, is a flowering tree pertaining to the family Lythraceae. It is native to Southeast Asian regions, including Malaysia, Indonesia, the Philippines, and southern China (8,9).

1.1 Botanical Description:

L. speciosa is a medium-sized to substantial size tree, growing up to 20-30 meters tall with a straight trunk and a spreading, dense crown. The bark is smooth and reddish-brown in color, peeling off in thin flakes. The leaves are simple, opposite, oblong-ovate to elliptic in shape, with entire margins and a pointed apex. The leaves are glabrous (hairless) and glossy green in color, measuring 10-25 cm long and 5-12 cm wide (11,12).

The flowers are enormous, beautiful, and borne in terminal panicles of up to 30 cm long. The petals are crinkled and vary in colour from white to pink, purple, or red, depending on their kind. The flowers are typically 5-7 cm in diameter and have numerous long, extended stamens. The plant produces a capsule as its fruit, ovoid to globose in shape, with numerous tiny, winged seeds. (11,12).

1.2 Traditional Uses:

The use of Lagerstroemia speciosa in traditional medical systems has been widespread, particularly in Southeast Asian countries, for treating various ailments due to its perceived therapeutic properties.

In Indonesian cultural medicine, the bark and leaves of L. speciosa have been used as astringents, diuretics, and to cure dysentery, diarrhoea, and diabetes. The plant's extracts have also been used to alleviate inflammation, fever, skin diseases, and as a wound-healing agent (8,9,13)

In Malaysian traditional medicine, the bark and leaves of L. speciosa were used to treat dysentery and diarrhoea and as a general tonic. Additionally, the plant is utilised in traditional Chinese medicine to cure a number of ailments, such as diabetes, heart disease, and diarrhoea. (10, 11,14).

1.3 Phytochemical Composition:

Lagerstroemia speciosa is a rich source of various bioactive phytochemical compounds, which contribute to its traditional medicinal properties and pharmacological activities. The major classes of compounds identified in this plant are:

1.3.1 Phenolic compounds:

Flavonoids: Quercetin, kaempferol, myricetin, and their glycosides have been isolated from different parts of the plant, including the leaves, bark, and flowers (8,9,13). Flavonoids are known for their antioxidant, anti-inflammatory, and anticancer properties.

Tannins: Both condensed and hydrolyzable tannins, such as gallic acid, ellagic acid, and their derivatives, have been identified in L. speciosa extracts (9,13). Tannins possess astringent, antimicrobial, and antioxidant activities.

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Phenolic acids: The plant extracts contain a variety of phenolic acids, including gallic acid, ellagic acid, coumaric acid, and ferulic acid (8, 13). The plant's anti-inflammatory and antioxidant qualities are enhanced by phenolic acids.

1.3.2 Terpenoids:

Triterpenoids: corosolic acid, oleanolic acid, betulinic acid, and their derivatives have been isolated from the bark, leaves, and flowers of L. speciosa (8,13). Numerous biological functions, such as hepatoprotective, anti-inflammatory, and anti-cancer properties, are displayed by these triterpenoids.

Steroids: Various steroidal compounds, such as β-sitosterol, stigmasterol, and their glycosides, have been identified in the plant's extracts (14, 13). Steroids are known for their potential anti-inflammatory, antimicrobial, and anticancer activities.

1.3.3 Alkaloids:

Indole alkaloids: Compounds such as isocorydine, isocorydine-N-oxide, and their derivatives have been isolated from L. speciosa (13, 14). Indole alkaloids are known for their diverse pharmacological activities, including antimicrobial, anticancer, and neuroprotective effects.

Isoquinoline alkaloids: Plant extracts contain a number of isoquinoline alkaloids, including norcycleanine and norarmepavine (13, 14). These alkaloids possess potential antimicrobial, anti-inflammatory, and cytotoxic properties.

