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A Review: Antioxidant and Antidiabitic Properties of Spermadictyon Suaveolens

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Abstract: ***Finding new and safer treatments for diabetes is very important. Natural substances, especially those that act as antioxidants and block certain sugar-digesting enzymes, are becoming more popular for managing diabetes. Current diabetes medicines can have side effects, especially with long-term use, so researchers are looking at natural options like plant-based compounds.***

These natural substances can help lower blood sugar levels after meals by slowing down the breakdown of carbohydrates. They also help reduce damage caused by harmful molecules called free radicals. This article looks at recent research on natural compounds that have both antioxidant effects and the ability to block sugar- digesting enzymes, which could lead to safer and more effective treatments for diabetes.

This study was done to see if an alcohol-based extract from the roots of S. suaveolens (EESS) can help fight diabetes, high cholesterol, and harmful substances in the body (antioxidants). Diabetes was caused in rats using a chemical called streptozotocin (STZ), and then the extract was given to see how well it worked. The extract was also tested in the lab to check its ability to reduce blood sugar and fight harmful free radicals.

The plant Spermadictyon suaveolens is used by tribes to help with bone pain, healing wounds, diabetes, snake and scorpion bites, viral infections, and to make charcoal for gunpowder. Scientists have studied the leaves, flowers, and stems and found that they have chemicals that can fight germs, malaria, cancer, inflammation, and insects. But the roots and bark of this plant have not been studied much yet. The plant has many natural chemicals in its stem and roots. These chemicals can help protect the body from damage and may have other health benefits .

Keywords: Spermadictyon suaveolens, antioxidant property, antidiabetic properties,phytochemical analysis, hydroalcoholic plant extract, GC-MS analysis, EC50.

I. INTRODUCTION

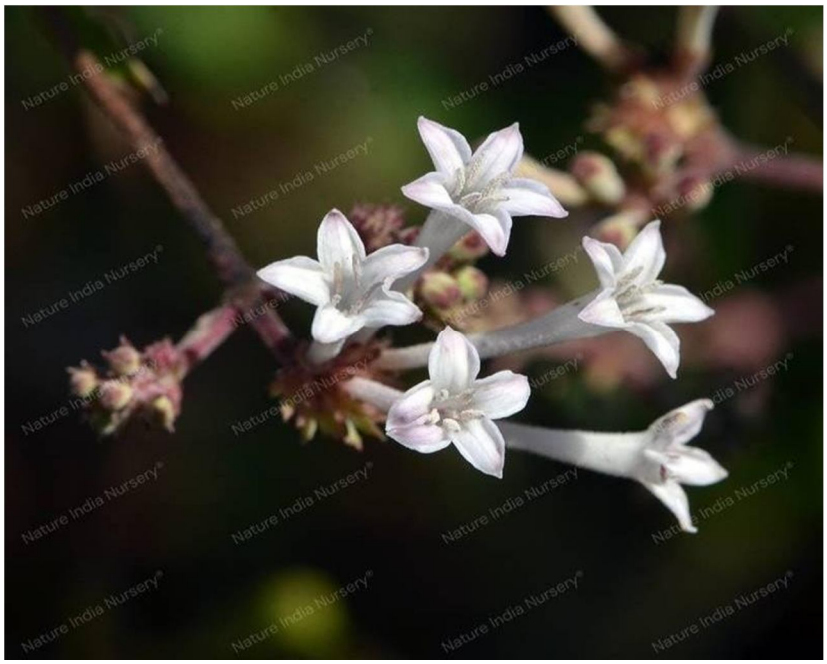
People around the world are looking for natural, plant-based medicines to help treat and prevent different diseases. As more people become concerned about the side effects and problems caused by chemical drugs, interest in herbal remedies is growing. Traditional knowledge about medicinal plants is very useful in finding new and effective treatments made from plants.One such plant is Spermadictyon suaveolens Roxb.

It has been used in traditional medicine for many years, but modern research on its healing properties is still limited. Studying this plant more closely could help scientists create new natural medicines that are both safe and effective, using a mix of old knowledge and modern science.

