International Journal of Science, Strategic Management and Technology
Volume **02** Issue **05** May-**2026** | ISSN: **3108-1762 (Online)** | Impact Factor: 3.8
An International, Peer-Reviewed, Open Access Scholarly Journal Indexed in recognized academic databases

TO Evaluate Antimicrobial Activity of Mangifera Indica Bark Extract

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https://doi.org/10.55041/ijsmt.v2i4.509

Cite this Article: Patil, L., Mahajan, A. & Risal, S. (2026). TO Evaluate Antimicrobial Activity of Mangifera Indica Bark Extract. International Journal of Science, Strategic Management and Technology, *02*(05). https://doi.org/10.55041/ijsmt.v2i4.509

ABSTRACT:

The present investigation was carried out to evaluate the antimicrobial activity of *Mangifera indica* bark extract in response to the increasing global concern of antimicrobial resistance. Medicinal plants are widely recognized as potential sources of bioactive compounds that may serve as alternative therapeutic agents. In this study, the bark of *Mangifera indica* was collected, cleaned, air-dried, and finely powdered before being subjected to ethanolic extraction. Preliminary phytochemical screening of the extract confirmed the presence of important bioactive constituents such as alkaloids, flavonoids, tannins, saponins, terpenoids, and steroids. These compounds are known to possess various biological activities, including antimicrobial effects. The antimicrobial activity of the extract was evaluated using the modified surface streak method against selected microorganisms. The results indicated a reduction in microbial growth in the treated samples as compared to the control. However, the zone of inhibition observed was moderate, suggesting that the extract exhibited limited antimicrobial activity under the experimental conditions. The antimicrobial action may be attributed to the presence of phytochemicals that interfere with microbial cell membranes, enzyme systems, and metabolic pathways. Overall, the study suggests that Mangifera indica bark extract possesses potential as a natural antimicrobial agent. Further studies involving optimization of extraction methods and concentration may enhance its effectiveness and broaden its pharmaceutical application.

KEYWORDS:

Mangifera indica, *antimicrobial activity*, *Bark extract, Phytochemicals, Modified surface streak method.*

1.INTRODUCTION

Microbiology is derived from the Greek words micros (small), bios (life), and logos (study), and it refers to the scientific study of microorganisms that are too small to be observed with the naked eye. These microorganisms include bacteria, fungi such as yeasts and moulds, protozoa, and microscopic algae. Viruses are also included in microbiology, although they are acellular and exist at the boundary between living and non-living organisms. Microbiology focuses on understanding the structure, function, and behaviour of microorganisms, as well as their interactions with humans, animals, plants, and the environment. [1,13]

Microbiology is an important applied biological science that plays a significant role in fields such as medicine, agriculture, food technology, and industrial biotechnology. While many microorganisms are beneficial and contribute to processes such as fermentation, nutrient cycling, and production of useful substances, others are pathogenic and responsible for causing infectious diseases in humans, animals, and plants.[2,5,6]

1.The Main types of Microorganisms

1.1. Bacteria:

Bacteria are unicellular prokaryotic organisms that lack a true nucleus and membrane-bound organelles. They are among the most abundant and diverse forms of life. Bacteria can survive in a wide range of environments, including soil, water, and inside living organisms. Many bacteria are beneficial, playing important roles in digestion and nutrient recycling, whereas some are pathogenic and cause diseases[3]

1.2.Archaea:

Archaea are similar to bacteria in size and shape but differ in their genetic composition and metabolic pathways. They are often found in extreme environmental conditions such as high temperature, salinity, or acidity. Archaea are considered to be among the earliest forms of life and play an important role in ecological balance.[3]

1.3.Fungi:

Fungi are eukaryotic organisms that include yeasts, molds, and mushrooms. Most fungi are multicellular, except yeasts, which are unicellular. They are non-photosynthetic and obtain nutrients through absorption. Fungi play a crucial role in decomposition and recycling of organic matter, although some species can cause infections.[4]

1.4.Protozoa:

Protozoa are unicellular eukaryotic organisms with complex internal structures. They are commonly found in aquatic environments and moist habitats. Some protozoa are free-living, while others are parasitic and responsible for diseases such as malaria and amoebiasis.[12]

1.5.Viruses:

Viruses are acellular infectious agents that require a host cell for replication. They consist of genetic material enclosed in a protein coat and are responsible for various diseases in humans, animals, and plants.[13]

Microbial interactions play an important role in maintaining ecological balance. These interactions may be beneficial, harmful, or neutral and are commonly categorized as mutualism, commensalism, or antagonism. For example, in mutualistic relationships such as nitrogen fixation, both organisms benefit from the association.[12]

In recent years, the excessive and inappropriate use of antibiotics has led to the emergence of antimicrobial resistance, which has become a major global health concern. Many microorganisms have developed resistance to commonly used drugs, reducing their effectiveness and making infections difficult to treat.[7]