1.3.4 Other compounds:

Carbohydrates: In L. speciosa extracts, a variety of mono-, oligo-, and polysaccharides have been found (13).

Proteins: Several proteins and enzymes were discovered in the plant extracts (9).

Essential oils: The plant's essential oils contain a mixture of volatile compounds, such as monoterpenes, sesquiterpenes, and their derivatives (13).

Fatty acids: Various fatty acids, including palmitic acid, linoleic acid, and oleic acid, have been identified in the plant's extracts (13).

1.4 Pharmacology:

Numerous investigations have looked into the pharmacological properties of extracts from Lagerstroemia speciosa and their isolated compounds, revealing potential therapeutic applications:

1.4.1 Antioxidant activity: Strong antioxidant and free radical scavenging actions have been demonstrated by extracts and compounds from L. speciosa, which may be a factor in their therapeutic qualities. (13,15).

1.4.2 Antimicrobial activity: The plant's extracts and isolated components have demonstrated antiviral, antifungal, and antibacterial properties against a wide range of pathogens. (8,13).

1.4.3 Anti-inflammatory and analgesic activities: Studies have demonstrated the anti-inflammatory and pain-relieving effects of L. speciosa extracts and compounds, supporting their traditional use in treating inflammation-related conditions (13,15).

1.4.4 Wound healing and skin protective effects: Extracts and compounds from L. speciosa have demonstrated potential in boosting wound healing and protecting the skin from UV radiation damage. (13, 15).

1.4.5 Antidiabetic and antihyperlipidemic effects: Preliminary studies have suggested that L. speciosa extracts and compounds may possess antidiabetic and lipid-lowering properties, potentially beneficial for managing diabetes and related metabolic disorders (13,14).

Despite its traditional use and purported pharmacological properties, more research is needed to completely understand the phytochemical profile and medicinal value of Lagerstroemia speciosa.

Fig 1: ***Lagerstroemia speciosa.***

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1.5 Extraction Methods for Phytoconstituents

1.5.1 Conventional extraction techniques:

1.5.1.1 Solvent Extraction:

1.5.1.1.1 Maceration: This is one of the simplest and oldest techniques used for extracting phytochemicals an appropriate solvent is absorbed into the plant material, and the extraction happens as the solvent diffuses into the solid plant matrix, dissolving the desired compounds. The polarity of the target compounds determines the solvent that can be utilised, with polar solvents like methanol, ethanol, and water being commonly used for extracting phenolic compounds, glycosides, and other polar constituents. Non-polar solvents like hexane, dichloromethane, or chloroform are used for extracting non-polar compounds like essential oils, terpenes, and lipids. Factors that can improve extraction efficiency include: increasing the solvent-to-solid ratio, prolonging the extraction time, and applying agitation or heat. Maceration is a simple, cost-effective method, but it can be time-consuming and may require larger solvent volumes [16, 17].

1.5.1.1.2 Soxhlet Extraction: The Soxhlet extraction technique is a continuous solid-liquid extraction method that employs specialised glassware. The plant material is set in a thimble-shaped container within the Soxhlet extractor, while the solvent is heated in a flask beneath. As the solvent evaporates, it condenses in the cooler upper chamber, repeatedly rinsing the plant material and extracting the desired compounds. The solvent, containing the extracted compounds, accumulates in the flask below. Maceration is less effective than Soxhlet extraction, as Soxhlet extraction provides for continual replenishment of the solvent, maximizing the contact between the solvent and the plant material. However, it requires larger solvent volumes, longer extraction times, and specialized equipment. The choice of solvent is based on the target compounds' polarity, similar to maceration [18, 19].

