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# SCREENING THE PHYTOCHEMICAL COMPOSITION AND EXPLORING THE PHARMACOLOGICAL POTENTIAL OF *DODONAEA VISCOSA* L. LEAVES

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## ABSTRACT

Plants have historically played a crucial role in human health, providing essential sustenance and serving as integral components of traditional medicinal systems worldwide. With approximately two-thirds of new therapeutic agents derived from higher plants, their significance in pharmaceutical research is undeniable. Phytochemistry serves as a fundamental tool in evaluating plant chemical constituents, with phytochemicals playing pivotal roles in traditional medicinal practices. *Dodonaea viscosa*, a member of the Sapindaceae family, has attracted attention for its pharmacological properties, particularly in the treatment of various ailments. This study aims to investigate the qualitative and quantitative phytochemical analysis of *Dodonaea viscosa* leaves, focusing on identifying chemical constituents for potential medicinal drug standardization and preparation. The study revealed a diverse array of phytochemical components, including alkaloids, terpenoids, phenolic compounds, tannins, flavonoids, amino acids, proteins, and carbohydrates in the methanolic leaf extract. Further characterization through FT-IR and GC-MS analyses identified specific functional groups and over 20 compounds in the extract. These findings underscore *Dodonaea viscosa* as a promising source of therapeutically potent compounds, laying a foundation for future pharmaceutical exploration. Continued research on this plant holds significant promise for advancing medicinal applications and enhancing global healthcare practices by contributing to the development of effective natural medicines.

**Keywords: Phytochemistry, flavonoids, amino acids, proteins**

## INTRODUCTION

Plants have long played a crucial role in human health, serving as vital sources of food and medicine. Medicinal plants, recognized as traditional or herbal medicine since the nineteenth century, continue to be utilized worldwide for their therapeutic properties. Traditional medicinal systems such as Homeopathy, Ayurveda, Yunani, and Siddha extensively employ medicinal plants due to their efficacy and minimal adverse effects **[1]**.

The significance of medicinal plants as sources of new therapeutic agents has been extensively discussed by researchers. These plants yield a substantial portion of the world's pharmaceutical resources, with approximately two-thirds of new chemicals identified annually originating from higher plants. Moreover, about 75% of the global population relies on medicinal plants for treating various disorders. Phytochemistry, focusing on the evaluation of chemical compounds produced by plants, plays a pivotal role in assessing the quality and quantity of these compounds. Phytochemicals, encompassing primary and secondary metabolites, exhibit medicinal value and have been instrumental in traditional medicinal approaches for treating numerous diseases. Many medicinal plants contain a significant number of antioxidants, which combat free radicals responsible for various diseases. Natural antioxidants derived from plants are increasingly utilized in pharmaceutical formulations due to their safety, cost-effectiveness, and fewer side effects. These antioxidants find applications in food, healthcare, and cosmetics, extending product shelf-life and enhancing efficacy **[2]**.

Diabetes mellitus, a metabolic disorder characterized by elevated blood sugar levels, poses severe health risks, including organ damage. Conventional drugs for diabetes mellitus are often expensive and associated with harmful side effects, particularly in India, where it is a prevalent health concern. Scientists are exploring herbal medicines derived from medicinal plants with proven antidiabetic activity as safer and more accessible alternatives. One such plant, *Dodonaea viscosa* from the family Sapindaceae, has been studied for its phytochemical profile, particularly in methanol extracts of its leaves **[3]**. The leaves of *D. viscosa* exhibit various activities, including anti-inflammatory, antimicrobial, antiviral, antioxidant, wound healing, and antidiarrheal properties, highlighting its potential as a therapeutic agent. In this paper, we aim to explore the collection and extraction of bioactive compounds from medicinal plants, focusing on qualitative and quantitative phytochemical analysis. Additionally, we delve into the pharmacological activities of

these compounds, particularly their potential in treating diseases such as diabetes mellitus. Moreover, we investigate the antioxidant potential of plant extracts and their role in combating oxidative stress-related diseases **[4]**.