Diabetes is a serious health problem, scientists around the world are trying to find natural and safe ways to treat it. In many growing and developing countries, more than 80% of people use herbal medicines to treat their illnesses. Natural treatments for diabetes are becoming popular because regular medicines can be expensive and sometimes cause side effects . Diabetes mellitus is a disease that affects how the body uses sugar and energy from food . Many studies have found that diabetes is linked to something called oxidative stress. This happens when the body makes too many harmful molecules called ROS (like superoxide, hydroxyl, and hydrogen peroxide).These harmful molecules can stop insulin from working properly and make it harder for the body to control blood sugar. When the body cannot remove these molecules fast enough, they start damaging important parts of the cells like proteins, fats, and DNA. This damage can make cells stop working and even cause them to die.The body uses antioxidants to remove these harmful molecules. But man- made antioxidants can be unsafe. Antioxidants that come from plants are saferand better for the body

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A. Antioxidant Properties

1) Advantages

- Neutralizes Free Radicals.
- Rich Phytochemical Profile. 3.Hepatoprotective Potential.

2) Disadvantages

- Variability
- Lack of human Trials.

B. Antidiabetic Propertis

1) Advantages

- Improve Glucose Tolerance.
- Enzyme Inhibition
- Hyperlipidemic management
- Enhanced Glucose Uptake

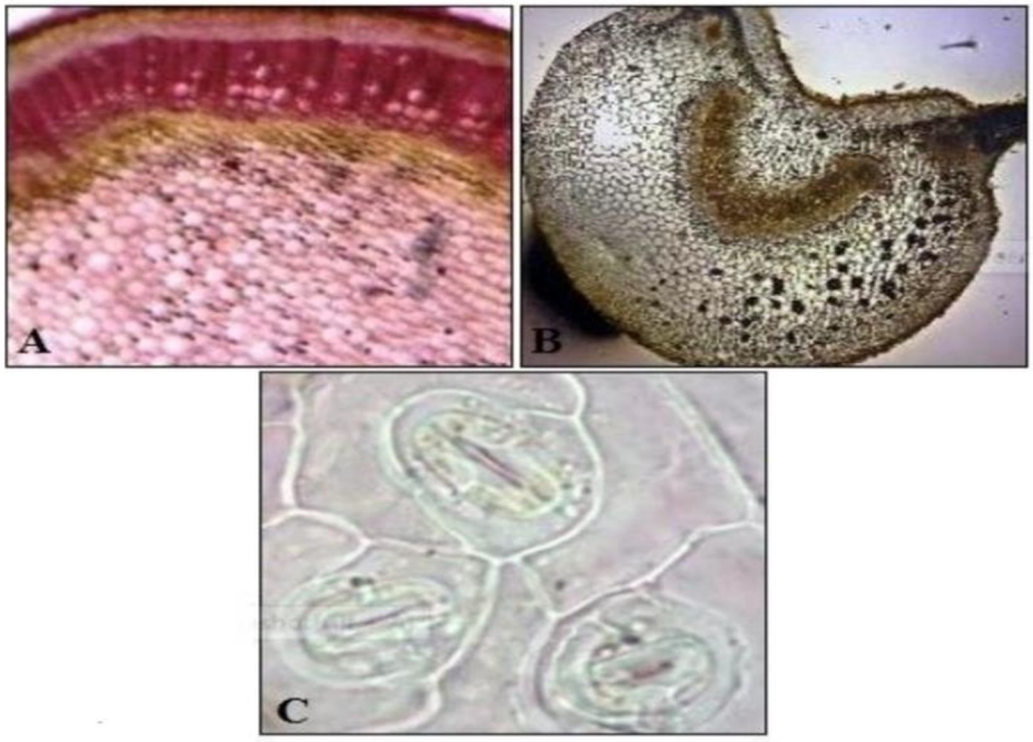
2) Disadvantages

- Limited Research On Active Principles
- Potential For Drug Intraction
- safety And Dosage Unknown

C. Microscopic Study of Spermadicyton Suaveolens

Looking at plant parts under a microscope helps check the quality of herbal medicines. This includes thin slices (cross-sections) of the root, bark, and leaves, which can be studied with or without special stains to highlight details . When the stem and leaf of Spermadicyton suaveolens were viewed under a microscope, a type of opening on the leaf surface called anomocytic stomata was seen (Figure 2). This is interesting because most plants in the Rubiaceae family usually have a different kind, called paracytic stomata. This difference may help identify and classify the plant.