1.5.1.1.3 Hydrodistillation: Hydrodistillation is a conventional technology that extracts the essential oils and volatile substances from plant sources. The plant material is immersed in water, and the mixture is heated to boiling. The volatile substances from the plant material are carried by the steam as the water boils; these compounds condense and are gathered as the essential oil fraction. There are various hydrodistillation setups, including the Clevenger apparatus, which allows for continuous water replenishment and efficient condensation. The process can be modified by using different hydrodistillation techniques like water distillation, steam distillation, or a combination of both. Aromatic plant essential oils are commonly extracted via hydrodistillation, but it is not suitable for non-volatile or thermally unstable compounds, which may degrade or remain in the plant residue [20, 21].

1.5.1.2 Others

1.5.1.2.1 Decoction: This procedure includes a long boiling time of the plant material, usually several hours or minutes, in water or another suitable solvent. The heat facilitates the extraction of water-soluble compounds, including phenolic compounds, glycosides, and polysaccharides. Traditional medicinal treatments frequently employ decoctions because they can extract a variety of phytochemicals. [22, 23].

1.5.1.2.2 Infusion: Similar to decoction, Infusion involves soaking the plant component in hot water or a suitable solvent for a shorter duration, typically ranging from a few minutes to an hour. By using this method, water-soluble substances can be extracted without the need for prolonged boiling, which is a requirement for decoctions. Infusions are commonly used for preparing herbal teas and extracting thermolabile compounds that may degrade under prolonged heating [22, 23].

1.5.2 Advanced Extraction Techniques

1.5.2.1 Supercritical Fluid Extraction (SFE):

Supercritical Fluid Extraction is a new and ecologically sound technology that uses supercritical fluids, usually carbon dioxide, as the extraction solvent. A supercritical fluid is an element that resides above its critical temperature and pressure, with properties similar to those of a liquid and gas. In its supercritical form, the fluid has strong diffusivity and low viscosity, and variable solvating properties, making it an effective extraction medium. SFE's key advantages are the capacity to precisely extract target molecules, the use of non-toxic, ecologically acceptable solvents, and the potential of solvent recycling. However, since supercritical carbon dioxide is non-polar, SFE requires specialised equipment

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and might not be appropriate for extracting polar or ionic compounds [24, 25].

1.5.2.2 Microwave-Assisted Extraction (MAE): MAE is a rapid and efficient extraction technique that utilizes microwave energy to facilitate the extraction of phytochemicals from plant materials. Microwave radiation induces dipole rotation and conduction of ions in the solvent and plant matrix, causing localised heating and pressure building. This ruptures the cell walls of the plant and allows the solvent to diffuse into the plant material, resulting in better extraction of target chemicals. MAE has various advantages over conventional procedures, including quicker extraction durations, lower solvent usage, and the possibility for higher extraction yields. However, it requires specialised microwave equipment and may be unsuitable for thermolabile chemicals due to the extreme temperatures involved. [26, 27].

1.5.2.3 Ultrasound-Assisted Extraction (UAE): UAE is a technique that employs ultrasonic waves to facilitate the extraction of phytochemicals from plant materials. Cavitation bubbles are produced in the solvent by the ultrasonic waves, which collapse and generate localized high temperatures and pressures. The resulting phenomenon ruptures plant cell walls, allowing the solvent to penetrate deeper into the plant matrix and extract more target components. UAE provides benefits such as more rapid extraction periods, decreased solvent use, and potentially higher yields when compared to traditional techniques. It can be used with other extraction procedures, such as maceration or Soxhlet extraction, to boost extraction efficiency. [28,29].

1.5.2.4 Enzyme-Assisted Extraction: Enzyme-assisted extraction uses enzymes including cellulases, pectinases, and hemicellulases to break down plant cell wall structures, allowing the desired phytochemicals to be released into the extraction solvent. Enzymes like these hydrolyze the structural elements of cell walls of plant such as cellulose, pectin, and hemicellulose, hence increasing solvent diffusion and extraction yield.This approach is widely used in combination with other extraction procedures that include maceration or ultrasound-assisted extraction, to improve extraction efficiency. Enzyme-assisted extraction is especially beneficial for extracting chemicals that are attached to the plant's cell wall matrix or trapped within the plant cells. [30, 31].

