

**REVEALING THE CHEMICAL BIOACTIVE COMPOUNDS OF *MORINGA OLEIFERA* BARK USING LC-MS ANALYSIS TO CONDUCT DETAILED BIOCHEMICAL ANALYSIS****Jyoti Rathore<sup>1\*</sup>, Kiran Thakur<sup>2</sup>**<sup>1</sup>Department of Chemistry Govt E V Post Graduate College Korba(C.G),<sup>2</sup>Department of Chemistry, Government Bilasa Girls PG College, Bilaspur (C.G)\*Corresponding Author's E mail: [joychemistryjrc@gmail.com](mailto:joychemistryjrc@gmail.com)

Received 14 June. 2024; Revised 16 June. 2024; Accepted 22 June. 2024, Available online 10 July. 2024



Cite this article as: Rathore J and Thakur K. Revealing the Chemical Bioactive compounds of *Moringa oleifera* bark Using LC-MS Analysis to Conduct Detailed Biochemical Analysis. Asian Journal of Pharmaceutical Education and Research. 2024; 13(3): 191-198.

<https://dx.doi.org/10.38164/AJPER/13.3.2024.191-198>

**ABSTRACT**

Parts of Africa and Asia are home to the plant known as *Moringa*, commonly referred to as *Moringa oleifera*. Because of its therapeutic and nutritious qualities, it is also known as the "drumstick tree" or the "miracle tree." Bioactive substances like tannins, phenolic acids, flavonoids, and alkaloids are found in the bark. It is well recognized that these substances may have anti-inflammatory and antioxidant qualities. Liquid Chromatography-Mass Spectrometry (LC-MS) is a widely used technology for analyzing *Moringa* bark samples in order to identify and quantify different components. Combining the mass analysis capabilities of mass spectrometry with the separation capabilities of liquid chromatography yields a potent analytical technique known as LC-MS. While studies on the leaves, seeds, and roots of *Moringa* have been conducted, there is considerably little scientific data directly pertaining to the medical benefits of the plant's bark. As a result, it's crucial to use caution when using *Moringa* bark and to get the most recent information from trustworthy sources. Non polar extracts were prepared and analyzed for phytochemical in different extracts. *M.oleifera* extracts LC-MS chromatogram showed 105 peaks, which denote the presence of 105 phytochemical substances. Peak area, retention period, and molecular formula were used to identify the phytochemical substances. The main compounds identified are Quercetin, Kampeferol, Cinnamic acid, Beta sitosterol and Rhamnetin. 2,4-Dimethyldodecane, Eicosane, n-Hexadecanoic acid, Heneicosane, Octadecanoic acid, Tetracosane and many more presented in Chromatogram. Further the reported phytochemicals can be studied for pharmaceutical use after clinical trials and its finished product.

**Keywords:** Chromatogram, Phytochemical, Liquid Chromatography, Mass Spectrometry**INTRODUCTION**

*Moringa oleifera*, commonly known as the drumstick tree, horseradish tree, or simply *Moringa*, is a versatile and nutrient-rich plant native to parts of Africa and Asia. While much attention is often

Rathore *et al.* Chemical Bioactive compounds of *Moringa oleifera* bark using LC-MS Analysis of Biochemical Analysis given to its leaves and seeds, the bark of the *Moringa* tree also holds significance for various traditional and medicinal uses. *Moringa oleifera* is a fast-growing, deciduous tree that can reach heights of up to 10 meters or more. The bark is typically smooth, with a whitish-gray color. *Moringa* supplements, including those containing bark extracts, are available in various forms, such as capsules, powders, and teas<sup>1-3</sup>. The bark is also sometimes used in traditional culinary practices in certain regions. While *Moringa* is generally considered safe for consumption, it's essential to exercise caution and moderation, as excessive intake may lead to adverse effects. Consultation with a healthcare professional is advisable, especially for pregnant or breastfeeding women and individuals with pre-existing medical conditions. The bark, like other parts of the *Moringa* tree, contains a variety of bioactive compounds, including alkaloids, flavonoids, phenolic acids, and tannins. These compounds contribute to the plant's antioxidant, anti-inflammatory, and antimicrobial properties<sup>4-10</sup>. In traditional Ayurvedic medicine, various parts of the *Moringa* tree, including the bark, have been used for their supposed medicinal properties. In different cultures, the bark has been employed as a remedy for various ailments, including digestive issues, inflammation, and as a general health tonic<sup>11-12</sup>.