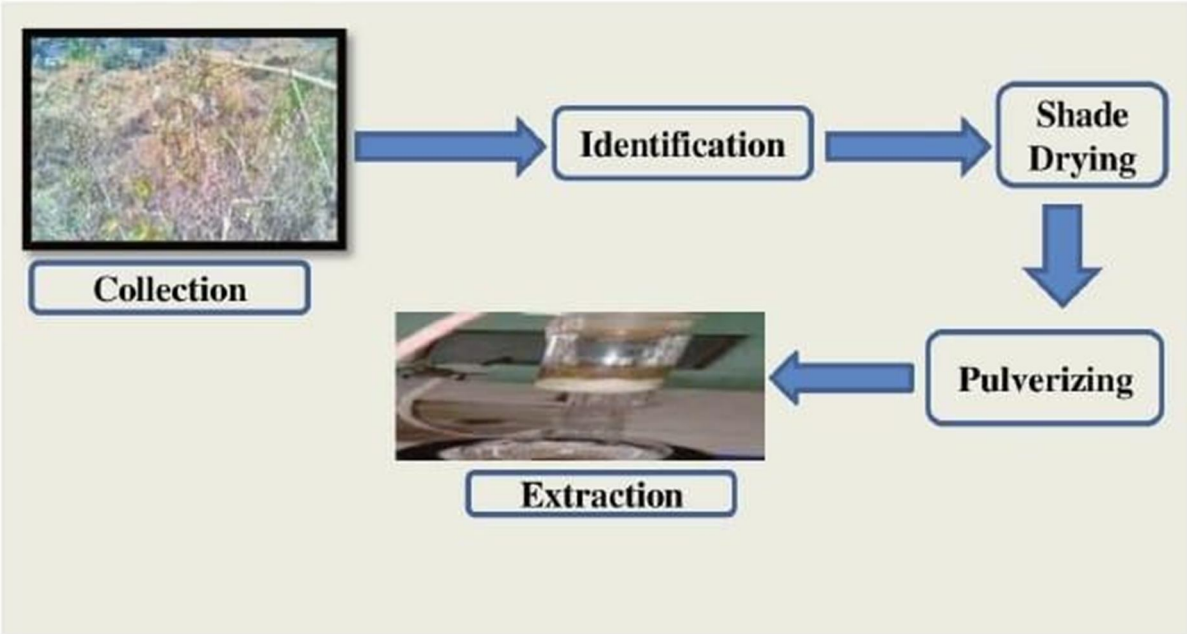
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II. MATERIALS AND METHODS

A. Collection and Identification of Plant Material

The roots of Spermadicyton suaveolons were collected and given to a trained plant expert for proper identification. After confirmation, the roots were cut into small pieces and dried in the shade. Once dried, they were ground into a fine powder using a Rising Automatic DP Pulverizer. The powder was then passed through a 40-mesh sieve to make sure it was evenly fine. Finally, powder was stored in an airtight container until it was needed for further use.



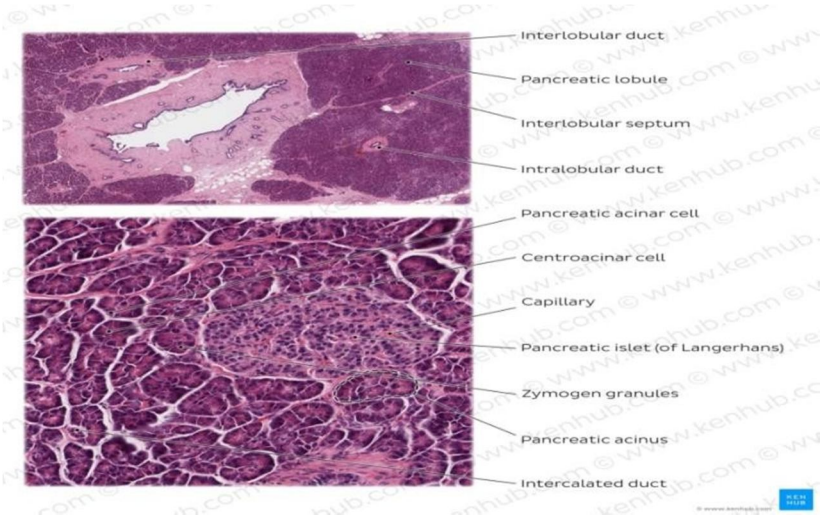
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B. In-vitro Antidiabetic Activity

Diabetes is a disease where the body has trouble using sugar properly. It can last a long time and cause many health problems.
There aren't many medicines that work well in treating diabetes, and most of them work in the same way. So, scientists are trying to find new medicines that can treat diabetes in better and different ways .

C. Protective Effect on the Pancreas

The pancreas was studied under a microscope .In healthy rats, the pancreas looked normal and well-organized. But in diabetic rats, there was damage. The part of the pancreas called the islets was harmed because some cells had died. The β-cells, which make insulin, were also reduced or destroyed.When diabetic rats were given a medicine called glibenclamide, their pancreas started to heal, and the islets looked more normal again.



