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THERAPEUTIC EFFICACY FROM THE GREEN SYNTHESIZED SILVER NANOPARTICLES BY USING ALOE VERA

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ABSTRACT

Aloe vera is one of the oldest known medicinal plants. The medical properties of *A. vera* gel and extracts have scientifically proven clinical evidence that is related in the literature to wound healing, anti-ulcer effects, anti-inflammatory effects, antioxidant activity, anticancer activity, antidiabetic effects, antihyperlipdemic activity, effectiveness in treating gastrointestinal disorders (e.g., constipation, dysentery and diarrhea), lowering low density lipoprotein (LDL), increasing high density lipoprotein (HDL), decreasing blood glucose level, treating genital herpes and psoriasis. Green synthesized silver nanoparticles by using aloe vera may exhibit enhanced therapeutic properties compared to nanoparticles synthesized using chemical methods or other plant extracts. The presence of bioactive compounds in aloe vera extracts can impart additional therapeutic effects to the nanoparticles, such as anti-diabetic, antioxidant, anti-inflammatory, and wound-healing activities, making them suitable for a wide range of biomedical applications. Hence the objective of this present study is to estimate the anti-oxidant, anti-diabetic and anti-inflammatory activity in the green synthesized silver nanoparticles by using aloe vera. Antioxidant activity were carried out by DPPH method. In-vitro ant-diabetic and anti-inflammatory activities were identified from the green synthesized silver nanoparticles by using aloe vera.

Keyboard: Medicinal plants, anti-diabetic, anti-inflammatory, therapeutic, anti-oxidant, nanoparticles

I INTRODUCTION:

Medicinal plant is *Aloe barbadensis* Miller, commonly known as Aloe Vera (Family: *Aloeaceae*). It has been used for centuries for Its health, beauty, medicinal and skin care properties. There are perennial succulents or xerophytes which are Around 60 to 100 cm tall. Aloe Vera has green flesh. Leaves covered by a thick cuticle or rind and an inner Clear pulp (gel) (Hullatti *et al.,* 2015). Aloe Vera has been reported to have significant therapeutic effects such as anti-diabetic, anti-oxidant, anti-cancer, anti-inflammatory, anti-bacterial, anti-fungal properties and these have been attributed to synergistic effects of numerous bioactive compounds in Aloe Vera (Hullatti *et al.,* 2015)

Aloe vera has been studied for its potential anti-inflammatory properties. Its gel contains compounds like acemannan, which may help reduce inflammation by inhibiting the production of inflammatory mediators. World Health Organization (WHO) endorses the evaluation of the potential of plants as effective therapeutic agents, especially in areas where there is a Lack of safe modern drug (Rajendran *et al.,* 2009)

Silver nanoparticles are increasingly being explored for biomedical applications such as drug delivery, imaging, and diagnostics. It's crucial to evaluate their biocompatibility, including their potential to cause hemolysis (Rajendran *et al.,* 2009).

Medicinal plants have been reported to have anti-oxidant activities for overcoming the oxidative stress and cell damage caused due to diabetes mellitus (Karpagam, Rajendran et al.,2016) The usage of herbal and natural drug products for the treatment of diabetes is growing worldwide, with the ancient Indian literature reports suggesting more than 800 plants having Anti-diabetic activities (Debnath *et al.,* 2017)

Silver nanoparticles derived from aloe vera, with their antioxidant, anti-inflammatory, and wound-healing properties, may offer potential therapeutic benefits in managing diabetic complications and promoting overall health and well-being in diabetic individuals (*Debnath et al., 2017*)

Antioxidants are micronutrients that have gained importance in recent years due to their ability to neutralize free radicals or their actions (*Gupta et al.,* 2014)

Silver nanoparticles have gained attention in biomedical research due to their antimicrobial properties and potential use in medical applications such as wound healing, drug delivery, and imaging. However, silver nanoparticles can also induce oxidative stress in cells due to their ability to generate reactive oxygen species (ROS) (*Gupta et al.,* 2014).

Thus the goal of this research is to determine the amount of anti-inflammatory, anti-diabetic and anti-oxidant activity in Aloe Vera. The present study is carried out by the following objectives:

- To determine the anti-inflammatory activity from the green synthesized silver nanoparticles by using Aloe Vera;

- To determine the Anti-diabetic activity from the green synthesized silver nanoparticles by using Aloe Vera;
- To determine the anti-oxidant activity from the green synthesized silver nanoparticles by using Aloe Vera and
- To evaluate and summarize the results.

