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Antioxidant activity of green tea and halloysite nanotube formation

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Abstract:
Nanomaterials called Halloysite Nanotubes (HNTs) are distinctive and adaptable. There are numerous uses for these nanotubes in cancer treatment and sustained drug delivery. Catechins, which make up as much as 30% of the dry weight of the leaf in green tea, are abundant. Catechins have antioxidant, anti-mutagenic, and anticarcinogenic effects:DPPH assay and H2O2 assay was used to test the antioxidant activity of biogenic synthesized green tea extract. The antioxidant potential of the plant extract depends on the presence of phenolic compounds and flavonoid. aqueous green tea extract from Hallo NF, which showed antioxidant efficacy in the DPPH and H202 assays. From our results we have concluded that aqueous green tea extract from Hallo NF, which showed antioxidant efficacy in the DPPH and H202 assays. Aqueous extracts showed higher antioxidant activity, which was correlated to high levels of phenolic compounds. With their hydroxyl groups, polyphenols are essential for scavenging free radicals, antioxidation, and other pharmacological processes
Keywords: Green tea, medicine, health, Halloysite nanotube.

1.Introduction:

Determining antioxidant activity and the overall antioxidant content in meals, beverages, nutritional supplements, and herbal extracts has been increasingly popular during the past ten years. This pertains to the idea that antioxidants can shield people from the harmful effects of free radicals, especially highly reactive oxygen and nitrogen species(1)(2). The separation of antioxidant chemicals from natural sources has recently received a lot of interest, particularly those of plant origin, including amaranth peel, mango, grape skin and seeds, blackcurrant seeds, tomato seeds, oregano, green pepper, tea, and mango. These plant extracts' high polyphenol concentration has mostly been credited with giving them antioxidant qualities. Plant secondary metabolites known as polyphenols provide a variety of advantages for human health, including their capacity to reduce inflammation and their capacity to prevent the development of cancer (1,3).

Camellia sinensis or Camellia assamica plant's leaves, leaf buds, and internodes are referred to as tea. These products can be made daily, through infusions, decoctions, etc. Tea is also the name for the fragrant beverage made from cured leaves and hot or boiling water (4)(5). In terms of health advantages, green tea has generally been determined to be superior to black tea. The polyphenols that provide green tea, its antioxidant and other health advantages are the main ingredients of interest. Flavonoids are the main polyphenols in green tea (6)(7)(8).

The flavan-3-ols, catechin, epicatechin, epicatechin gallate, and epigallocatechin gallate, as well as their fermentative byproducts, theaflavins and thearubigins, are the main flavonoids found in tea. The amount of flavonoids in dry green and black tea leaves is comparable, and green tea has the majority of catechin. On fermentation, catechin levels drop, while flavones, quercetin, kaempferol, and myricetin are unaffected (9)(10)(11). Catechins, which make up as much as 30% of the dry weight of the leaf in green tea, are abundant. Catechins have high antioxidant properties because the hydroxyl groups in their structure can donate hydrogens, which is why their capacity to scavenge free radicals is greater than that of vitamin C, vitamin B, or beta-carotene. The antioxidant, anti-mutagenic, and anticarcinogenic effects of catechins have been discovered, and they also have the potential to protect against cardiovascular disease (9,12). Due to their toxicological potencies, a number of effective applications of nanotechnology, such as carbon nanotubes, nanofluids, nanoparticles, nano emulsions, and nanocapsules, are not thought to be safe for both humans and the environment. Nanotubes made of halloysite are inexpensive, environmentally beneficial, and naturally occurring(13)(14). Nanomaterials called Halloysite Nanotubes (HNTs) are distinctive and adaptable. There are numerous uses for these nanotubes in cancer treatment and sustained drug delivery (6,15). The aim of the study is to analyze antioxidant activity of green tea and halloysite nanotube formation

2.Materials and methods:

2.1Study setting: The study was conducted in Chennai, Tamil Nadu, India's Saveetha Institute of Medical and Technical Sciences (considered to be a university, Department of Pharmacology, Nanomedicine Laboratory, Saveetha Dental College and Hospitals. In the current investigation,Antioxidant activity of green tea and halloysite nanotube formation. The plant extract was obtained from the Dental College and Hospitals nanomedicine laboratory culture lab in Chennai, Tamil Nadu, India's Saveetha Institute of Medical and Technical Sciences.