D. Pancreas Histopathology

This section describes what the pancreas looked like under a microscope in different groups of rats:

1) Normal Control: The healthy rat's pancreas looked normal. The islets of Langerhans (the part that makes insulin) were clearly seen with round, pale β-cells (insulin-producing cells) in the center.
2) Diabetic Control: In diabetic rats that didn't get any treatment, the islets were smaller and the cells were damaged or dying. The cell nuclei looked dark and broken down (a sign of cell death).
3) Standard Drug Treated: Rats treated with the diabetes medicine glibenclamide had normal-looking islets and β-cells, similar to healthy rats.
4) Treated with 200 mg/kg Ethanolic Extract: Diabetic rats treated with 200 mg/kg of the plant extract had normal islets and β-cells that looked healthy and well-shaped.
5) Treated with 400 mg/kg Ethanolic Extract: Rats treated with 400 mg/kg of the extract also had normal-sized islets, but there was some damage to the β-cells in the center.

E. Antioxidant Test (DPPH Method)

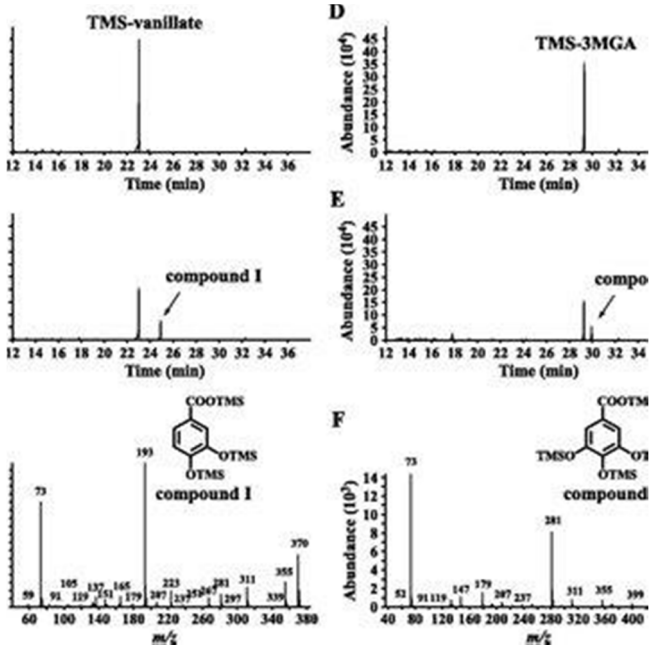
Scientists tested how well the four plant extracts (AESS, EESS, CESS, and PESS) can fight harmful molecules called free radicals. They used a lab method called the DPPH test.
Here's what they did:
They made a special purple-colored solution using a chemical called DPPH mixed with methanol (a type of alcohol).
The plant extracts were first mixed with a liquid called DMSO to help them dissolve.
Then, they mixed 2 mL of the DPPH solution with 2 mL of each plant extract at different strengths (from 100 to 1000 micrograms per milliliter).
This test helps show how strong the plant extracts are at removing or "scavenging" free radicals, which helps protect the body from damage.

The percentage inhibition was determined using the equation :-

$$\% \text{ Inhibition} = \frac{\text{Absorbance}_{\text{Control}} - \text{Absorbance}_{\text{Test}}}{\text{Absorbance}_{\text{Control}}} \times 100$$

F. GC-MS Analysis

The chemical compounds found in the methanolic and isopropyl alcohol extracts of the leaves, stems, and roots of S. suaveolens have been identified and listed. Details such as peak area, retention time, relative peak percentage, molecular formula, and compound names are provided in Tables 4–9. The GC-MS chromatograms (graphs showing the chemical profile) of both types of extracts are also shown. The isopropyl alcohol extract of S. suaveolens leaves showed 8 main peaks in the chromatogram. The mass spectra of these peaks were compared with the NIST library, and the matches are shown in Two of the compounds identified are tridecanoic acid and n-hexadecanoic acid (also called palmitic acid, with the formula $C_{16}H_{32}O_2$). These were found at retention times of 22.23 and 25.83, with relative peak areas of 12.393% and 34.244%, respectively. The chromatogram of the methanolic root extract showed 8 noticeable peaks with more than 3% peak area (Table 8; Fig. 3). The mass spectra of these peaks were compared with the NIST library, and the matched compounds are listed in Figure 8. The two compounds with the highest peak areas are n-hexadecanoic acid (also called palmitic acid, $C_{16}H_{32}O_2$), with a retention time of 26.12 minutes and a relative area of 23.233%, and hexadecanoic acid, methyl ester ($C_{17}H_{34}O_2$), with a retention time of 24.94 minutes and a relative area of 17.820%.

