Journal of Chemical Health Risks
www.jchr.org
JCHR (2025) 15(3), 330-339 | ISSN:2251-6727

Free Radical Scavenging Activity and Anti-Inflammatory Activity of Camellia Sinensis Mediated Silver Nanoparticles Incorporated Hyaluronic Acid, Poly Vinyl Alcohol Nano Formulations - An in Vitro Study

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(Received: 16 March 2025 Revised: 20 April 2025 Accepted: 01 May2025)

KEYWORDS

Camellia Sinensis, silver nanoparticles, wound healing, ROS

ABSTRACT:

The study investigates the synergistic potential of a novel nanocomposite combining green tea extract, silver nanoparticles (AgNPs), poly vinyl alcohol (PVA) and hyaluronic acid (HA) for its antioxidant and anti-inflammatory properties. Green tea, rich in polyphenols, offers potent antioxidant and anti-inflammatory effects, while silver nanoparticles are renowned for their broad-spectrum antimicrobial activity. Hyaluronic acid, a biocompatible polymer, serves as a stabilizing and bioactive agent, enhancing the biocompatibility and efficacy of the nanocomposite. The synthesis of the green tea-AgNP-HA-PVA nanocomposite was optimized using a green synthesis approach, ensuring eco-friendliness and minimizing toxicity. Poly vinyl alcohol is a poly hydroxy polymer and chemically resistant emulsifier with good adhesion properties. Because of its membrane forming ability and hydrophilic qualities, poly vinyl alcohol is commonly used as a polymer. Comprehensive in vitro assays demonstrated significant antioxidant activity, as indicated by DPPH radical scavenging, along with notable anti-inflammatory effects in LPS-stimulated macrophage models. Additionally, the nanocomposite exhibited robust antimicrobial efficacy against common oral pathogens, including Streptococcus mutans and Candida albicans. These findings suggest that the green tea-AgNP-HA nanocomposite holds promise as a multifunctional therapeutic agent in the management of oral diseases, with potential applications in preventing and treating infections, reducing inflammation, and promoting tissue regeneration and wound heling. Further in vivo studies are recommended to explore its clinical efficacy and safety.

1. Introduction

A new era in health and illness management is promised by the growing body of information regarding free radicals and reactive oxygen species (ROS) in biology, which has led to a medical revolution. Ironically, oxygen—an element necessary for life—can be harmful to the human body in some circumstances. The majority of oxygen's potentially hazardous effects are brought on by the production and operation of certain chemical molecules called reactive oxygen species (ROS), which have a propensity to transfer oxygen to other substances(1).Nano Particles are in the nm size range, and the usage of nanomaterials in contemporary treatment is a rapidly growing area. It involves the expansion of materials in the range of nanometers or in the molecular range. The decrease in the size of a material to a nanoscale leads to a surge in surface area and surface area to volume ratio, which results in progressive physicochemical properties(2). Silver is a bactericidal agent which has been used for the treatment

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JCHR (2025) 15(3), 330-339 | ISSN:2251-6727