2.2 ANTIOXIDANT ACTIVITY:

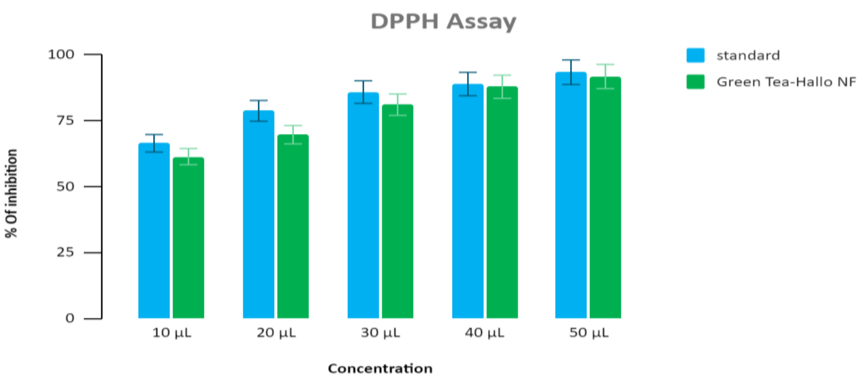
2.2.1 DPPH METHOD

2.2.2 Antioxidant activity: DPPH assay was used to test the antioxidant activity of biogenic synthesized green tea extract . Diverse concentrations (10µL,20µL,30µL,40µL,50µL) of green tea hallo- NF extract was mixed with 1 ml of 0.1 mM DPPH in methanol and 450 µl of 50 mM Tris HCl buffer (pH 7.4) and incubated for 30 minutes. Later, the reduction in the quantity of DPPH free radicals was assessed dependent on the absorbance at 517 nm. Ascorbic acid was used as standard. The percentage of inhibition was determined from the following equation,

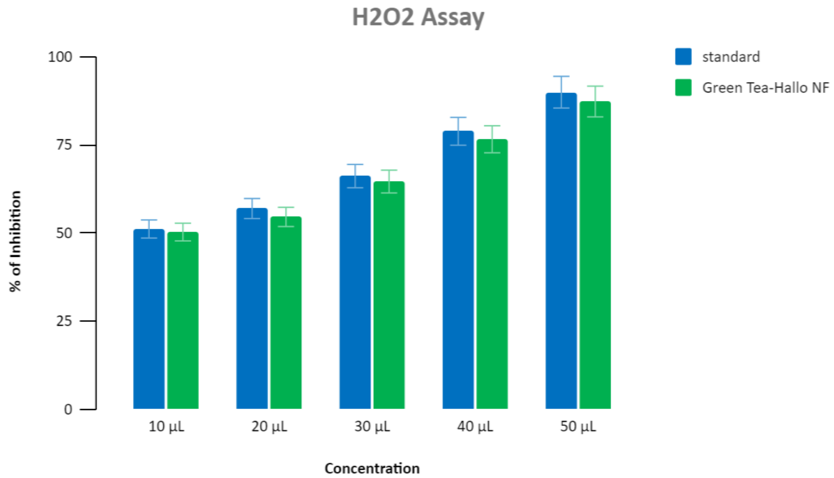
$$\% \text{ inhibition} = \frac{\text{Absorbance of control} - \text{Absorbance of test sample}}{\text{Absorbance of control}} \times 100$$

2.3 HYDROXYL RADICAL SCAVENGING ASSAY: All solutions were prepared freshly.1.0mL of the reaction mixture contained 100µL of 28mM of 2-deoxy-2-ribose (dissolved in phosphate buffer,pH 7.4), 500µL solution of various concentrations of the green tea hallo NF (10µL,20µL,30µL,40µL,50µL) 200µL of 200µM Fecl3 and 1.04mM EDTA (1:1 v/v),100µL H2O2(1.0mM) and 100µL ascorbic acid(1.0mM).After an incubation period of 1 hour at 37°C the extent of deoxyribose degradation at about 532nm against the blank solution . Vitamin E was used as a positive control.