**Table 1.1 Chemical constituents of *Moringa oleifera* bark**<sup>13-22</sup>

S.No	Chemical Constituents	Description
1	<b>Alkaloids</b>	Moringine is a prominent alkaloid found in <i>Moringa oleifera</i> bark. Alkaloids often have pharmacological effects and may contribute to the plant's medicinal properties.
2	<b>Flavonoids</b>	Flavonoids are a group of polyphenolic compounds with antioxidant properties. Some examples found in <i>Moringa oleifera</i> bark include quercetin, kaempferol, and rutin.
3	<b>Phenolic Acids</b>	Chlorogenic acid and caffeoylquinic acid are examples of phenolic acids present in <i>Moringa oleifera</i> bark. Phenolic acids contribute to the antioxidant activity of the plant.
4	<b>Tannins</b>	Tannins are polyphenolic compounds with astringent properties. They are believed to have antioxidant and antimicrobial effects. <i>Moringa oleifera</i> bark contains tannins, which may contribute to its traditional medicinal uses.
5	<b>Saponins</b>	Saponins are glycosides with surfactant properties. <i>Moringa oleifera</i> bark contains saponins, which may have various biological activities, including antimicrobial and anti-inflammatory effects.
6	<b>Terpenoids</b>	Terpenoids are a diverse group of compounds with a wide range of biological activities. Some terpenoids have been identified in <i>Moringa oleifera</i> bark and may contribute to its medicinal properties.

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7	<b>Phytosterols</b>	Beta-sitosterol is an example of a phytosterol found in <i>Moringa oleifera</i> bark. Phytosterols are plant sterols with potential cholesterol-lowering properties.
8	<b>Glycosides</b>	<i>Moringa oleifera</i> bark contains various glycosides, which are compounds formed by the combination of a sugar molecule with another chemical group. These may have diverse biological activities.

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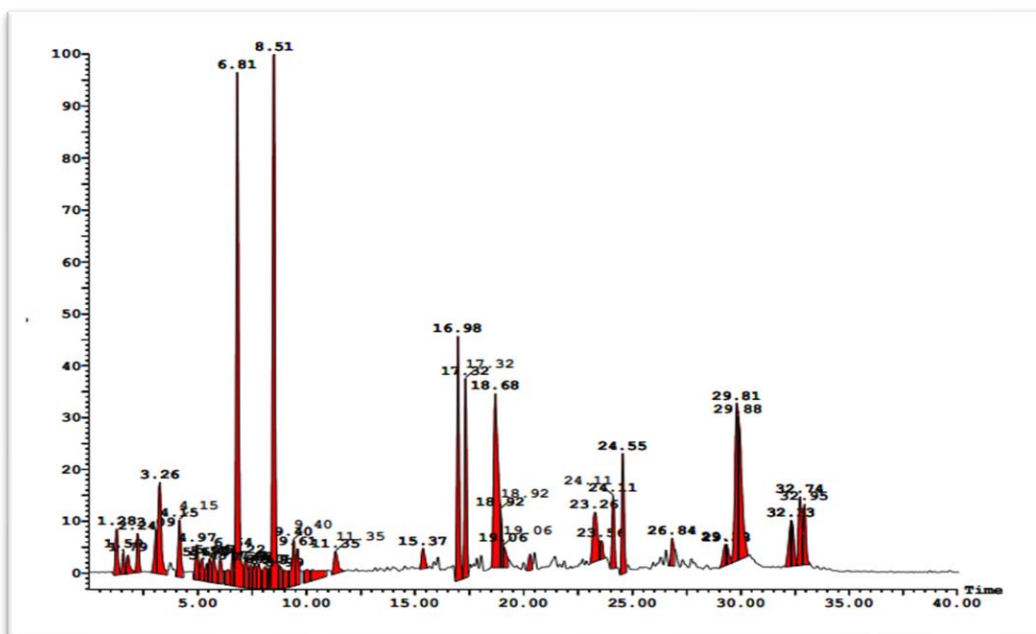
### Pharmaceutical properties of *Moringa oleifera* bark

1. Anti-inflammatory property - The bark of *Moringa oleifera* is believed to have anti-inflammatory effects. In traditional medicine, it has been used to alleviate inflammation and related conditions.
2. Antioxidant property - *Moringa* bark, like other parts of the plant, contains antioxidants. Antioxidants help neutralize free radicals in the body, which are implicated in various health issues, including aging and certain diseases.
3. Analgesic property - The anti-inflammatory properties of *Moringa* bark may contribute to its traditional use in alleviating pain associated with inflammatory conditions.
4. Cardiovascular property - Some studies suggest that *Moringa* extracts, including those from the bark, may have cardiovascular benefits, such as helping to lower blood pressure and cholesterol levels. These effects are likely due to the presence of bioactive compounds with vasodilatory and lipid-lowering properties<sup>23-27</sup>.