## MATERIALS AND METHODS

### Collection of Plant Material

The experimental plant, *Dodonaea viscosa,* was sourced from Gandhi Market, Tiruchirappalli. Fresh leaves of *D. viscosa* were selectively collected, excluding other plant parts. The leaves underwent thorough washing with running tap water to remove any debris. Subsequently, the leaves were shade dried for two to three weeks until complete drainage of moisture content. The dried leaves were finely powdered and stored in a clean sterile bottle at room temperature.

### Extraction of Leaf Parts

Methanolic extracts of *D. viscosa* leaves were prepared using the Soxhlet extraction method. Ten grams of leaf powder were added to 150ml of methanol in a distillation flask. The solvent was evaporated to obtain the crude extract, which was then stored in a clean sterile bottle at room temperature for further experimentation.

### Phytochemical Screening

Phytochemical screening involved conducting chemical tests on the methanolic extract of *D. viscosa* leaves following standard procedures outlined **[5-8]**. Each plant family, genus, and species produce a characteristic mix of primary and secondary metabolites, some of which are utilized by humans as medicines, flavorings, or recreational drugs.

### Antioxidant Activity

The radical scavenging potential of the nanoparticles was assessed using the DPPH reagent. Solvent served as the blank, while ascorbic acid was used as the control. Test samples were taken at five different concentrations. DPPH was added to all the tubes, and their absorbance was measured at 517nm **[9]**.

### Anti-diabetic Activity

The Alpha-Amylase Inhibitory Assay, following a modified procedure **[10]** involved placing 1000 µL of sample (20-100 µg/ml) in a tube and adding 250µL of 0.02M sodium phosphate buffer (pH 6.9) containing α-amylase solution (0.5mg/mL). After preincubation at 25ºC for 10 min, 250µL of 1% starch solution in 0.02M sodium phosphate buffer (pH 6.9) was added at timed intervals and further incubated at 25ºC for 10 min. The reaction was stopped by adding 500µL of dinitrosalicylic acid (DNS) reagent, followed by incubation in boiling water for 5 min and cooling to room temperature **[11 - 12]**. Absorbance was measured at 540 nm using a spectrophotometer after dilution with 5mL distilled water. Percentage inhibition was calculated using the formula

[(Abs control – Abs compounds) / Abs control] x 100.

## RESULTS AND DISCUSSION

### Phytochemical Analysis of *Dodonaea viscosa* L. Leaves

Phytochemical analysis plays a crucial role in evaluating the presence of phytoactive compounds in medicinal plants. The screening of methanolic extract of *Dodonaea viscosa* L. leaves revealed the presence of several medicinally active compounds. The components identified include alkaloids, steroids, terpenoids, phenolic compounds, tannins, flavonoids, amino acids, proteins, and carbohydrates. The quantitative and qualitative results are presented in **Table 1** and depicted in **Figure 1**. This analysis underscores the potential pharmacological significance of *Dodonaea viscosa* L. leaves due to the presence of diverse phytochemical components known for their medicinal properties. Further investigations are warranted to explore the therapeutic implications of these compounds **[13]**.

### Identification of Functional Groups in Methanolic Extract of *Dodonaea viscosa* Leaves

The present study revealed the separation of various types of compounds from the methanolic extract of *Dodonaea viscosa* leaves. FT-IR spectroscopy was employed to identify the functional groups of the active compounds based on their peak values **[14-15]**. The results of FT-IR peak values and corresponding functional groups are depicted in **Figure 2** and tabulated in **Table 2** below.

**Table 1: Qualitative Analysis of secondary metabolites of *D. viscosa* leaves**

| S. No. | Phytoconstituents | Test performed | Methanol |
|---|---|---|---|
| 1 | Terpenoids | Salkowski test | (++) |
| 2 | Flavonoids | Alkaline reagent test | (-) |
| | | Lead acetate test | (+) |
| 3 | Saponins | Foam test | (++) |
| | | Froth test | (++) |
| 4 | Tannins | | (-) |
| 5 | Alkaloids | Mayer's test | (++) |
| | | Hager's test | (++) |
| 6 | Steroids | Salkowski test | (+) |
| 7 | Glycosides | Libermann's test | (+) |
| 8 | Phlobotannins | Precipitate test | (-) |
| 9 | Proteins | Xanthoproteic test | (+) |
| | | Ninhydrin test | (+) |
| 10 | Coumarins | | (+) |
| 11 | Cardiac glycosides | Keller -Killani test | (-) |
| 12 | Carbohydrates | Fehling's test | (+) |
| | | Benedict's test | (++) |
| 13 | Phenols | | (+) |