1.5.3 Others

1.5.3.1 Pressurized Liquid Extraction (PLE): PLE is a technique that uses high pressures and temperatures to improve the solvent's solubility and diffusion throughout the plant matrix, hence improving extraction efficiency. The high pressure enables the application of solvents at temperatures exceeding their boiling points, making it easier to extract phytochemicals that are thermally labile or attached to plant material. Compared to conventional procedures, PLE has advantages such as faster extraction durations, lower solvent usage, and potentially higher extraction yields. However, it needs specialised equipment and may not be suited for thermally unstable chemicals due to the high temperatures required. [32, 33].

1.5.3.2 Pulsed Electric Field Extraction (PEF): it is a extraction technique that involves applying high-voltage electric pulses to the plant material immersed in a conductive solution or solvent. The electric pulses create pores in the cell membranes of the plant, facilitating the release of intracellular compounds into the extraction solvent. PEF extraction offers advantages such as reduced extraction times, improved extraction yields, and the capability to extract thermolabile compounds. without subjecting them to high temperatures. However, it requires specialised equipment and may not be appropriate for plant materials with high electrical resistance. [34, 35]. The extraction process selected is determined by a variety of parameters, including the plant material, target compounds, their physicochemical qualities, and the desired yield and purity. In many circumstances, a mixture of extraction techniques or a multi-step extraction approach may be used to produce the best results. Furthermore, considerations like cost, scalability, and environmental effect should be addressed while selecting an optimal extraction process.

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2 Analytical Techniques for Identification and Quantification: -

2.1 Chromatographic techniques:

2.1.1 High Performance Liquid Chromatography (HPLC)

Instrumentation	Mobile phase	Result	Reference
1)HPLC system by M/s Shimadzu containing LC-10AT VP pumps, SCL-10A VP auto injector. Column: Phenomenex Luna C18 . Detector: SPD – M10 AVP Photodiode array detector.	acetonitrile: 0.1% (v/v) phosphoric acid in water (75:25, v/v).	Retention Time: 9.4 ± 0.4 min. The % RSD for intra- and inter-day: 0.02 – 0.08. Linearity: 2.0 –12.0 µg per injection. Correlation coefficient: 0.9981 ± 0.0004. LOD and LOQ: 0.016 and 0.048 µg	HPLC by Katta Vijaykumar (36)
2)Agilent 1100 series instrument (Agilent Corp.) equipped with a degasser, pump, UV-vis detector, and autosampler. Column: Reverse phase125×4 mm, 5 µm particle size;	Isocratic mobile phase system consisting acetonitrile and 0.1% (v/v) aqueous phosphoric acid (6:4).	Detection wavelength: 204 nm. The retention time: 9.2±0.4 min. LOD and LOQ: 0.452 and 1.37µg/ml. Linearity: 3.12 to 50 µg/ml. Correlation coefficient: (y=9.3200x+1.8422, r=0.9998). %RSD for intra- and inter-day: 1.55–3.06% and 1.33–4.56%.	HPLC by Gorawit Yusakul (37)
Shimadzu UFLC Prominence system. Binary pumps, auto sampler and Degasser. Detector:	Gradient of acetonitrile: water	A) Asiatic acid: Retention time: 5.894 Regression equation: y = 4540.x + 1048	HPLC Nishad P Joshi(38)

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SPD – M 20 A photo diode array detector. Column: C18 column		Correlation coefficient:0.9997 Linearity: 0.5-600µg/ml. LOD and LOQ: 0.3 &0.5µg/ml respectively. B) Corosolic Acid: Retention time:7.366 Regression equation: y = 2588.x + 8834 Correlation coefficient:0.9998 Linearity: 1.0-600µg/ml. LOD and LOQ:0.2 and 0.5µg/ml respectively.	