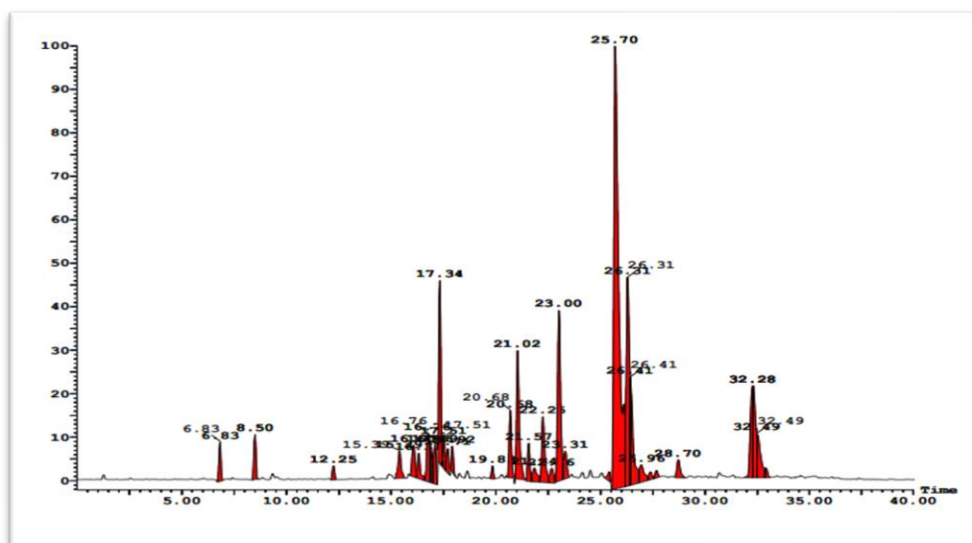
### MATERIAL AND METHODOLOGY

*Moringa oleifera* bark was gathered from the forest in the Korba area of the state of Chhattisgarh. The bark of the *Moringa oleifera* plant was collected, cleaned, and ground into a fine powder. Using several non-polar solvents, including benzene, hexane, chloroform, and ethyl acetate, the fine powder was extracted using the Soxhlet method. The extraction process took a full day. Following the assembly of the soxhlet extractor and the addition of 50g of powdered *Moringa Oleifera*, the extraction process began at 61°C with a chloroform solvent. The extracted was collected and vacuum-distilled dried after a 24-hour period. For the remaining three solvents benzene, hexane, and ethyl acetate the same procedures were carried out at boiling points of 80°C, 68°C, and 77°C, respectively. *Moringa Oleifera* flower benzene extract and *Moringa Oleifera* flower chloroform extract were the labels placed on the extracts. Both the hexane and ethyl acetate extracts from

Rathore *et al.* Chemical Bioactive compounds of *Moringa oleifera* bark using LC-MS Analysis of Biochemical Analysis *Moringa oleifera* flowers are available. After obtaining the final residue, an LC-MS analysis was conducted<sup>28-31</sup>.