**(+) ---->Present (++) ----> Highly Present (-) ---> Absent**

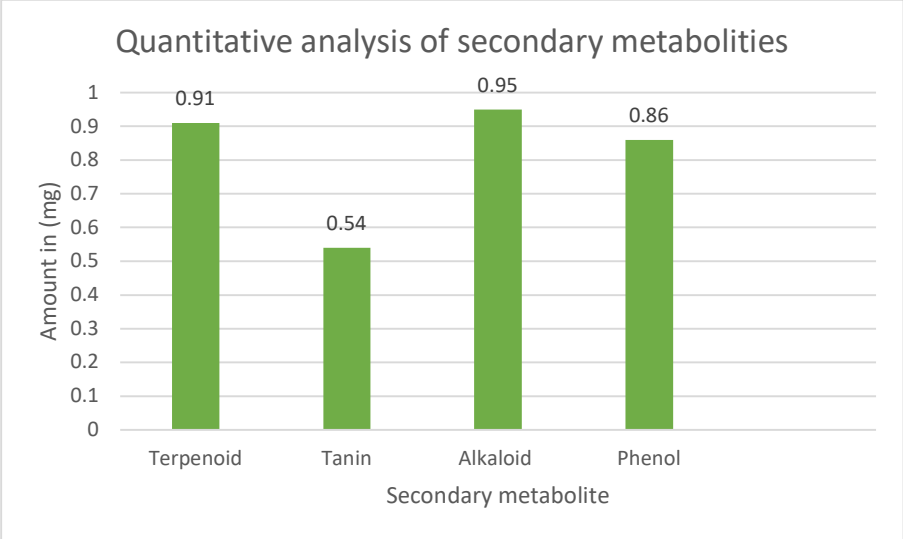


**Figure 1: Quantative analysis of secondary metabolites**

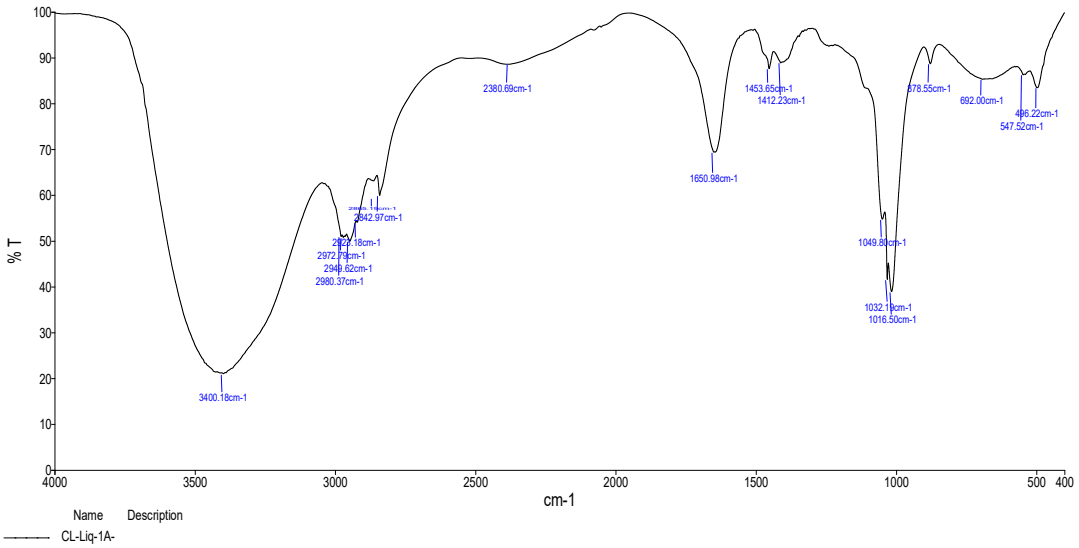


**Figure 2: FT-IR spectrum showing peak values**

**Table 2: Functional groups present in *D. viscosa* leaves**

| PEAK VALUES | BOND | Functional group |
|---|---|---|
| 3400.18 | O-H stretch-bonded | Alcohols, phenols |
| 2980.37 | C-H, C=O | Aldehyde, ketones |
| 2949.62 | C-H stretch off C=O | Aldehydes |
| 2972.79 | C-H stretch off C=O | Aldehydes |
| 2923.18 | C-H stretch off C=O | Aldehydes |
| 2842.97 | C-H, C=O | Aldehyde, ketones |
| 2865.19 | C-H stretch off C=O | Aldehydes |
| 2380.69 | Unknown | Unknown |
| 1650.98 | N-H bend | Primary amines |
| 1453.65 | C-C stretch (in ring) | Aromatics |
| 1412.23 | C-C stretch (in ring) | Aromatics |
| 1049.80 | C-N stretch | Aliphatic amine |
| 1032.19 | C-N stretch | Aliphatic amine |
| 1016.50 | Unknown | Unknown |
| 878.55 | C-H “oop” | Aromatics |
| 692.00 | -C (triple bond) C-H: C-H | Bend alkynes |
| 547.52 | C-Br stretch | Alkyl halides |
| 496.22 | Unknown | Unknown |

The FT-IR analysis indicated the presence of diverse functional groups associated with different compounds within the methanolic extract of *Dodonaea viscosa* leaves. This comprehensive characterization provides valuable insights into the chemical composition of the extract and lays the groundwork for further elucidating its potential pharmacological activities.

**Identification of Compounds in Methanolic Extract of *Dodonaea viscosa* Leaves by GC-MS Analysis**

The results obtained from the GC-MS analysis have provided crucial insights, leading to the identification of 20 different compounds. These compounds encompass a wide range of components known for their various pharmacological activities, as shown in **Table 3**. The identification of these components was based on their retention time, as illustrated in **Figure 3**. Subsequently, the pharmacological activities associated with these components were determined and meticulously tabulated.