II MATERIALS AND METHODS

Selection and collection of Aloe Vera:

Selection and collection of an aloe vera plant, should be looked for one that is in good condition and shows no signs of damage or disease. There should be no discoloration or dryness on the leaves, which should be firm, thick, and fleshy. Inspect the roots as well, which should be white and firm rather than brown or mushy. Before selecting an aloe vera plant.

Processing of Aloe Vera:

Maceration is an extraction procedure in which coarsely powdered drug material, either leaves or stem bark or root bark, is placed inside a container; the menstruum is poured on top until completely covered the drug material. The container is then closed and kept for at least three days. The content is stirred periodically, and if placed inside bottle it should be shaken time to time to ensure complete extraction. At the end of extraction, the micelle is separated from marc by filtration or decantation. Subsequently, the micelle is then separated from the menstruum by evaporation in an oven or on top of water bath. This method is convenient and very suitable for thermolabile plant material (Ingle et al., 2017). Through this extraction method Aloe Vera inflorescence extract is taken.

In vitro Anti-Inflammatory Activity :

Heat-Induced Hemolysis:

The method had been previously described by Shinde et al. (1999) and slightly modified and followed by Henneh et al. (2018). The reaction mixture (2 ml) consisted of 1.0 ml of 10% HRBC and 1 ml of various solvents plant extracts (1 mg/ml), which was added to each tube and gently mixed. The positive control consisted of 1.0 ml of HRBC and 1.0 ml of various concentrations of diclofenac sodium (10 to 50 µg/ml). The negative control consisted of 1.0 ml of 10% erythrocyte suspension and 1.0 ml of normal saline alone. The experiment was performed in triplicates. The resulting solution was heated at 56° C for 30 minutes and cooled to room temperature and centrifuged at 2500 rpm for 10 minutes. The supernatant was collected and the absorbance of each solution was measured spectrophotometrically (UVmini 1240, Shimadzu) at 560 nm as an

indicator of the degree of haemolysis. The percentage inhibition of hemolysis was calculated using the formula.

Percentage of inhibition = Ac – At

---------- X 100

Ac

Where 'Ac' is absorbance of control and 'At' is absorbance of the test.

In vitro anti-diabetic activity:

Inhibition assay for α-amylase activity:

A-amylase was premixed with extract at various concentrations (50-250 µg/mL) and starch as a substrate was added (0.5% starch solution) to start the reaction. The reaction was carried out at 37°C for 5 min and terminated by addition of 2 mL of DNS (3,5- dinitrosalicylic acid) reagent. The reaction mixture was heated for 15 min at 100°C and diluted with 10 mL of distilled water in an ice bath (Miller, 1959).

α -amylase activity was determined by measuring spectrum at 540 nm. The IC50 value was defined as the concentration of α-amylase inhibitor to inhibit 50% of its activity under the assay conditions.

Percentage of inhibition = -- Ac – At X 100/ Ac

Where 'Ac' is absorbance of control and 'At' is absorbance of the test.

Estimation of Antioxidant activity of aloe vera:

Antioxidants are neutralizing chemicals that minimize oxidative damaging to biological processes by giving free radicals electrons and passing them off as harmless (Shantabi et al., 2014). Antioxidant compounds can scavenge free radicals and increase shelf life by retarding the process of lipid peroxidation, which is one of the major reasons for deterioration of food and pharmaceutical products during processing and storage (Halliwell 1997). Hence antioxidant activity of the fresh and cabinet dried Cocos nucifera inflorescence was measured by DPPH radical scavenging assay (DPPH).

2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay of aloe vera:

The DPPH radical scavenging test is a widely employed technique that provides the initial means of assessing antioxidant activity. The test is ET-based, and the HAT mechanism is really a minor reaction pathway (Prior et al., 2005). The deep purple chromogen radical DPPH is stable. It can be obtained commercially and doesn't have to be created before the test.

The DPPH scavenging test relies on antioxidants' ability to donate electrons in order to neutralize DPPH radicals. The DPPH color changes during the reaction, which can be seen at 517 nm, and this discoloration serves as a gauge for the effectiveness of the antioxidants.

100 µL of leaf extract and 3 mL of DPPH working solutions were mixed together in a test tube. Three milli liters of solution containing DPPH in 100 µL of methanol is often given as a standard. After that, the tubes

were kept in complete darkness for 30 min. The absorbance was therefore determined at 517 nm.