As a result, there is a growing interest in exploring alternative therapeutic agents derived from natural sources. Medicinal plants have been used for centuries and are considered rich sources of bioactive compounds such as alkaloids, flavonoids, tannins, saponins, and terpenoids. These compounds are known to possess antimicrobial, antioxidant, and anti-inflammatory properties.[8]

Mangifera indica, commonly known as mango, belongs to the family Anacardiaceae and is widely cultivated in tropical regions. Different parts of the plant, including bark, leaves, and fruits, have been used in traditional medicine. The bark contains important phytochemicals such as mangiferin, tannins, and terpenoids, which contribute to its antimicrobial activity.[9]

The utilization of mango bark, often considered an agricultural waste product, provides a cost-effective source of bioactive compounds and contributes to environmental sustainability. Therefore, the present study aims to evaluate the antimicrobial activity of *Mangifera indica* bark extract using standard laboratory techniques.

Several studies have reported the antimicrobial potential of *Mangifera indica* extracts obtained from different parts of the plant. These extracts have shown activity against both Gram-positive and Gram-negative bacteria, indicating broad-

spectrum antimicrobial properties . In addition, phytochemical investigations have revealed that compounds such as tannins and flavonoids contribute significantly to antimicrobial effects by disrupting microbial cell membranes and metabolic pathways.[10,11]

Thus, the present investigation focuses on evaluating the antimicrobial potential of *Mangifera indica* bark extract.

2.MATERIAL AND METHOD:

2.1.Preparation of *Mangifera indica* bark powder:

Fresh bark of Mangifera indica was collected from a healthy tree and washed thoroughly with distilled water to remove dust and impurities. The bark was air-dried at room temperature for about 15 days to eliminate moisture content. After complete drying, the bark was ground into a fine powder using a mechanical grinder and stored in an airtight container for further use.[10]

2.2.Extraction by maceration method:

The extraction of bioactive compounds was carried out using the maceration method. Approximately 20 g of the powdered bark was taken in a conical flask and mixed with 200 ml of ethanol. The mixture was allowed to stand for 24–48 hours with occasional shaking to ensure proper extraction of phytochemicals. After the extraction period, the mixture was filtered using Whatman filter paper to separate the liquid extract from the solid residue. The filtrate was then concentrated using a water bath maintained at 40°C to evaporate the solvent and obtain the crude extract.[10]

2.3.Phytochemical test:

Serial Number	Test	Procedure	Observation	Result
1.	**Hager's Test**	1ml extract + 2drops Hager's reagent	Yellow colour found	Alkaloid presents
2.	**Alkaline reagent test**	1ml extract + 2drops NaOH + diluted HCl 2drops	Yellow colour found	Flavonoids present
3.	**Ferric chloride test**	1ml extract + FeCl3 2drops	Blue black colour found	Tannins present
4.	**Foam test**	1ml extract + 1ml distilled water	Stable foam	Saponins present
5.	**Terpenoids test**	1ml extract + 1ml chloroform + 1ml conc. H2So4	Reddish brown colour found	Terpenoids present
6.	**Salkowski test**	1ml extract + 1ml chloroform + 1ml conc. H2So4	Red brown ring found	Steroid present
7.	**Quinones test**	2ml extract + 5 drops conc. H2So4 shake for 5 Min.	Red colour	Quinones absent

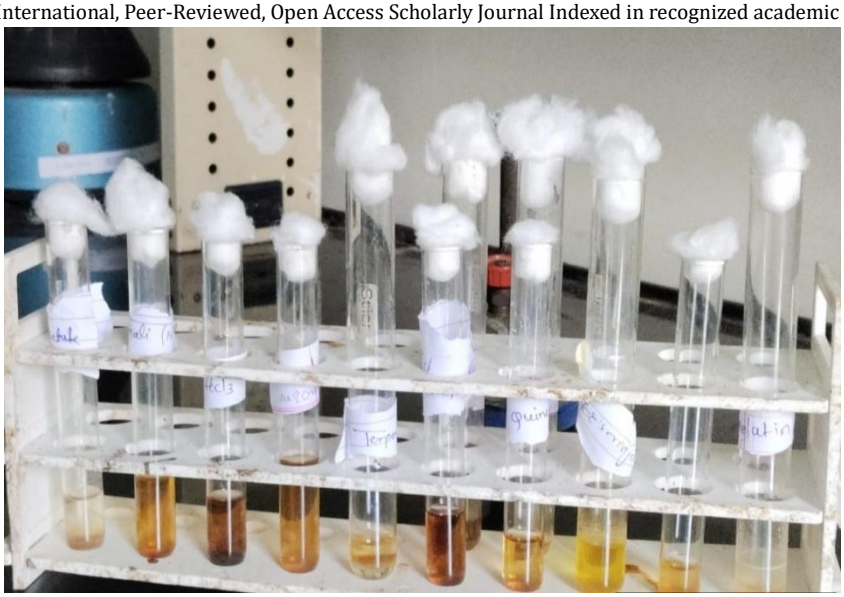

Fig 1. Phytochemical Test

2.4.Evaluation Parameter:

By Modified Surface Streak Method:

The antimicrobial activity of the extract was determined using a modified surface streak method under aseptic conditions. Nutrient agar medium (5.6 g) was accurately weighed and dissolved in 200 ml of distilled water with continuous heating until completely dissolved. The prepared medium was sterilized for about 20 minutes and allowed to cool to a suitable temperature Sterile petri plates were prepared and disinfected using ethanol. The sterilized nutrient agar was poured into the 5 petri plates and allowed to solidify. After solidification, the microbial inoculum was uniformly spread over the agar surface. The plant extract was then applied on the inoculated agar surface in a zig-zag pattern on designated test plates. The experimental setup included negative control, positive control, and extract-treated plates. All plates were incubated at 32°C for 24–48 hours under controlled laboratory condition. After incubation, the plates were observed for microbial growth inhibition in the treated regions and compared with control plates to evaluate the antimicrobial activity of the extract.[11,12]

Fig.2 Laminar air flow

3.Result:

The antimicrobial activity of *Mangifera indica* bark extract was evaluated using the modified surface streak method. After incubation at 32°C for 24–48 hours, the extract-treated plates showed a slight reduction in microbial growth compared to the positive control plates. The zone of inhibition observed was moderate, indicating that the extract exhibited antimicrobial activity against the *Pseudomonas spp*. under the given experimental conditions. Overall, the results suggest that *Mangifera indica* bark extract give the antimicrobial activity against the *Pseudomonas spp*.

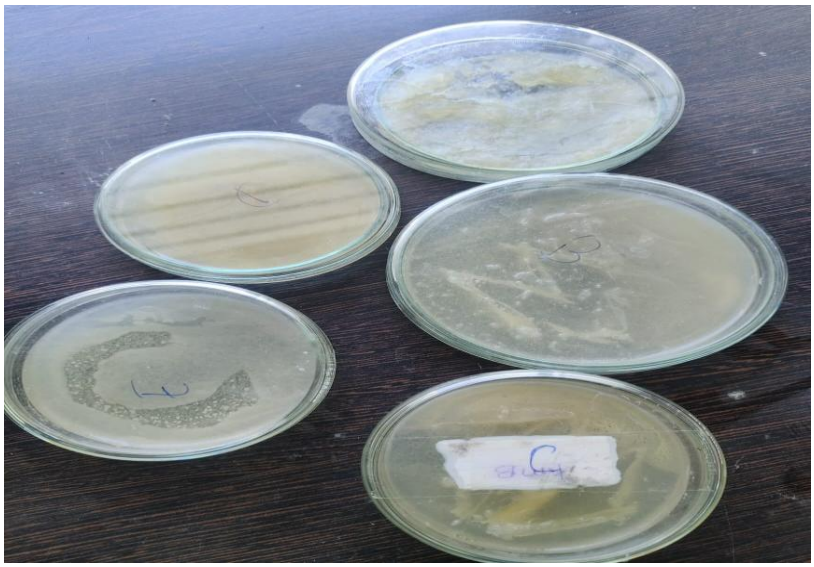

Fig.3 Antimicrobial activity of *Mangifera indica* bark

4.Discussion:

The present study demonstrated that *Mangifera indica* bark extract exhibited antimicrobial activity, as evidenced by the reduction in microbial growth observed in the treated plates, including against *Pseudomonas spp*. The antimicrobial effect may be attributed to the presence of bioactive phytochemicals such as tannins, flavonoids, and alkaloids, which are known to inhibit microbial growth. These compounds may exert their effect by disrupting microbial cell membranes or interfering with essential metabolic processes. The findings of the present study are consistent with previous reports that have demonstrated antimicrobial activity of *Mangifera indica* extracts. Although the zone of inhibition observed was moderate, including against *Pseudomonas spp*, it indicates the potential of the plant as a natural antimicrobial agent. The moderate activity may be due to factors such as extraction method, concentration of the extract, or experimental conditions.

5.Conclusion:

The present study concludes that *Mangifera indica* bark extract exhibits antimicrobial activity against the tested bacterial strains, including Pseudomonas *spp*. The observed moderate inhibition indicates the presence of bioactive phytochemicals such as tannins, flavonoids, and alkaloids, which may be responsible for the antimicrobial effect. Overall, the findings suggest that the bark extract possesses antimicrobial potential and can be considered as a natural source for further development of plant-based antimicrobial agents.

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