of wound diseases. For instance, silver nitrate is still used for the treatment of non- healing chronic disease. Dressing based on silver nanoparticles (AgNPs) does not lead to a complication, even when applied for a protracted period. Hyaluronic acid, a naturally occurring carbohydrate polymer, possesses excellent bioadhesive property, which is an excellent material mostly used in medicine and cosmetic industry. The combination of hyaluronic acid and AgNPs displays robust antibacterial activity, thus making it an appropriate element during wound covering. Metal nanoparticles as a single conjugate have been known to carry efficient properties for wound healing. As a natural carbohydrate polymer generally present in the extracellular matrix, HLA exhibits outstanding biocompatibility in comparison to synthetic polymers. It has been reported that HLA based bio mucoadhesive microparticles possess the enhanced bio mucoadhesive property in vitro and much longer pulmonary retention and reduced systemic exposure in vivo(3). And hydrogels formed by HLA can adhere well to the skin surface, enhance the skin hydration and improve drug permeation time. Therefore, it may be an interesting idea, that HLA can be used as an alternative matrix of nanocrystals-based hydrogel (NC-gel). There have been reports of green tea's health advantages for a wide range of conditions, including as liver disease, heart disease, and many cancers(3,4). A large number of green tea's health benefits are associated with its catechins, specifically (-)-epigallocatechin-3-gallate. Green tea catechins have also been studied in humans for the treatment of metabolic syndrome, which includes cardiovascular risk factors, type II diabetes, and obesity. Green tea consumption may offer defense against cancer and other chronic illnesses. The antioxidant activity of green tea polyphenols has been suggested as a possible mechanism for the action of green tea polyphenols that prevent cancer. In view of their remarkable antimicrobial properties, AgNPs have been used in various types of wound coverings, for instance, chitosan , poly(vinyl alcohol)/sodium alginate hydrogels and plasma-treated electrospun polycaprolactone scaffold .The wound coverings loaded with AgNPs developed from diverse biocom- patible polymers showed virtuous repressive activity against Staphylococcus aureus, E. coli, S.epidermidis, and Salmonella typhimurium. Artificial synthesis of NPs is limited due to the fact that it involves high costs, energy consumption and additional resources to dispose of toxic by-products(5). Therefore, the natural renewable sources such as plant extracts such as green tea which are employed in the reduction and stabilization of Ag ions in AgNPs. This study is to evaluate the antioxidant activity of the combination of green tea, hyaluronic acid and silver nanoparticles which would promote wound healing and surgical site infections.

The study of materials at extremely small scales, usually at the nanoscale level, is known as nanotechnology. The distinctive qualities of nanoparticles set them apart from their bulky counterparts.The change in the surface-to-volume ratio caused by the small size results in an increase in the biochemical and catalytic activity. Because of their easy synthesis, flexibility, plasticity, shape, and large surface area, silver nanoparticles stand out among other metallic nanoparticles and are the ones that have been studied the most(6). Silver nanoparticles should also be taken into consideration due to their low toxicity, high application in vitro and in vivo, and antibacterial activity. Silver nanoparticles have more antibacterial activity than pure silver metal because of their high surface-to-volume ratio and higher number of surface atoms. Because of their huge surface area, nanoparticles can easily connect or penetrate microbial cell walls, disrupting their permeability and making them porous, ultimately resulting in cell leakage. Because the nanoparticles bind to proteins that contain phosphorus and sulfur, they also cause damage to DNA and cause inactivation of proteins. An alternative mechanism posits that Ag^+ is released and interacts with various enzymes and proteins,thiol groups, ultimately disrupting the respiratory chain. Green tea has been shown to have beneficial effects against a variety of diseases such as cancer, obesity, diabetes, cardiovascular disease, and neurodegenerative diseases(7). Through cellular, animal, and human experiments, green tea and its major component, epigallocatechin-3-gallate (EGCG) have been demonstrated to have anti-inflammatory effects. Our previous findings have indicated that green tea and EGCG suppress the gene and/or protein expression of inflammatory cytokines and inflammation-related enzymes. Reactive oxygen species (ROS), which impede ATP synthesis and deactivate DNA replication, are another consequence of Ag^+ ions that lead to cell death. Hyaluronic acid, a naturally occurring carbohydrate polymer, possesses excellent bioadhesive properties, which is an excellent material mostly used in medicine

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JCHR (2025) 15(3), 330-339 | ISSN:2251-6727

and cosmetic industry. As a natural carbohydrate polymer generally present in the extracellular matrix, HLA exhibits outstanding biocompatibility in comparison to synthetic polymers(8). It has been reported that HLA based biomu- coadhesive microparticles possess the enhanced bio mucoadhesive property in vitro and much longer pulmonary retention and reduced systemic exposure in vivo . And hydrogels formed by HLA can adhere well to the skin surface, enhance the skin hydration and improve drug permeation time. Therefore, it may be an interesting idea, that HLA can be used as an alternative matrix of nanocrystals-based hydrogel (NC-gel).