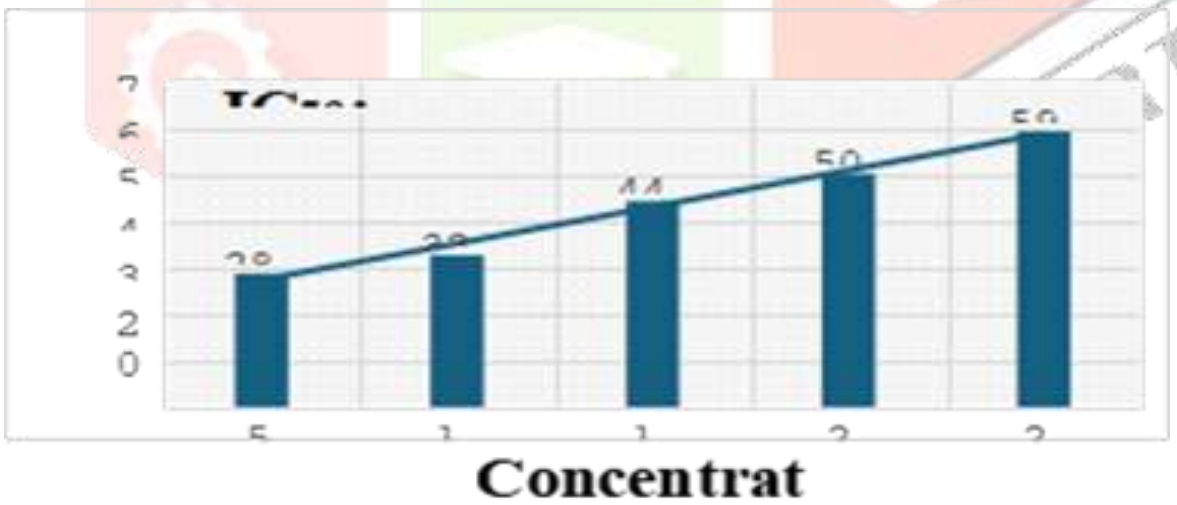
Scavenging Activity = Absorbance of the control – Absorbance of the sample × 100 % Absorbance of the control