3. Results:



3.1 FIGURE 1: The antioxidant activity of the samples was further assessed using the DPPH radical scavenging assay. Similar to the H_2O_2 assay, both the standard and Green Tea–Hallo NF sample exhibited increasing inhibition with increasing concentration.
At 10 µL, the standard showed approximately 67% inhibition, whereas the Green Tea–Hallo NF sample demonstrated about 61% inhibition. At 20 µL, the inhibition increased to around 79% for the standard and 70% for the Green Tea–Hallo NF sample.
At 30 µL, the radical scavenging activity further increased to ~86% for the standard and ~82% for the Green Tea–Hallo NF extract. Higher concentrations of 40 µL and 50 µL produced the maximum antioxidant activity, with the standard reaching approximately 90–94% inhibition and the Green Tea–Hallo NF sample showing around 88–92% inhibition.



3.2 FIGURE : The hydrogen peroxide scavenging activity of the standard and Green Tea–Hallo NF extract was evaluated at different concentrations (10–50 µL). The results showed a concentration-dependent increase in percentage inhibition for both samples.
At 10 µL, the standard exhibited approximately 51% inhibition, while the Green Tea–Hallo NF sample showed around 49–50% inhibition. As the concentration increased to 20 µL and 30 µL, the inhibition activity gradually increased, reaching about 57% and 66% for the standard and 55% and 64% for the Green Tea–Hallo NF sample. Further increases in concentration to 40 µL and 50 µL resulted in higher scavenging activity, with the standard reaching approximately 79% and 90% inhibition, respectively, while the Green Tea–Hallo NF extract showed about 76% and 87% inhibition.
The antioxidant potential of the plant extract depends on the presence of phenolic compounds and flavonoid. aqueous green tea extract from Hallo NF, which showed antioxidant efficacy in the DPPH and H202 assays. Aqueous extracts showed higher antioxidant activity, which was correlated to high levels of phenolic compounds. With their hydroxyl groups, polyphenols are essential for scavenging free radicals, antioxidation, and other pharmacological processes. Our study found positive correlations as well as significant correlations between total phenolics, flavonoids, and the antioxidant activities of green tea

4.Discussion:In previous research Significant IC50 values and positive correlations between various antioxidant activity testing were seen in butanol extracts. Numerous phenolic and flavonoid components were found in the most effective n-butanol extracts against free radicals, with varying levels of presence and concentration (16). In previous Tea, green tea catechins were isolated, and the impact of tannase-assisted processing on their antioxidative activity was subsequently investigated. Utilizing tests for DPPH, superoxide anion, trolox-equivalent antioxidant capacity (TEAC), hydrogen peroxide, and metal ion chelation, their antioxidant capacity was assessed. With better superoxide anion, hydrogen peroxide, and 2,2-diphenyl-1-picrylhydrazyl (DPPH) scavenging effects than the untreated analogue at a concentration of 200 ppm, the results demonstrate that tannase-treated green tea has a higher antioxidant capacity than the untreated analogue (17). In another study researchers showed that Both in the linoleic acid oxidation system and the lard oxidation system, the selenium-enriched green tea showed noticeably stronger antioxidant activity than ordinary green tea. These findings imply that, in comparison to conventional green tea, the combination of selenium and green tea components greatly increases the antioxidant activity of green tea (18). Prior study showed TPC and the antioxidant activity of green tea were strongly correlated. It can be said that green tea might function as a natural antioxidant replacement (12).
In another study,By adding halloysite nanotubes (HNTs) to stabilize the oil droplets, chitosan (Ch)-based films with clove essential oil (CEO) as an active ingredient were created. To help with their use as food packaging materials, the films' physical, mechanical, and antioxidant properties were examined. Total phenolic content, 2,2-diphenyl-1-picrylhydrazyl, and reducing power assays were used to measure the antioxidant activity of the films with various doses of HNT. The Ch/CEO film with 15 wt% HNT has the strongest antioxidant activity (19). Previous research has demonstrated the viability and selectivity of using enzyme-adsorbed nanotubes as an affinity medium for the quick screening of enzyme inhibitors from complicated combinations (20).

5. Conclusion:
From our results we have concluded that aqueous green tea extract from Hallo NF, which showed antioxidant efficacy in the DPPH and H202 assays. Aqueous extracts showed higher antioxidant activity, which was correlated to high levels of phenolic compounds. With their hydroxyl groups, polyphenols are essential for scavenging free radicals, antioxidation, and other pharmacological processes.

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7. Conflict of Interest:
The authors reported no conflict of interest while performing this study.

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- SaveethaDental College and Hospitals.
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9. Reference:

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