In response to infections, the body exhibits inflammation as an immunological reaction. Redness, heat, swelling, pain, and even loss of function are the main signs of inflammation. They could have a shorter or longer duration and be acute or chronic. In the acute phase, inflammation is characterized by increased blood flow and vascular permeability along with the accumulation of fluid, leukocytes, and cytokines (inflammatory mediators). In the chronic phase, inflammation is differentiated by the start of particular cellular and humoral immune responses to pathogens at the site of tissue damage(4). Nowadays, cyclooxygenase (COX) enzymes (COX-1 and COX-2), which create prostaglandins, thromboxane, and other inflammatory mediators, are inhibited by steroids, nonsteroidal medications, and even some naturally occurring chemicals to reduce inflammation.

2. Materials and Methods

Green tea (AgNPs)

Preparation of Plant Extract

1 g of green tea powder was weighed and mixed with 100 mL of distilled water. The plant extract was kept in the heating mantle for boiling the extract with 50℃ for 15 - 20 mins. After the boiling extract was filtered using muslin cloth and the filtered extract was separated. The plant extract was used to synthesize nanoparticle solutions.

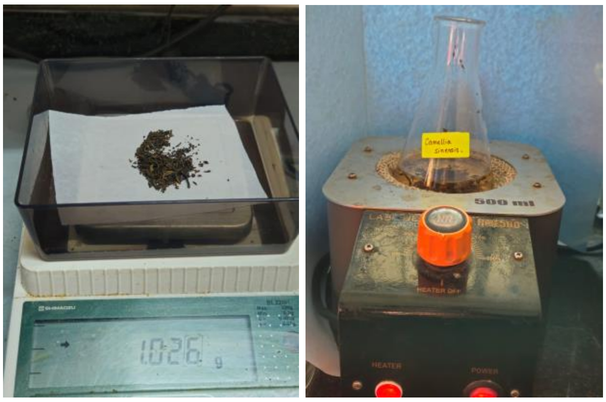

Figure 1: Depicts the weighting of green tea powder and placement in the orbital shaker.

Preparation of Silver Nanoparticles

2 mM of silver nitrate was weighed and mixed with 80 mL of distilled water. The silver nitrate solution was mixed with 20 mL of plant extract. Both the solutions were mixed and placed in the orbital shaker for 48 hrs in 400 rpm. The synthesized silver nanoparticle was centrifuged at 8000 rpm for 10 mins. After the completion of centrifugation, the pellet was collected in the separate sterile tubes for the use of further biomedical applications.

Figure 2: Depicts the preparation of green tea-Silver nanoparticles along with addition of hyaluronic acid and Poly vinyl Alcohol

Preparation of Hyaluronic acid + Poly vinyl Alcohol + AgNPs

500 mg of Hyaluronic acid and Polyvinyl Alcohol was weighed and mixed with 25 mL of distilled water. The solution was mixed and kept in the clear solution.

5 mL of hyaluronic acid solution,polyvinyl Alcohol and 5 mL of AgNPs was mixed well. The solution was placed in the sonicator for 30 mins. After the completion of the sonication process, the AgNPs and hyaluronic acid solution was kept in the orbital shaker for 24 hrs. The AgNPs and hyaluronic acid solution was used for further biomedical application.

Figure 3: Depicts the prepared Green tea - AgNP - Hyaluronic acid - Polyvinyl Alcohol.

3. Procedure

DPPH Radical Scavenging Assay:

A stock solution of 0.1 mM 2,2-diphenyl-1-picrylhydrazyl (DPPH) was prepared in methanol. For each assay, a fresh working solution was prepared by diluting the stock solution to a final concentration of 20 µM in methanol. Different concentrations (10, 20, 30 ,40, 50 µg/mL) of the C. Sinensis with hyaluronic acid mediated silver nanoparticles were added to 200 µL of the DPPH working solution in a 96-well plate. The plate was incubated in the dark for 10 minutes at room temperature. The absorbance was measured at 517 nm using a spectrophotometer. Methanol was used as a blank.

The percentage of DPPH scavenging activity was calculated using the following formula:

% DPPH Scavenging Activity = [(A Control – A Sample) / A control] × 100

where A control is the absorbance of the control (DPPH solution without the sample), and A sample is the absorbance of the sample (DPPH solution with the green synthesized silver nanoparticles). Ascorbic acid of the same different concentrations was used as standard.