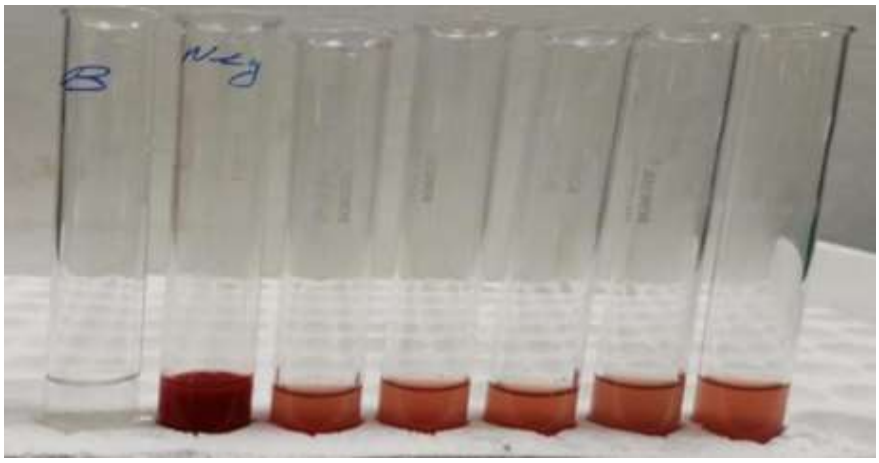
III RESULT

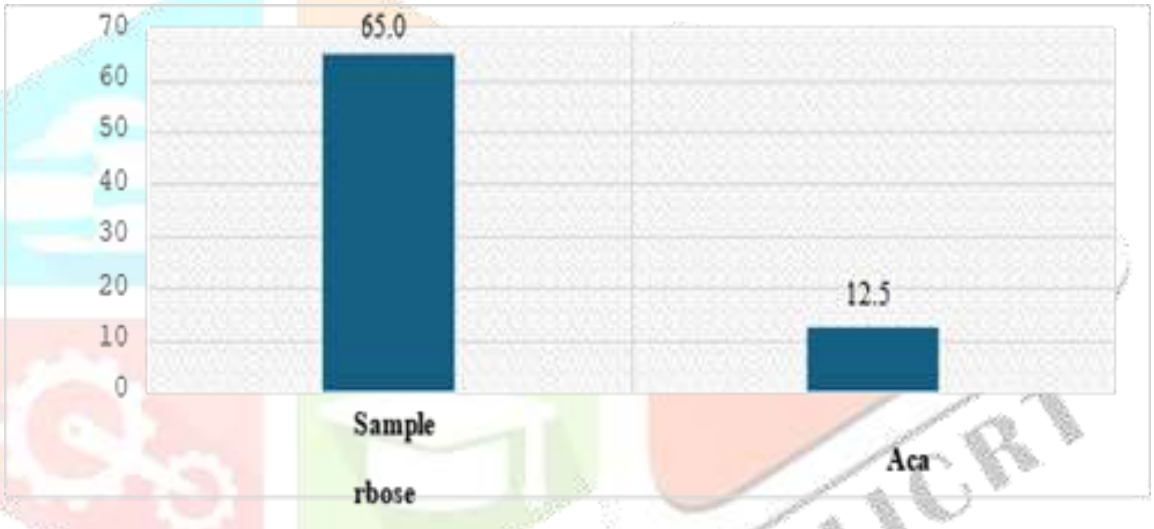
In vitro Anti-Inflammatory Activity

Table 1: Heat-Induced Hemolysis of Sample

Extracts	% of Inhibition		% Scavenging activity IC_{50} (µg/mL)
Sample	50µl	32.01	74.74
	100µl	36.03	
	150µl	40.39	
	200µl	47.97	
	250µl	53.38	







In vitro Anti- Diabetic Activity

Table 2: Inhibition assay for α-amylase activity of Sample

Extracts	% of Inhibition		% Scavenging activity IC_{50} (µg/mL)
Sample	50µl	28.77	65.02
	100µl	32.76	
	150µl	44.27	
	200µl	50.16	
	250µl	59.17	

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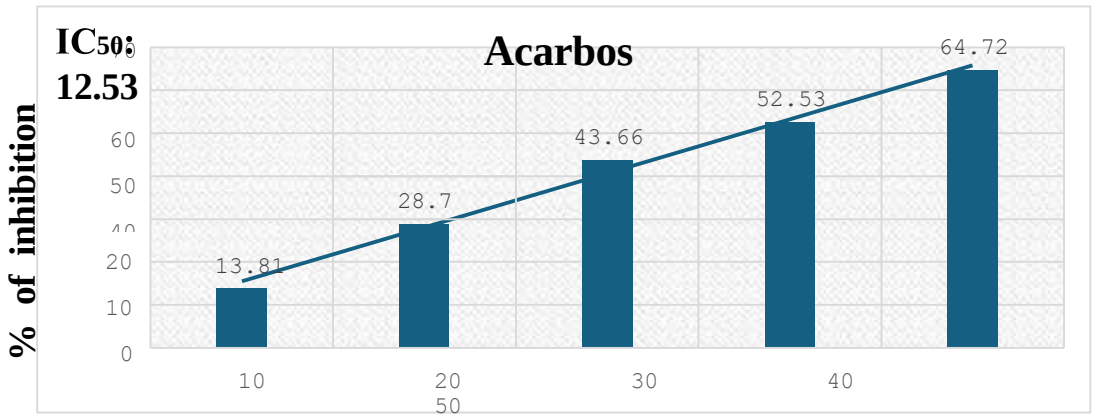