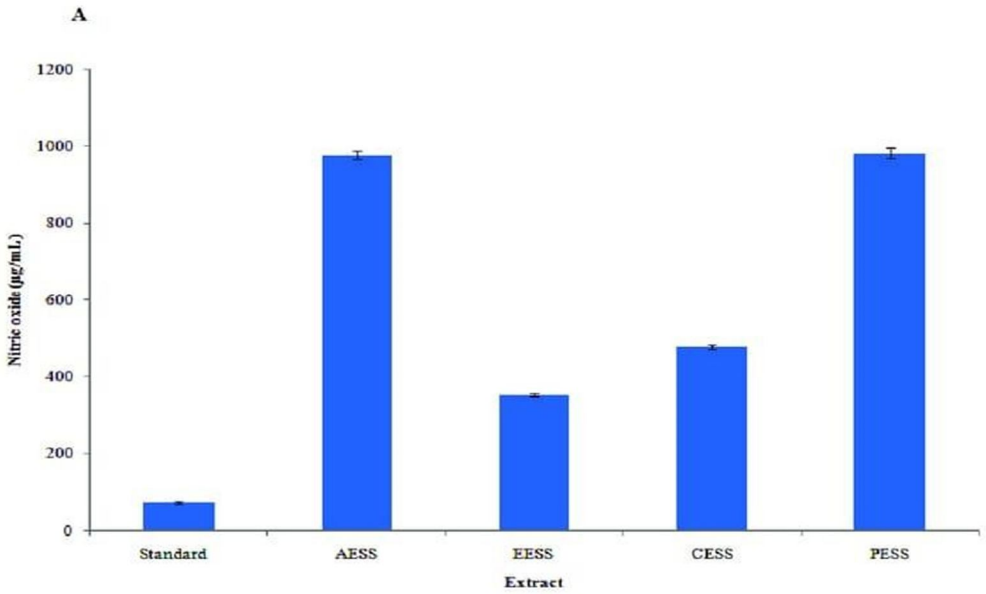


G. In vitro Antioxidant

Nitric oxide scavenging test :-

Nitric oxide is a very reactive substance. When it comes in contact with oxygen, it forms stable compounds. Nitric oxide reacts with oxygen to form stable compounds called nitrates and nitrites. The Griess reagent was used to measure them. The amount of nitrous acid goes down because the test compounds can remove (or "scavenge") these reactive molecules.The antioxidant power of the extracts is shown in Figure 2A. The results showed that as the concentration increased, the antioxidant activity also increased. The EESS extract was the most effective (354.69 ± 0.92 µg/mL) at removing free nitrite radicals compared to the other extracts.

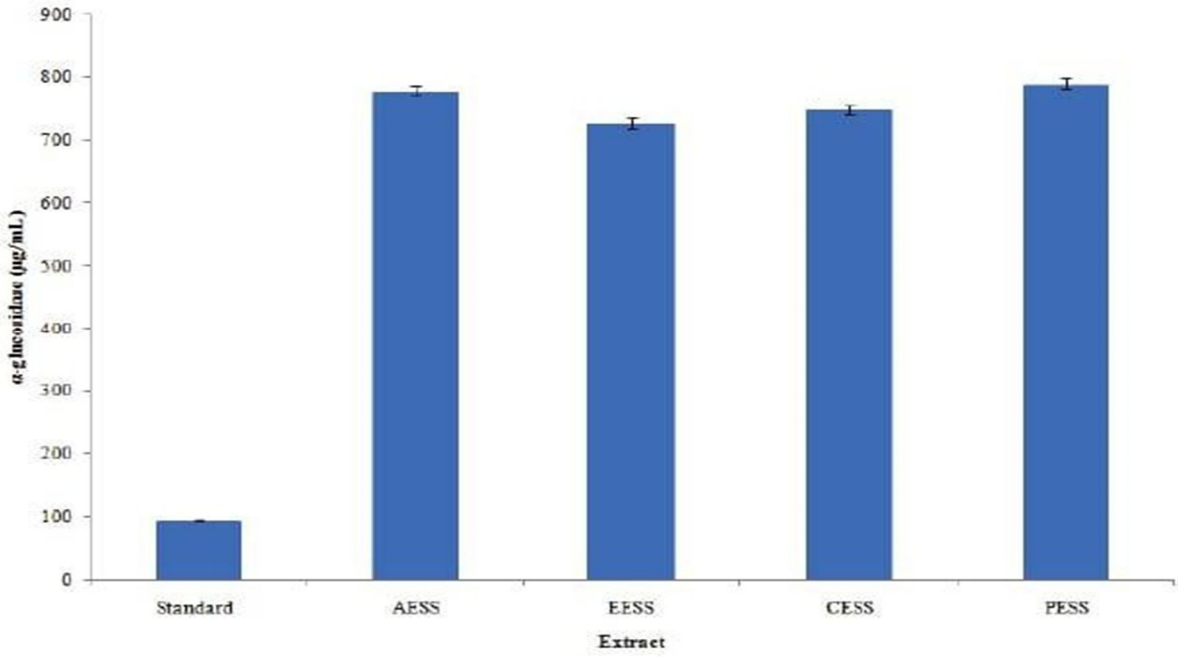
However, EESS was still less effective than the standard (73.06 ± 0.42 µg/mL).