Hydrogen Peroxide Radical Scavenging Assay

The H2O2 scavenging power of biosynthesized Ag-NPs was assessed. A 40 mM H2O2 solution was prepared in a phosphate buffer (pH 7.4). A solution of the test sample (AgNPs) and a standard sample of ascorbic acid at varying concentrations (10, 20, 30, 40, and 50 µg /mL) were individually added to 0.6 mL of H2O2 solution. After 10 min of incubation in a dark place, the absorbance of the reaction solution was observed spectrophotometrically at 230 nm. Vitamin C was used as standard.

The percentage of H2O2 scavenging activity was calculated using the following formula:

% inhibition= [Absorbance of control- Absorbance of sample] / Absorbance of control ×100

FRAP ASSAY:

REAGENTS FOR FRAP ASSAY:

a) Acetate buffer 300 mM pH 3.6: Weigh 3.1g sodium acetate trihydrate and add 16 ml of glacial acetic acid and make the volume to 1 L with distilled water.

b) TPTZ (2, 4, 6-tripyridyl s- triazine): (M.W. 312.34), 10 mM in 40 mM HCl (M.W. 36.46).

c) FeCl3. 6 H 2O: (M.W. 270.30), 20 mM. The working FRAP reagent was prepared by mixing a, b and c in the ratio of 10:1:1 just before testing. Standard was FeSO4. 7 H 2O: 0.1 - 1.5 mM in methanol. All the regents were prepared from Merck (Germany) company.

Procedure

2.3 mL of the FRAP reagent was mixed with 0.7 mL of the aqueous extracts at different concentrations (10, 20,

30, 40, and 50 µg /mL). The mixture was then incubated at 37ºC for 30 min in the dark. The absorbance was measured at 593 nm against a blank having all the reagents excluding the sample using a spectrophotometer. Increased absorbance of the reaction mixture indicates an increase of reduction capability. Samples were measured in triplicates. Ascorbic acid was used as the standard.

ABTS:

ABTS radical cation (ABTS+) was formed by reaction of 7.0 mM ABTS (50% ethanol) with 2.45 mM potassium persulfate (in distilled water). This reagent was stored under refrigeration for at least 24 h. Before use, the reagent was diluted with 50% ethanol until absorbance of 1.0 (± 0.02) at 734 nm. In 96-well microplates 250 µL ABTS+ and 20 µL of sample (different concentrations of the sample solution (10, 20, 30, 40, and 50 µg /mL) was dissolved in distilled water) were added. Ascorbic acid was used as standard. The blank was 20 µL of ethanol. After 10 min of reaction in the dark, the reading was performed at 734 nm using a microplate reader.

The radical scavenging activity was calculated as follows:

I (%) = [(Abs0−Abs1)/Abs0] × 100, where Abs0 is the absorbance of the blank and Abs1 is the absorbance in the presence of the test compound at different concentrations.

NITRIC OXIDE RADICAL INHIBITION ASSAY:

Nitric oxide radical inhibition can be estimated by the use of Griess Ilosvay reaction [Garrat, 1964]. In this investigation, Griess Illosvoy reagent was modified by using naphthylethylene diamine dihydrochloride (0.1%w/v) instead of 1-naphthylamine(5%). The reaction mixture (3mL) containing sodium nitroprusside (10 mm, 2 mL), phosphate buffer saline (0.5 mL) and green tea based Ag-NP with hyaluronic acid and polyvinyl alcohol (10, 20, 30, 40, and 50 µg /mL) or standard solution (ascorbic acid, 0.5mL) was incubated at 25°C for 150 min. After incubation, 0.5mL of the reaction mixture mixed with 1 mL of sulfanilic acid reagent (0.33 % in 20 % glacial acetic acid) and allowed to stand for 5 min for completing diazotization. Then, 1 mL of naphthyl ethylenediamine dihydrochloride was added, mixed and allowed to stand for 30 min at 25°C. A pink coloured chromophore is formed in diffused light.