2.1.2 High Performance Thin Layer Chromatography (HPTLC)

Instrumentation	Mobile phase	Result	Reference
1) Camag microlitre syringe on a pre-coated silica gel aluminium plates 60 F – 254 (20 nm x 10nm) with 250 µm. Camag Linimat IV applicator 20 cm x 10 cm twin trough glass chamber. Scanner: Camag TLC scanner-III.	Chloroform: methanol (9:1).	Recovery Percentage: 99.86 ± 0.831% Linearity: 2 – 12 µg/ spot Correlation coefficient: 0.9735 ± 0.0014. The LOD and LOQ: 0.004 and 0.013 µg per Spot respectively.	HPTLC by Katta Vijaykumar (36)
2) 10 × 10 cm preactivated HPTLC silica gel 60 F254 plates (Merck, India). TLC applicator Linomat-V with N2flow. Scanner: CAMAG scanner III	Petroleum ether: ethyl acetate: formic acid (5:5:1)	Linearity: 200 to 1000ng/ spot. Correlation coefficient: 0.99 Standard Deviation: 4.59 Linear regression equation: Y= 0.273x + 48.38 % RSD: 1.10%	HPTLC by V Sai Saraswati (39)
3) 20 cm × 10 cm aluminium			

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foil plates coated with silica gel 60F254. CAMAG Linomat V sample applicator	Chloroform–methanol 8.5:1.5 (v/v)	Precision (n = 6): 0.78 Repeatability (n = 5): 1.92 Limit of detection [ng]: 06 Limit of quantitation [ng]: 16 Linearity correlation coefficient:0.996 Range [µg]: 0.5–4.5	HPTLC by Uppuluri V. Mallavadhani (40)

2.1.3 Reverse Phase High-performance liquid chromatography (RP-HPLC)

Instrumentation	Mobile phase	Result	Reference
1) A Shimadzu model HPLC with quaternary LC-2010 AHT VP pumps UV/Vis detector SPD-10 AVP. AVP system controller, rheodyne injector fitted with a 20 µl loop and class VP 5.032. Column: Phenomenex Luna C18 (250 mm x 4.6 mm id, 5 µm particle size)	acetonitrile: 0.1% aqueous orthophosphoric acid (85:15, v/v)	UV maxima for Corosolic acid: 210 nm. Regression equation: y=53828x+7782.5 Correlation coefficient: = 0.9987 %RSD for intraday and interday precision: 0.2090-0.4607 and 0.9755-1.5419 respectively. % recovery: 98.14 ± 0.80 - 100.97 ± 1.05 LOD & LOQ: 0.067 µg/ml and 0.225 µg/ml respectively.	RP-HPLC BY Patel Anar J. (41)

3 Conclusion:

3.1 High-Performance Liquid Chromatography (HPLC):

HPLC was used to isolate, identify, and quantify the bioactive chemicals found in Lagerstroemia speciosa. The approach displayed great precision and accuracy, indicating its suitability for routine phytochemical analyses. The calibration curves for the chemicals demonstrated excellent linearity, with a correlation coefficient (R^2) of 0.9981. The detection limits were low, and the LOD and LOQ values demonstrated the method's sensitivity in identifying even trace amounts of the analytes. The approach demonstrated good recovery rates ranging from 98.14% to 100.97%, confirming its accuracy in measuring chemicals. Because of its stability

and reproducibility, HPLC is the best method for conducting comprehensive analyses of complex mixtures of plant components.

3.2 High-Performance Thin-Layer Chromatography (HPTLC):

HPTLC was utilized for quick screening and semi-quantitative analysis of phytochemicals. This approach is useful since it is simple, inexpensive, and can handle several samples at the same time. The method was verified for linearity, precision, and accuracy, and the %RSD values indicated satisfactory repeatability. HPTLC's optical and densitometric detection capabilities make it an effective tool for basic phytochemical analysis and quality control in herbal formulations. The method's high resolution and sensitivity for detecting numerous phytoconstituents such as flavonoids and tannins make it an important tool in phytochemical analysis.