H. In vitro antidiabetic activity

Diabetes happens when the body can't properly control blood sugar, and this can cause long-term health problems. Since there are only a few medicines available, we need to find new drugs that can help in different ways.

- α-Glucosidase Activity: The SS extracts were tested to see how well they could block α-glucosidase. The EESS extract worked the best among the plant extracts, but it was still not as strong as the standard drug acarbose.
- Acute Toxicity Study: EESS was safe when given by mouth at a high dose of 2 g/kg. No animals died after 14 days. For the study, smaller doses of 200 mg/kg and 400 mg/kg were used.The animals grew normally and acted normally, showing that EESS is safe.



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III. METHODOLOGY

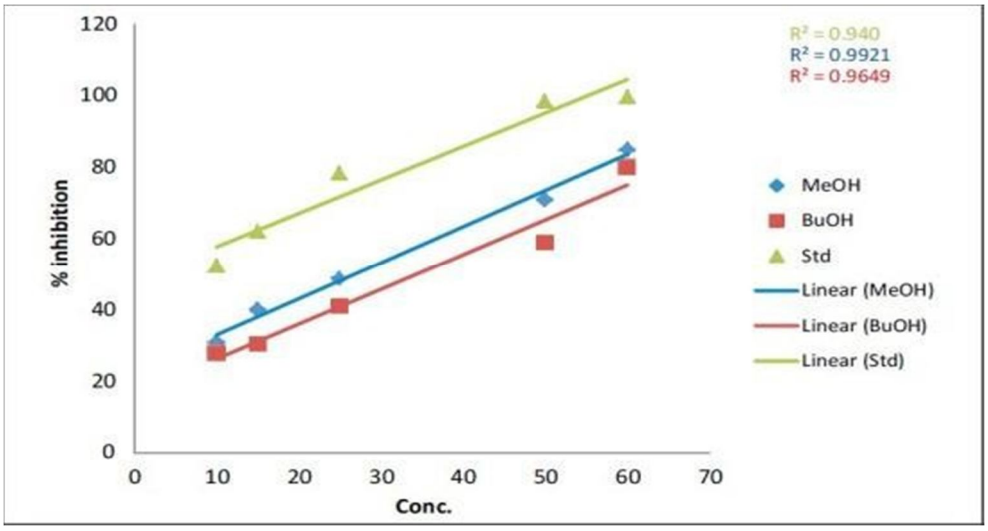
1) Preparing the DPPH mixture: Mix 1.5 mL of DPPH solution with 1.5 mL of ethanol.Measure its absorbance (how much light it absorbs) at 517 nm. This is the starting point
2) Adding the plant sample or standard: Add 1.5 mL of the plant extract (leaf, stem, or root) or a standard antioxidant to the DPPH mixture.Adjust the total volume to 3 mL with ethanol.
3) Reaction time: Let the mixture sit in the dark for 15 minutes so the reaction can happen.
4) Measuring the absorbance: After 15 minutes, measure how much light the mixture absorbs at 517 nm.
5) Controls and blanks: Control: Only DPPH and ethanol, no plant extract, to show the maximum absorbance.
6) Blank: Plant extract and ethanol, but no DPPH, to correct for any color the plant extract already has.