The absorbance of these solutions was measured at 540 nm against the corresponding blank solutions.

% scavenging/Reduction = [Absorbance of control - Absorbance of test sample] /Absorbance of control X 100

Anti Oxidant Activity

Table 1 Depicts the values of zone of inhibition of Hyaluronic acid, PVA and Green tea induced with Silver nanoparticles through DPPH Assay.

DPPH	Standard	Hyaluronic acid + AgNPs
10	66.25	62.49
20	78.52	73.26
30	85.63	80.55
40	88.68	84.73
50	93.15	86.32

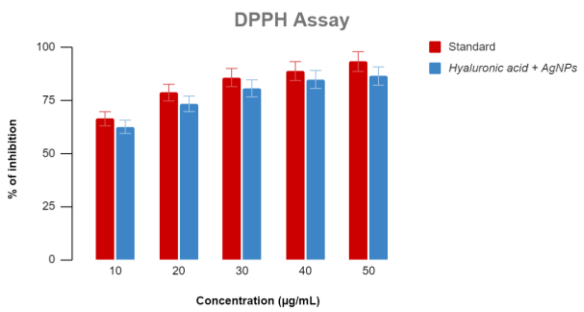

Table 2 Depicts the values of zone of inhibition of Hyaluronic acid, PVA and Green tea induced with Silver nanoparticles through H2O2 Assay.

H2O2	Standard	Hyaluronic acid + AgNPs
10	51.1	49.2
20	56.9	52.9
30	66.1	60.3
40	78.8	72.1
50	89.9	85.6

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JCHR (2025) 15(3), 330-339 | ISSN:2251-6727

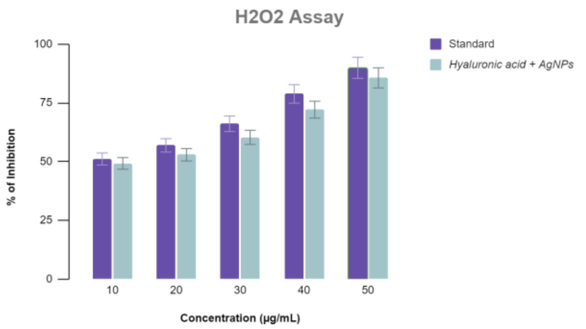


Table 3 Depicts the values of zone of inhibition of Hyaluronic acid, PVA and Green tea induced with Silver nanoparticles through FRAP Assay.

FRAP		
conc	standard	Hyaluronic + AgNPs
10	72.98	66.95
20	76.84	74.56
30	81.31	78.73
40	85.84	82.72
50	90.89	87.43

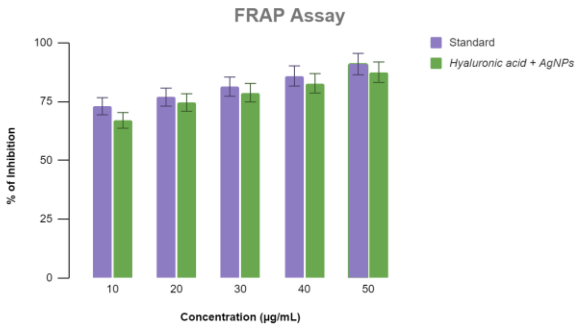


Table 4 Depicts the values of zone of inhibition of Hyaluronic acid, PVA and Green tea induced with Silver nanoparticles through ABTS Assay.

ABTS		
conc	standard	Hyaluronic acid + AgNPs
10	70.56	68.52
20	75.68	72.94
30	82.43	78.83
40	86.57	82.54
50	91.39	88.16