3.3 Reverse Phase High-Performance Liquid Chromatography (RP-HPLC):

RP-HPLC allowed for the precise separation and quantification of hydrophilic and hydrophobic components in Lagerstroemia speciosa. The approach was highly sensitive, with excellent linearity (correlation coefficient of 0.9981) and low LOD (0.067 µg/ml) and LOQ (0.225 µg/ml). The method's precision, as measured by intra- and inter-day %RSD values, was within acceptable ranges, demonstrating its consistency and reliability. The recovery rates also demonstrated the accuracy of RP-HPLC in analyzing bioactive components, making it an effective tool for quality control and standardization of herbal products.Each analytical approach used in the study provides distinct benefits and contributes to a thorough examination of the phytochemicals in Lagerstroemia speciosa. The method used is determined by the study's specific requirements, such as comprehensive quantification, quick screening, or structural elucidation. Advanced chromatographic and spectroscopic techniques enable reliable identification and quantification of bioactive chemicals, which is critical for verifying the medicinal plant's pharmacological potential. These technologies' great precision, accuracy, and sensitivity assure consistent results, which supports the plant's use in traditional medicine and prospective therapeutic applications (42).

Reference: -

1. Kittakoop, P., Mahidol, C., & Ruchirawat, S. (2014). Alkaloids as important scaffolds in therapeutic drugs for the treatments of cancer, tuberculosis, and smoking cessation. Current Topics in Medicinal Chemistry, 14(2), 239-252.
2. Singh, R. (2015). Chemotaxonomic significance of phytochemical analysis in traditional medicine. In Medicinal Plants and Natural Product Research (pp. 231-252). Nova Science Publishers, Inc.
3. Atanasov, A. G., Zotchev, S. B., Dirsch, V. M., & Supuran, C. T. (2021). Natural products in drug discovery: Advances and opportunities. Nature Reviews Drug Discovery, 20(3), 200-216.
4. Sarker, S. D., & Nahar, L. (2012). An introduction to natural products isolation. In Natural Products Isolation (pp. 1-25). Humana Press, Totowa, NJ.
5. Medina-Mercado, J. L., Martínez-Rodríguez, A., & Ruiz-Montoya, M. (2022). Phytochemical analysis as a tool for plant authentication: Advantages and limitations. Journal of AOAC International, 105(1), 25-38.
6. Choudhary, M. I., & Sekhon, B. S. (2011). Recent developments in the phytochemical and pharmacological studies of the genus Iris. Phytochemistry Reviews, 10(3), 339-357.
7. Verpoorte, R., Choi, Y. H., & Kim, H. K. (2009). Ethnopharmacology and systems biology: A perfect holistic match. In Evidence-based Complementary and Alternative Medicine (eCAM) (Vol. 2, No. S1). Oxford University Press.
8. Lohézic-Le Dévéhat, F., Bakhtiar, A., Bézivin, C., Amoros, M., & Boustie, J. (2013). Antiviral and cytotoxic activities of some Indonesian plants. Fitoterapia, 74(5), 400-405.
9. Syamsunir, N., Akbar, A., & Hakim, A. (2020). A review: Medicinal uses of Lagerstroemia speciosa (L.) Pers. In Indonesian Traditional Medicine. HAYATI Journal of Biosciences, 27(2), 75-81.
10. Ong, H. C., Norzalina, J., & Fatimah, I. N. (2011). Malay herbal medicine in Gemencheh, Negri Sembilan, Malaysia. Fitoterapia, 82(7), 1241-1259.
11. Lim, T. K. (2012). Lagerstroemia speciosa. In Edible Medicinal and Non-Medicinal Plants (pp. 471-477). Springer, Dordrecht.
12. Gilman, E. F., & Watson, D. G. (1994). Lagerstroemia speciosa: Crape-Myrtle. University

Journal of Chemical Health Risks

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JCHR (2024) 14(5), 505-516 | ISSN:2251-6727

of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS.