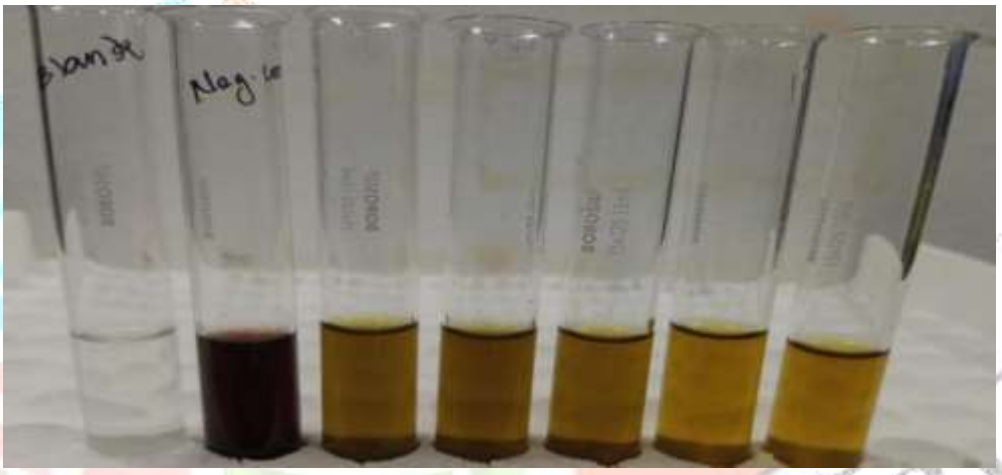

In vitro Anti- oxidant activity: DPPH activity of Sample

Table 3: DPPH activity of Sample

Extracts	% of Inhibition		% Scavenging activity IC_{50} (µg/mL)
Sample	50µl	11.25	13.57
	100µl	20.27	
	150µl	37.95	
	200µl	48.77	
	250µl	62.04	

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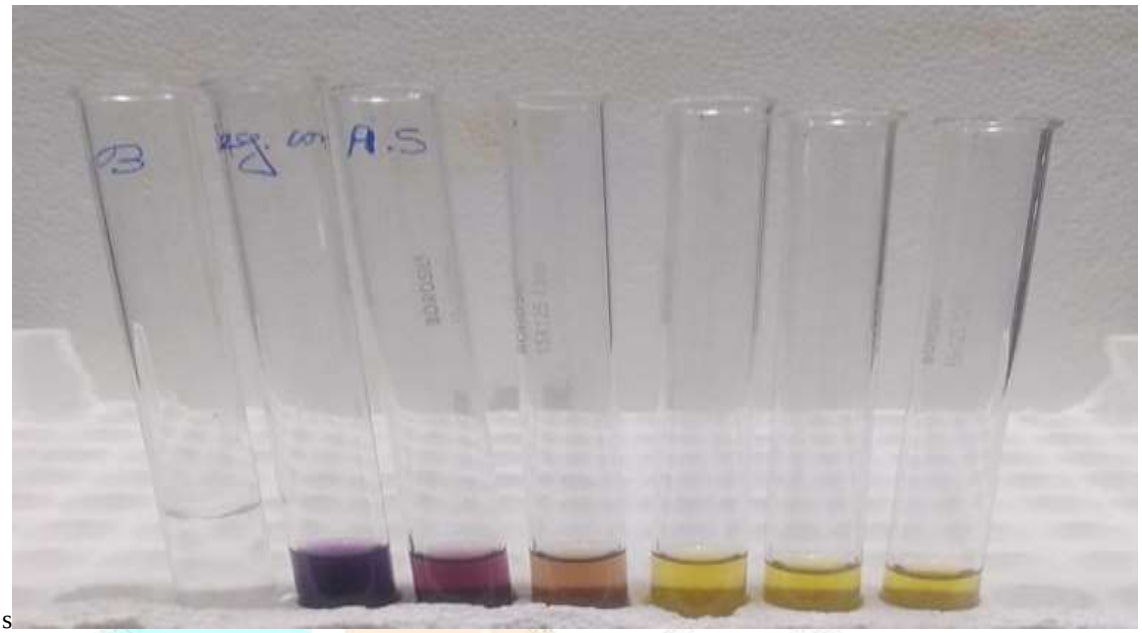

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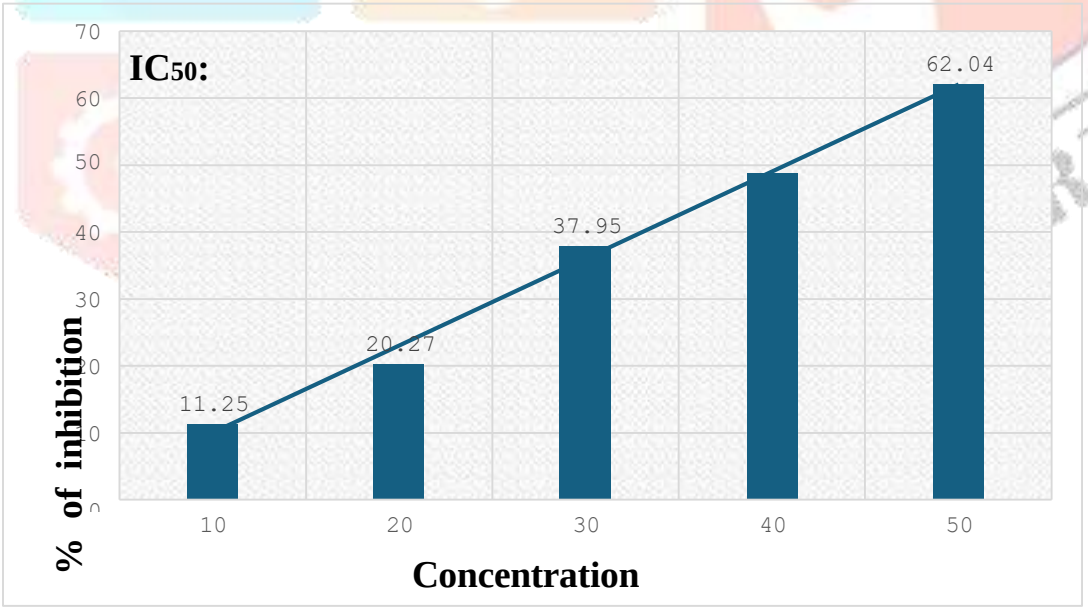