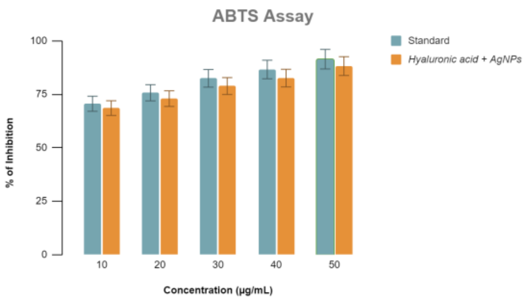
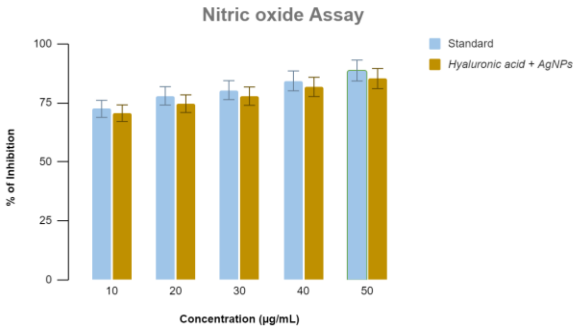


Table 5 Depicts the values of zone of inhibition of Hyaluronic acid, PVA and Green tea induced with Silver nanoparticles through Nitric oxide Assay

Nitric oxide		
conc	standard	Hyaluronic acid + AgNPs
10	72.43	70.58
20	77.94	74.62
30	80.37	77.81
40	84.28	81.73
50	88.67	85.26



4. Anti Inflammatory Activity

Procedure

Bovine Serum Albumin Denaturation Assay

The green synthesized silver nanoparticles were tested for their anti-inflammatory activity using two assays, Bovine serum albumin denaturation assay. 0.45 mL of bovine serum albumin was mixed with 0.05 mL of different concentrations (10, 20, 30 ,40, 50 µg/mL) of C sinensis mediated silver nanoparticles along with hyaluronic acid. The pH was adjusted to 6.3. Then it was kept at room temperature for 10 minutes followed by

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incubation in a water bath at 55°C in a water bath for 30 min. Diclofenac sodium was used as the standard group while dimethyl sulphoxide was used as control. Then, the samples were measured spectrophotometrically at 660nm.

The percentage of protein denaturation was determined utilizing the following equation,

% inhibition= [Absorbance of control - Absorbance of test sample] /Absorbance of control X 100

Egg Albumin Denaturation Assay

To perform the egg albumin denaturation assay, 0.2 mL of fresh egg albumin was mixed with 2.8 mL of 1X phosphate buffer. Different concentrations (10, 20, 30 ,40, 50 µg/mL) of C.sinensis along with hyaluronic acid-mediated silver nanoparticles were added to the reaction mixture. The pH was adjusted to 6.3. Then it was kept at room temperature for 10 minutes followed by incubation in a water bath at 55°C in a water bath for 30 min. Diclofenac sodium was used as the standard group while dimethyl sulphoxide was used as control. Then, the samples were measured spectrophotometrically at 660nm.

The percentage of protein denaturation was determined utilizing the following equation,

% inhibition= [Absorbance of control - Absorbance of test sample] /Absorbance of control X 100

Membrane Stabilization Assay:

The in vitro membrane stabilization assay is a widely used technique for evaluating the membrane stabilizing properties of natural and synthetic compounds. This assay measures the ability of a compound to stabilize the cell membrane by preventing its disruption and subsequent release of intracellular contents. The materials include Human red blood cells (RBCs), Phosphate-buffered saline (PBS), Tris-HCl buffer (50 mM, pH 7.4), Different concentrations of silver nanoparticles (10, 20, 30 ,40, 50 µg/mL), Centrifuge tube, UV-Vis spectrophotometer.

Preparation of RBC Suspension:

Collect fresh human blood in a sterile tube containing anticoagulant. Centrifuge the blood at 3000 RPM for 10 minutes at room temperature to separate the RBCs from other blood components. Remove the supernatant and wash the RBCs three times with PBS. Resuspend the RBCs in the Tris-HCl buffer to obtain a 10% (v/v) RBC suspension

Assay Procedure:

Pipette 1 mL of the RBC suspension into each centrifuge tube. Then different concentrations of silver nanoparticles (10, 20, 30 ,40, 50 µg/mL) were added to each tube. Mix gently and incubate the tubes at 37°C for 30 minutes. Centrifuge the tubes at 2500 RPM for 5 minutes at room temperature to pellet the RBCs. Measure the absorbance of the supernatant at 560 nm using a UV-Vis spectrophotometer.