13. Haque, M. A., Shaha, R. K., Ahmed, S. U., Rahman, M. M., Rahman, M. M., Rahmatullah, M., & Jahan, R. (2014). Use of inorganic compounds and vegetable drugs at a village practitioner of Jhenaidah district, Bangladesh. American-Eurasian Journal of Sustainable Agriculture, 8(1), 1-10.
14. Zhang, Y., Tan, H., Cao, Y., Zhang, Y., & Ye, W. (2018). Phytochemistry and pharmacological activities of Lagerstroemia speciosa: A review. Chinese Herbal Medicines, 10(3), 279-287.
15. Peng, R., Chen, J., Zhang, Y., Du, Y., & Ye, W. (2019). Comprehensive review on phytochemistry, pharmacological activities, and quality control of Lagerstroemia speciosa (L.) Pers. Chinese Herbal Medicines, 11(4), 339-355.
16. Azwanida, N. N. (2015). A review on the extraction methods use in medicinal plants, principle, strength and limitation. Medicinal and Aromatic Plants, 3(1), 1-10.
17. Sasidharan, S., Chen, Y., Saravanan, D., Sundram, K. M., & Yoga Latha, L. (2011). Extraction, isolation and characterization of bioactive compounds from plants' extracts. African Journal of Traditional, Complementary and Alternative Medicines, 8(1).
18. Luque de Castro, M. D., & Priego-Capote, F. (2010). Soxhlet extraction: Past and present panacea. Journal of Chromatography A, 1217(16), 2383-2389.
19. Dar, R. A., Shahnawaz, M., & Qazi, P. H. (2019). General overview of medicinal plants: A review. The Journal of Phytopharmacology, 8(1), 349-351.
20. Tongnuanchan, P., & Benjakul, S. (2014). Essential oils: Extraction, bioactivities, and their uses for food preservation. Journal of Food Science, 79(7), R1231-R1249.
21. Asbahani, A. E., Miladi, K., Badri, W., Sala, M., Addi, E. H. A., Casabianca, H., ... & Elaissari, A. (2015). Essential oils: From extraction to encapsulation. International Journal of Pharmaceutics, 483(1-2), 220-243.
22. Asif, M., Yehya, A. H. S., Al-Mansoori, L., Revadigar, V., Ezzat, M. O., Javed Awan, M. U., ... & Oon, C. E. (2016). Decoction, the hot water extract: Insights on extraction technology versatility. Saudi Journal of Biological Sciences, 23(4), 473-479.
23. Kaur, G. J., & Arora, D. S. (2009). Antibacterial and phytochemical screening of Anethum graveolens, Foeniculum vulgare and Trachyspermum ammi. BMC Complementary and Alternative Medicine, 9(1), 1-10.
24. Mardigan, L. P., Pratama, M. A., Sutrisno, E. A., & Wulansari, A. K. (2020). Supercritical fluid extraction of bioactive compounds from natural sources: A review. Food Research International, 137, 109402.
25. Khaw, K. Y., Parat, M. O., Shaw, P. N., & Falconer, J. R. (2017). Solvent supercritical fluid technologies to extract bioactive compounds from natural sources: A review. Molecules, 22(7), 1186.
26. Chemat, F., Rombaut, N., Meullemiestre, A., Turk, M., Perino, S., Fabiano-Tixier, A. S., & Abert-Vian, M. (2017). Review of green food processing techniques. Preservation of plant cells for food application: Principles and applications. Innovative Food Science & Emerging Technologies, 58, 102211.
27. Vásquez, V., Medina-Jarramón, A., Millán, R., & Giménez, E. (2020). Microwave-assisted extraction of phytochemicals from plant sources: A critical and updated review. Molecules, 25(3), 593.
28. . Dzah, C. S., Duan, Y., Zhang, H., Bermingham, J., & Hui, Y. H. (2020). Ultrasound-assisted extraction of phytochemicals from plant materials: Modeling, optimization and scale-up considerations. Ultrasonics Sonochemistry, 64, 105022.
29. Vilkhu, K., Mawson, R., Simons, L., & Bates, D. (2008). Applications and opportunities for ultrasound assisted extraction in the food industry—A review. Innovative Food Science & Emerging Technologies, 9(2), 161-169.
30. Puri, M., Sharma, D., & Barrow, C. J. (2012). Enzyme-assisted extraction of bioactives from plants. Trends in Biotechnology, 30(1), 37-44.
31. Barzana, E., Rubio, D., Rodriguez, R. I., Cortes, J., & Garcia, F. (2002). Enzyme-mediated solvent extraction of carotenoids from marigold flower (Tagetes erecta). Journal of Agricultural and Food Chemistry, 50(16), 4491-4496.4.2.5.
32. Mustafa, A., & Turner, C. (2011). Pressurized liquid extraction as a green approach in food and herbal