**Fig 1: LC-MS Chromatogram of Quercetin**



**Fig 2: LC-MS Chromatogram of Kampeferol**

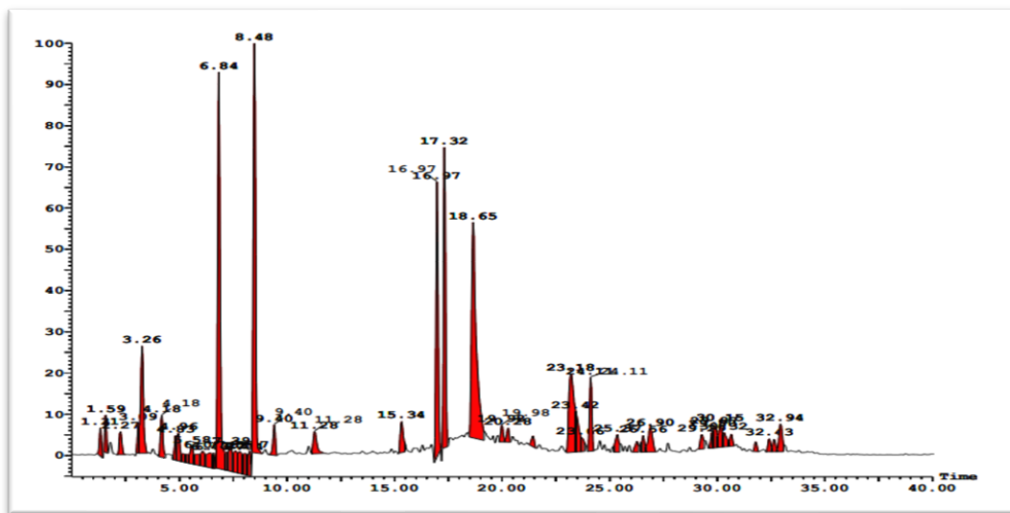


Fig 3: LC-MS Chromatogram of Rhamnetin

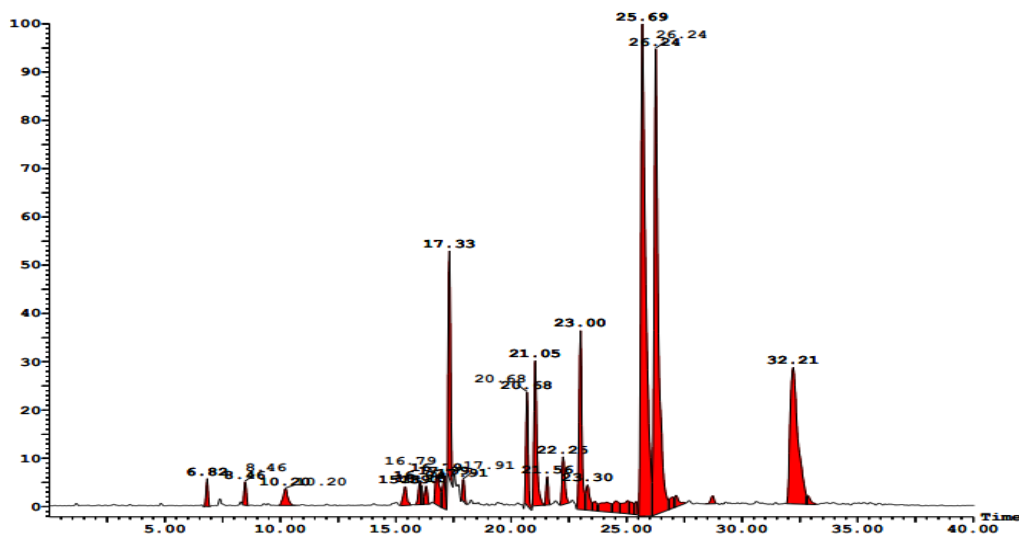


Fig 4: LC-MS Chromatogram Beta Sitosterol

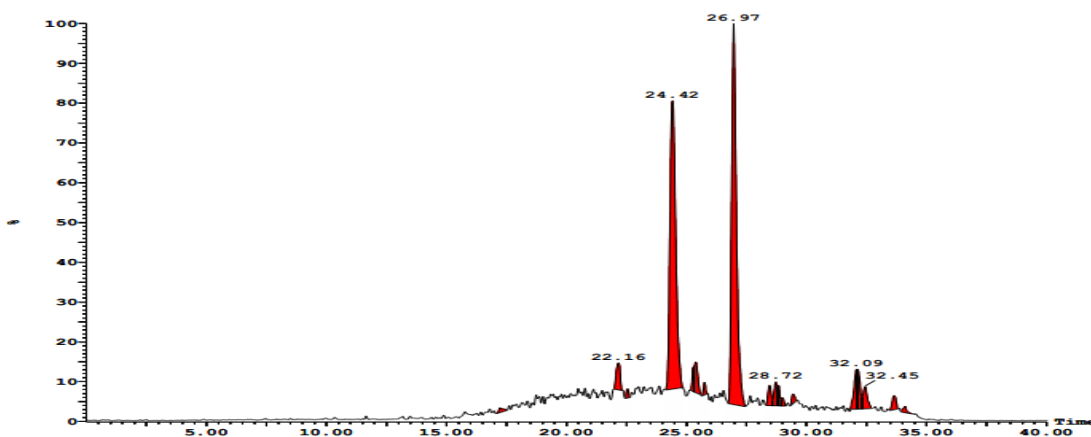


Fig 5: LC-MS Chromatogram of Cinnamic acid

## CONCLUSION

It's important to note that research on the medicinal properties of *Moringa oleifera* bark is ongoing, and more scientific studies are needed to fully understand its potential benefits and any associated risks. As with any herbal remedy, it's advisable to seek guidance from healthcare professionals before incorporating *Moringa* bark or its extracts into your health regimen. Some studies suggest that *Moringa* bark may have anti-inflammatory effects, which could be beneficial for conditions involving inflammation. The presence of antioxidants in the bark may help neutralize free radicals in the body, potentially contributing to overall health. *Moringa* bark extracts have been investigated for their potential antimicrobial properties.

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