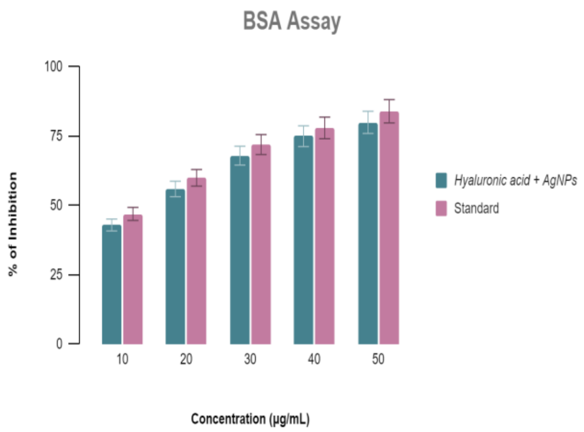
Calculate the percentage inhibition of haemolysis using the following formula:

% inhibition = [(OD control – OD sample) / OD control] x 100

Where OD control is the absorbance of the RBC suspension without the test compound(s) and OD sample is the absorbance of the RBC suspension with the test.

Table 6 Depicts the values of zone of inhibition of Hyaluronic acid, PVA and Green tea induced with Silver nanoparticles through BSA Assay

BSA	10	20	30	40	50
Hyaluronic acid + AgNPs	43	56	68	75	80
Standard	47	60	72	78	84



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JCHR (2025) 15(3), 330-339 | ISSN:2251-6727

Table 7 Depicts the values of zone of inhibition of Hyaluronic acid, PVA and Green tea induced with Silver nanoparticles through EA Assay.

EA	10	20	30	40	50
Hyaluronic acid + AgNPs	51	60	65	68	78
Standard	55	64	69	72	81

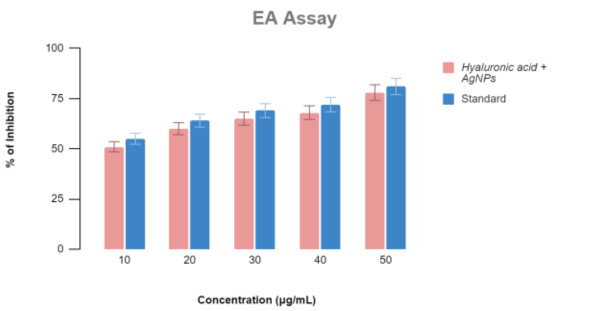
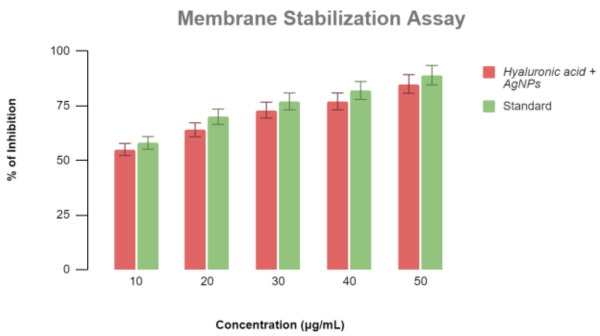


Table 8 Depicts the values of zone of inhibition of Hyaluronic acid, PVA and Green tea induced with Silver nanoparticles through MSA Assay

MSA	10	20	30	40	50
Hyaluronic acid + AgNPs	55	64	73	77	85
Standard	58	70	77	82	89



5. Discussion

In this study, we effectively used green synthesis AgNPs with Camellia sinensis extract. Camellia sinensis includes catechins with strong antioxidant activity, which reduces inorganic metal ions to nanoscale form(9). This is consistent with previous research in which morin, a flavonoid, displayed the same capabilities. In the in vitro investigation, medium and low doses of green tea AgNPs elicited mild physiological alterations, suggesting that the pharmacodynamic effects of green tea AgNPs are dosage and concentration dependent(10). The main challenge for nano biotechnologists and nanotechnologists is to develop a laboratory and, as a result, a pilot protocol for the synthesis of stable, durable, and nontoxic nanomaterials using biosynthesis procedures, such as plant component extraction and then NP biosynthesis.Biological approaches for NP synthesis are currently a crucial approach to replacing present chemical reduction processes, which are not helpful to the environment or humans. Because NPs, as the primary building block of nanomaterials derived from plant material, frequently exhibit short-term stability in terms of shape and size. Furthermore, aggregates are frequently formed during storage.(11)