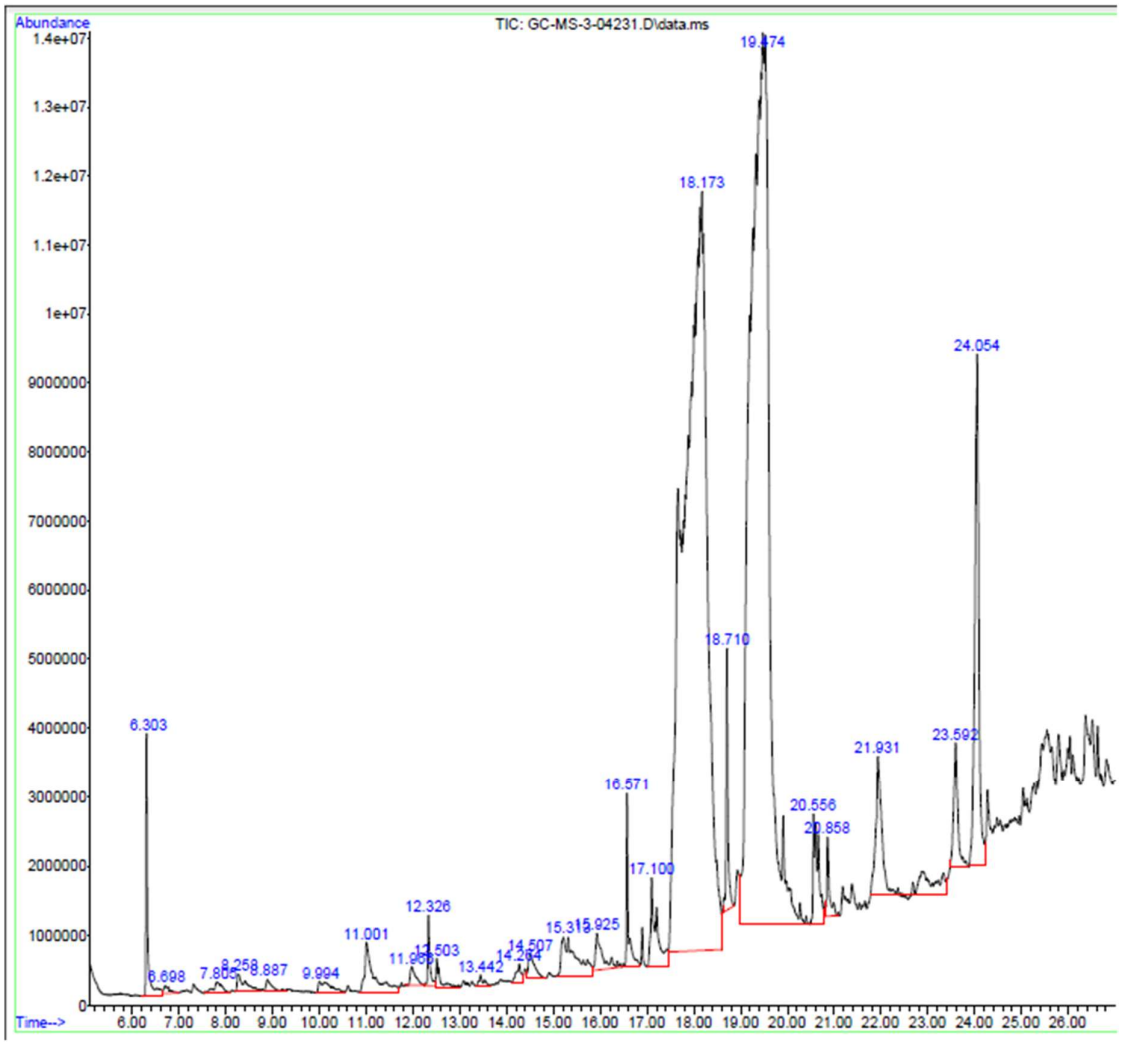


**Figure 3: GC-MS analysis**

**Table 3: GC-MS analysis of *D. viscosa* leaves L.**

| PEAK | RETENTION TIME | COMPONENT |
|---|---|---|
| 1 | 6.303min | Propanedioicacid,dimethylester |
| 2 | 6.698min | cis-3-Methyl-2-n-propylthiophane, Isopropylisothiocyanate, Methyl3,4-di-O-acetyl-2-acetamine |
| 3 | 7.805min | Cycloheptanone, Pentane,3-methylene-,2H-Pyran |
| 4 | 8.258min | Proline,3,4-didehydro-, 3,4Dehydro-dl- proline,2,5-Dihydro-3-methyl-thiophene |
| 5 | 8.887min | Ethanone,1-cyclohexyl-,3H-Pyrazol-3-one,2,4-dihydro-2,3-Acetylthymine |
| 6 | 9.994min | 4H-Pyran-4-one,2,3-dihydro-3,5-,Propanamide,N, N-dimethyl- |
| 7 | 11.001min | Benzaldehyde,2-methyl-,3-methyl-,4-methyl- |
| 8 | 11.966min | 5-Hydroxymethylfurfural, Benzenemethanol,3-fluoro-, 2,2,3,3-Tetramethylcyclopropanec. |
| 9 | 12.326min | 2-Methoxy-4-vinylphenol,3-Methoxyacetophenone,Ethanone, |