IV. RESUIT

A. *Extraction*

Antioxidant Activity :-

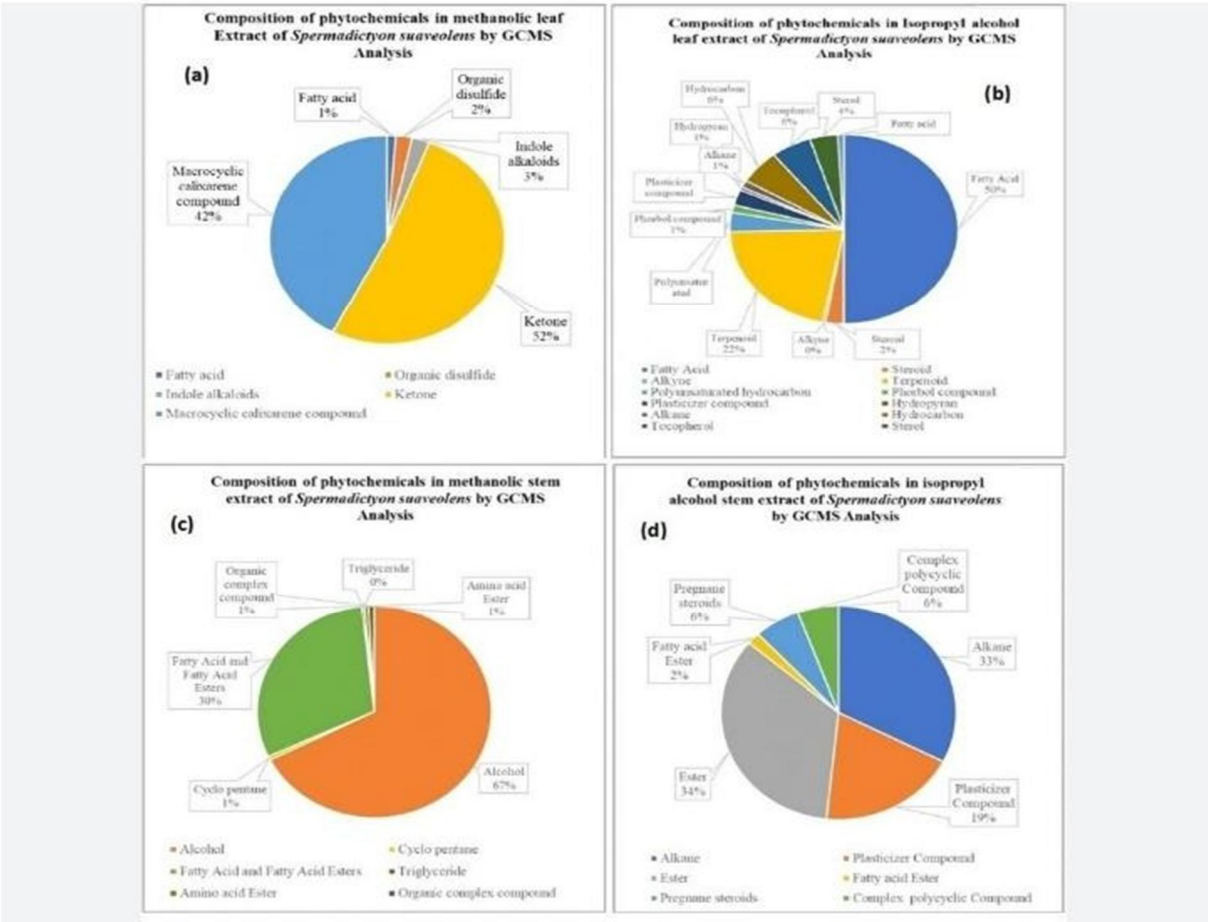
1) Repeating the test: Each plant sample (leaf, stem, root) was tested three times with DPPH.The average result was used for each plant part.
2) Finding EC50 (strength of the antioxidant): EC50 is the concentration of extract needed to reduce 50% of the DPPH.%RSA was plotted against the logarithm of extract concentration.The concentration that gave 50% scavenging was converted back from the log scale to the actual concentration . EC50 was calculated for ascorbic acid (standard) and for the leaf, stem, and root extracts.Test each sample 3 times → take the average.See how much the extract can "neutralize" DPPH → calculate %RSA.Figure out the amount needed to reduce DPPH by half → that's EC50.