Due to their strong antioxidant qualities, hyaluronic acid, green tea, and silver nanoparticles are useful in a variety of therapeutic and cosmetic applications. Because silver nanoparticles (AgNPs) may neutralize free radicals, they have demonstrated strong antioxidant activity. They can stop oxidative stress, which is a big cause of aging and a lot of illnesses. AgNPs are also helpful in infection control and wound healing because of their potent antibacterial qualities. Green tea is high in polyphenols, especially the potent antioxidants called catechins(12). The most well-known catechin in green tea is called epigallocatechin gallate, or EGCG, and it has been extensively researched for its capacity to fend off oxidative stress, lessen inflammation, and shield cells from harm.

This study summarizes findings on the anti-inflammatory properties of green tea extract with silver nanoparticles and hyaluronic acid to reveal their potential usefulness in the prevention and inhibition of inflammatory disorders, by the anti-inflammatory action. Green tea and EGCG have various targets and work in a pleiotropic fashion, so we may consider using them to improve the quality of life in patients with inflammatory diseases(13). Green tea and EGCG offer favorable health effects with no serious side effects; nevertheless, caution should be exercised to avoid overdose, which can cause detrimental effects such as hepatic damage.Because of their higher surface-to-volume ratio, AgNPs are more powerful at lower doses, reducing their toxicity(14). Pure silver nanoparticles can control anti-inflammatory

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JCHR (2025) 15(3), 330-339 | ISSN:2251-6727

cytokine release, promoting wound healing while minimizing scarring. Wound dressing for treating microbial infections based on endogenous triggers such as pH, temperature, enzymes, and toxins released by bacteria(15).The key limiting element for NP use in wound healing is formulation expense. The formulations could be lowered by reducing NP doses and increasing output on a greater scale. Primarily, the use of lower-cost adjuvants or the formulation of composite NPs can improve therapeutic efficiency.

When combined, these components can create a synergistic effect that enhances antimicrobial activity by increasing the Stability and Efficacy of Hyaluronic acid which can help stabilize silver nanoparticles, allowing for a controlled and sustained release of silver ions, enhancing their antimicrobial efficacy(16).The combination can improve penetration into microbial biofilms and tissues, leading to better retention and prolonged antimicrobial action. The presence of green tea polyphenols and hyaluronic acid can mitigate the potential cytotoxic effects of silver nanoparticles on human cells, making the formulation safer for medical and cosmetic applications. The combination can be used in wound dressings to prevent infection and promote healing.In skincare products, it can help manage acne and other skin infections while providing hydration and anti-aging benefits(12).Thus this study portrays that the Green tea-Silver nanoparticle-Hyaluronic acid and Poly vinyl alcohol showed an enhanced antioxidant and anti-inflammatory activity.Coatings on medical devices can reduce the risk of infections. Overall, the integration of green tea, hyaluronic acid, and silver nanoparticles represents a promising approach for developing effective antimicrobial treatments with reduced side effects.

6. Conclusion

From this study, we describe an environmentally favorable approach for green synthesis of silver nanoparticles and hyaluronic acid. Both standard (ascorbic acid) and AgNPs demonstrated considerable free-radical scavenging activity, implying that they have antioxidant properties. The non toxicity of AgNPs was also validated by the DPPH and hydrogen peroxide radical scavenging assays. However, in vivo and molecular research are required in the future to determine the precise mechanism of the anticancer activity of produced AgNPs.The green production process for silver nanoparticles is both cost effective and efficient. In this investigation, we used Camellia sinensis (green tea) to synthesize silver nanoparticles and the produced silver nanoparticles (AgNPs) were effective as anti inflammatory agent using various techniques as evidenced by the well diffusion assay.

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