plants extraction: A review. Analytica Chimica Acta, 703(1), 8-18.

33. Mottaleb, M. A., & Sarker, S. D. (2012). Accelerated solvent extraction for natural
34. products isolation and downstream processing. Phytochemical Analysis, 23(4), 302-308.
35. Lieu, L. N., & Le, V. V. M. (2010). Application of ultrasound in grape mash treatment in juice processing. Ultrasonics Sonochemistry, 17(1), 273-279.
36. Boussetta, N., Turk, M., De Taeye, C., Larondelle, Y., Lanoisellé, J. L., & Vorobiev, E. (2013). Influence of high voltage electrical discharges on the extraction of polyphenols and proteins from grape pomace. Food Research International, 54(1), 406-412.
37. Yusakul, G.; Saensom, P.; Mitsantia, N.; Pengdee, C.; Putalun, W. Development of a High-Performance Liquid Chromatography for Analysis of Corosolic Acid in Lagerstroemia Species and Their Hypoglycemic Potentials. *Songklanakarin J. Sci. Technol.* **2020**, *42* (2), 314–320. https://doi.org/10.14456/sjst-psu.2020.40.
38. Anar P, Shah MB, Singh RP. Issue:4 Citation [Internet]. Vol. 18, Patel Anar J et al. Ijppr.Human. 2020. Available from: www.ijppr.humanjournals.comwww.ijppr.humanjournals.com
39. Vijaykumar K, Murthy PB, Kannababu S, Syamasundar B, Subbaraju G V. Quantitative Determination of Corosolic acid in Lagerstroemia Speciosa Leaves, Extracts and Dosage Forms. International Journal of Applied Science and Engineering. 2006;4(2):103–14.
40. Joshi NP, Vaidya V V, Pawar SS, Gadgil JN. DEVELOPMENT AND VALIDATION OF HPLC METHOD FOR SIMULTANEOUS DETERMINATION OF BIO-ACTIVE MARKERS COROSOLIC ACID, ASIATIC ACID AND β-SITOSTEROL FROM LEAVES OF LAGERSTROEMIA SPECIOSA LINN. AND FROM MARKETED FORMULATION.
41. Sai Saraswathi V, Rajaguru P, Santhakumar K. Solar catalysed activity against methyl orange dye, cytotoxicity activity of MCF-7 cell lines and identification of marker compound by HPTLC of Lagerstroemia speciosa. J Photochem Photobiol B. 2017 May 1;170:263–70.
42. Anar P, Shah MB, Singh RP. Issue:4 Citation [Internet]. Vol. 18, Patel Anar J et al. Ijppr.Human. 2020. Available from: www.ijppr.humanjournals.comwww.ijppr.humanjournals.com