V. CONCLUSION

In this study, we used a method called GC-MS to identify the natural chemical compounds in the leaves, stems, and roots of S. suaveolens. We tested extracts made using methanol and isopropyl alcohol. A total of 69 chemical compounds were found in these extracts. Some of the key compounds identified—such as 3,5-Dihydroxy-6-methyl-2,3-dihydro-4H-pyran-4- one, Squalene, Phytol, Vitamin E, and others—are likely responsible for the plant's antioxidant properties Finding new medicines to treat diabetes is very important to make treatment safer and more effective. Natural substances that act as antioxidants and block certain enzymes that break down carbohydrates are becoming more popular in managing diabetes. However, there isn't much scientific information available about the health benefits of the root extract of Spermadicyton suaveolens. That's why we decided to study how well this plant extract can fight harmful molecules (antioxidant activity) and block the enzyme α-amylase, which helps digest carbohydrates.

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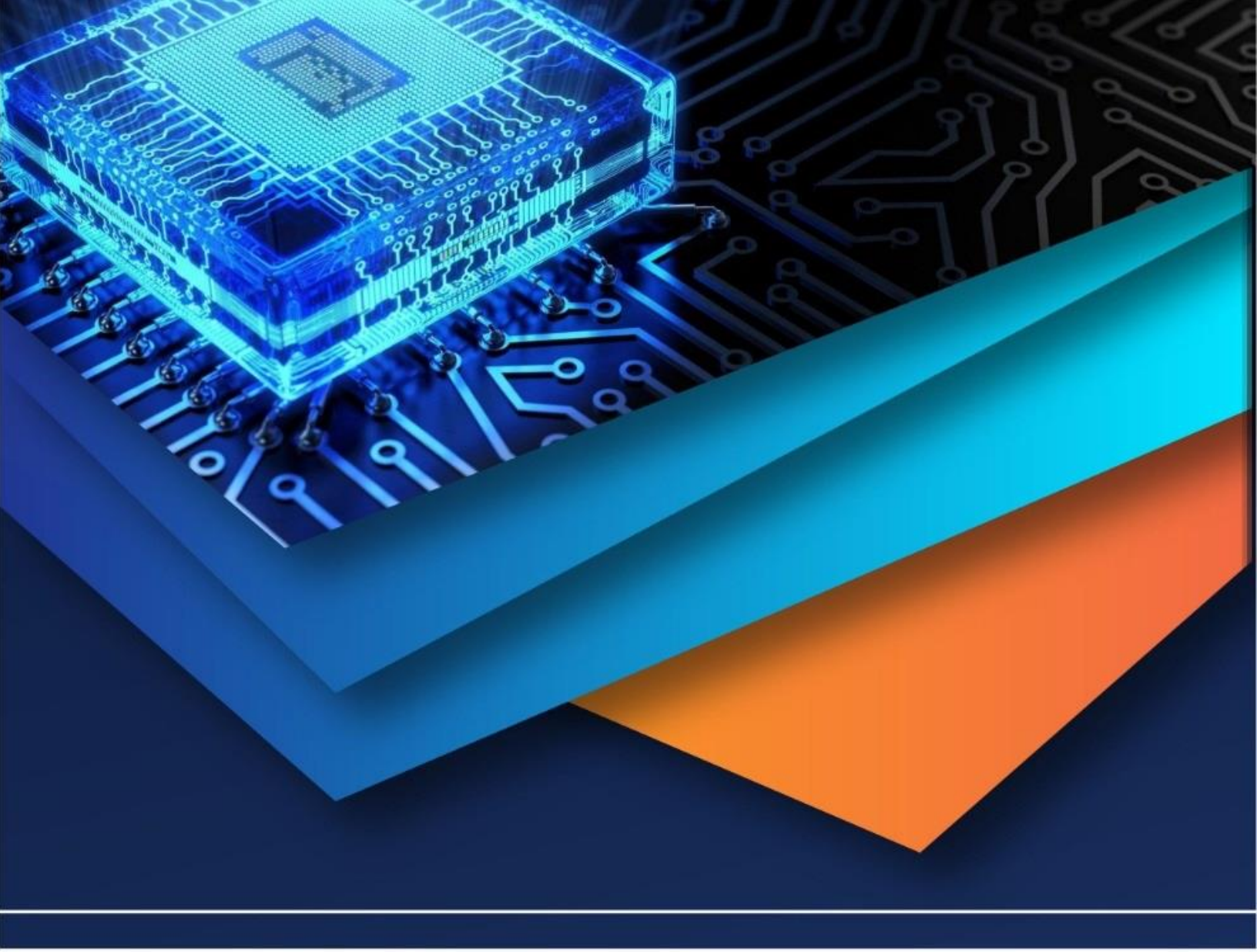
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