| 10 | 12.503min | Caryophyllene,2Bicyclo[7.2.0]undec-4-ene,4,11 |
| 11 | 13.442min | 24-Amino-1-methyl-5-nitropyrazole, Benzocycloheptene,3-hydroxy-,2-Propanol,1-(dibutylamino)- |
| 12 | 14.264min | 2,4(1H,3H)-Pyrimidinedione,2,5-Difluorobenzoicacid,3,4-Difluorobenzoicacid, |
| 13 | 14.507min | 2-Hydroxy-5-methylbenzaldehyde,(3-Nitrophenyl)methanol ,3,5-Dimethylanisole |
| 14 | 15.313min | Caryophylleneoxide, Spiro [4.5] dec-6-ene, |
| 15 | 15.925min | Ethyl. alpha. -d-glucopyranoside,1,3,5-Trithiane,2,4,6-trimethyl,2,3,5,6-Tetrafluoroanisole |
| 16 | 16.571min | Bicyclo[3.1.1]heptane |
| 17 | 17.100min | Phytol,acetate, Cyclohexene,1-Buta-1,3-dienyl-pyrrolidine |
| 18 | 18.173min | 4-O-Methylmannose, D-Fructose,3-O-methyl-,2-O-Methyl-D-mannopyranosa |
| 19 | 18.710min | n-Hexadecanoicacid, Octadecanoicacid |
| 20 | 19.474min | 1-Butene,1-(methylthio)-,1,3-Dioxane,2-pentadecyl-, |