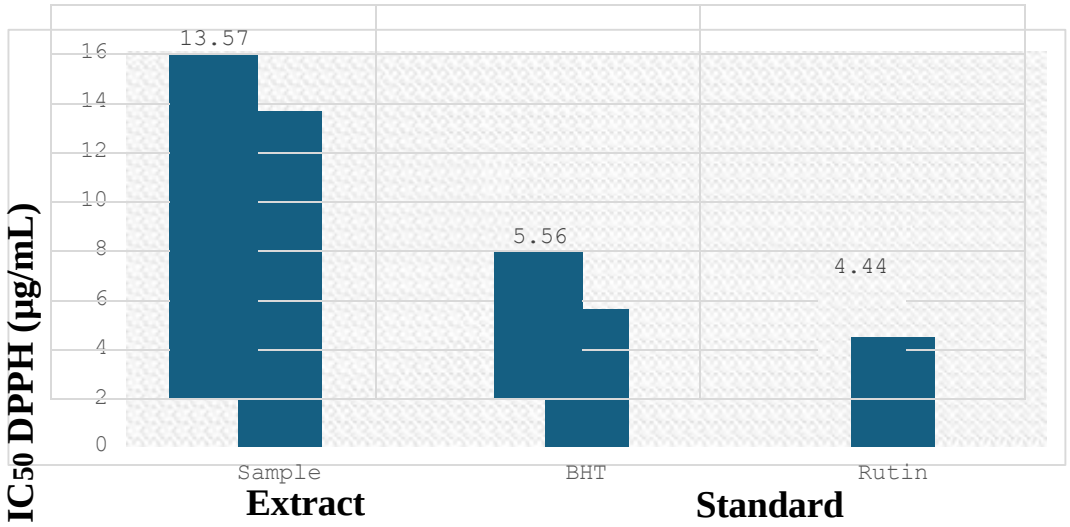

IV DISCUSSION

There are many methods to estimate the anti-inflammatory action , anti oxidant activity and anti-diabetic activity. The extract was effective in reducing the heat-induced hemolysis at various concentrations. The results showed that maximum inhibition was with aqueous extract of aloe vera with 53.38% at 250µl/ml . The results showed that the anti-diabetic effectively inhibited the α-amylase enzyme activity with a maximum inhibition of aloe Vera with 59.17% at a concentration of 250µg/ml. The results showed that the anti-oxidant with a maximum inhibition of aloe vera with 62.04% at a concentration of 250µg/ml.

V CONCLUSION

The synthesis of silver nanoparticles using Aloe vera, and their subsequent application as antioxidants, antidiabetic agents, and anti-inflammatory agents, represents a promising avenue in biomedical research. Through various studies and experiments, it has been demonstrated that these nanoparticles exhibit significant potential in mitigating oxidative stress, managing diabetes, and reducing inflammation.

In conclusion, the green synthesis of silver nanoparticles utilizing Aloe vera offers a sustainable and eco-friendly approach that harnesses the inherent properties of natural resources. The multifaceted benefits of these nanoparticles underscore their importance in combating various health issues, including oxidative damage, diabetes, and inflammatory conditions. Further research and development in this field hold promise for the advancement of novel therapeutic interventions with broad applications in healthcare and medicine. Aloe vera offers eco-friendly approach to synthesizing nanoparticles. Chemical methods on producing silver nanoparticles has high-energy processes, leading to environmental concerns. Green synthesis of silver nanoparticles using aloe vera is mainly used in Antimicrobial coating, bio-compatibility, targeted drug delivery, enhanced drug stability, controlled drug release and diagnostic applications.

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