The comprehensive analysis conducted via GC-MS has enabled the identification of diverse compounds present in the methanolic extract of *Dodonaea viscosa* leaves. This detailed characterization serves as a foundation for further exploring the pharmacological potential and therapeutic applications of these compounds.

**Antioxidant Activity of Methanolic Extract of *Dodonaea viscosa* Leaves**

The antioxidant activity of the methanolic extract of *Dodonaea viscosa* leaves was assessed using two methods: DPPH (2,2-diphenyl-1-picrylhydrazyl) and FRAP (Ferric Reducing Antioxidant Power). The free radical scavenging property of DPPH and the FRAP value were calculated and compared with standard values of ascorbic acid. The assays were performed at various concentrations (25 µl, 50 µl, 75 µl, 100 µl) to evaluate the dose-dependent antioxidant activity **[16]**.

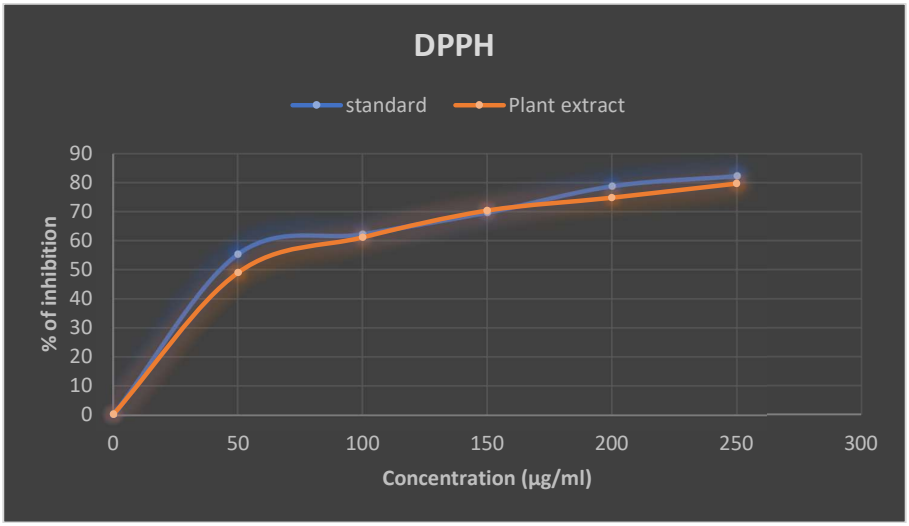


**Figure 4: Antioxidant activity of *D. viscosa* leaves**

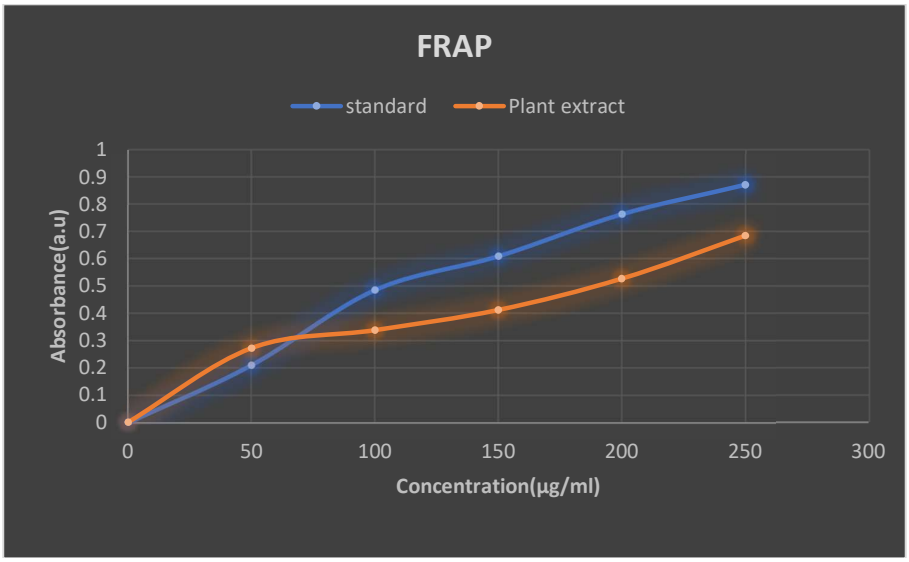


**Figure 5: FRAP activity of *D. viscosa* leaves**

The results of the antioxidant activity assays provide valuable insights into the potential of the methanolic extract of *Dodonaea viscosa* leaves as an antioxidant agent. Further analysis and comparison with standard antioxidants such as ascorbic acid help in understanding the efficacy

**Antidiabetic Activity of Methanolic Extract of *Dodonaea viscosa* Leaves**

The antidiabetic activity of the methanolic extract of *Dodonaea viscosa* leaves was evaluated by assessing its α-amylase inhibitory activity. The assay was conducted according to a standard method with minor modifications. The results were expressed as percentage inhibition at various concentrations (25 µl, 50 µl, 75 µl, 100 µl).

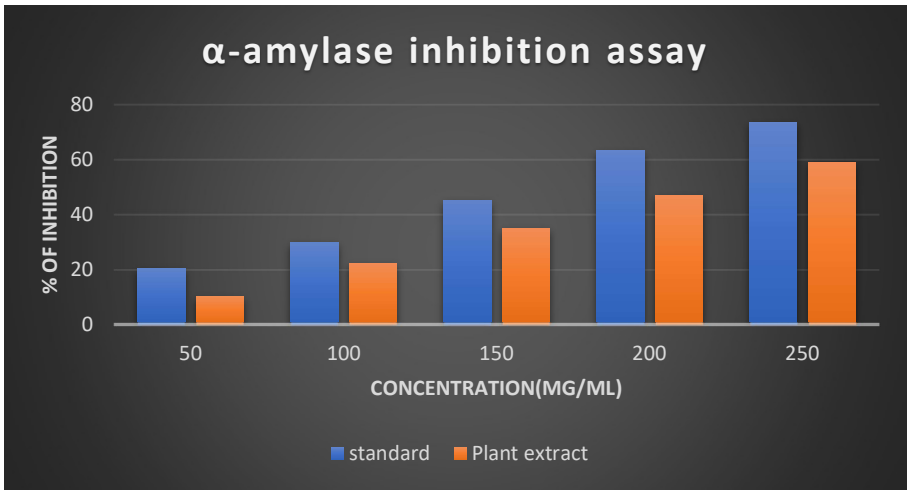


**Figure 6: α-amylase inhibition assay of *D. viscosa* leaves**

The results of the α-amylase inhibitory activity assay provide valuable insights into the potential of the methanolic extract of *Dodonaea viscosa* leaves as an antidiabetic agent. Further analysis of these results can contribute to understanding the efficacy of the extract in managing diabetes mellitus by inhibiting α-amylase activity.

## CONCLUSION

The phytochemical screening of *Dodonaea viscosa* leaves has unveiled the presence of diverse secondary metabolites, including alkaloids, terpenoids, phenols, saponin, and carbohydrates. The quantitative analysis identified tannins, terpenoids, alkaloids, and phenols, emphasizing the potential medicinal significance of this plant. Further characterization through FT-IR and GC-MS analyses revealed specific functional groups and more than 20 compounds in the methanolic leaf extract. These findings lay the groundwork for future pharmaceutical exploration, suggesting *Dodonaea viscosa* as a source of therapeutically potent compounds for potential use in medicinal applications. Continued research on this plant may lead to the development of natural products as effective medicines in the future.

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