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Anti-inflammatory and antioxidant properties of *Terminalia chebula* mediated gold nano particles

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Abstract:
It is of interest to assess the antioxidant and anti-inflammatory properties of *Terminalia chebula* gold nanoparticles. Anti-inflammatory and antioxidant properties of the nan composite were assessed using Bovine Serum Albumin (BSA) and DPPH Assay respectively at 10 µL, 20 µL, 30 µL, 40µL, 50 µL. Values for anti-inflammatory property of nanoparticles were higher than the standard values at 40µL, 50 µL concentrations. Percentage of inhibition was highest at 40 µL (86%) and 50 µL (84.6%). The values for antioxidant property of nanoparticles were found to be higher than the standard values at concentrations except at 40µL, 50 µL. Percentage of inhibition was highest at 20 µL (86.2%).Within the limits of the study it can be concluded that *Terminalia chebula* mediated gold nanoparticles have exceptional anti-

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inflammatory and antioxidant properties and further can be incorporated in dental material or can be used to coat suture materials to improve their properties.

Keywords: Gold, characterization, green synthesis, nanoparticle, nano composite, anti-inflammatory property; and antioxidant property.

Background:

Every area of science has undergone a fresh revolution as a result of nanotechnology, a rising subject of study. In recent years, nanoparticles have grown significantly in significance among the scientific community. The fields of optics, electronics, biomedicine, and materials science have all made use of this technology **[1]**. One of the most prominent uses for nanoparticles in recent years has been the delivery of drugs and genes, as well as powerful antibacterial, anticancer, and antioxidant agents **[2–4]**. Nanotechnology deals with nanoparticles that are atomic or molecular aggregates characterized by size less than 100 nm. These are actually basic elements derived by modifying their atomic and molecular properties **[5,6]**. The manufacture of zinc oxide nanoparticles uses a variety of standard techniques, including chemical reduction**[7]**, laser ablation**[8]**, solvothermal, inert gas condensation**[9,10]**, and the sol-gel**[11]** method. Even while it takes less time to create vast amounts of nanoparticles using traditional physical and chemical techniques, the capping agents that are needed to ensure stability require hazardous chemicals, which cause toxicity in the environment **[3]**. Green synthesis offers a number of advantages in terms of environmental friendliness and suitability for biomedical applications **[4]**. Because it avoids the need for complex operations like intracellular synthesis, numerous purification steps, or the upkeep of microbial cell cultures, the utilization of agricultural wastes or plants and their parts has become a viable alternative to chemical synthetic procedures **[5].**

Due to their nontoxicity, biocompatibility, drug-making potential, and antibacterial action, gold nanoparticles (AuNP) are better **[12,13]**. Gold's ability to kill contacts has recently been the subject of extensive research. According to studies, the release of ions from the copper surface causes increased intracellular oxidative stress in the bacterial cell wall, which leads to bacterial cell lysis **[14]**. Due to the high frequency of oxide layer deposition on the nanoparticle surface, which would result in decreased antibacterial function, the synthesis of gold nanoparticles is very technique sensitive **[15].** T*erminalia chebula*, a species of Terminalia native to South Asia that is known as black- or chebulic myrobalan has spread from India and Nepal east to southwest China (Yunnan), south to Sri Lanka, Malaysia, and Vietnam **[16]**. The *Terminalia chebula* (*T. Chebula*), which is rich in polyphenols, is widely utilised in ayurvedic treatment. In situ gold nanoparticle synthesis is made possible by polyphenols in the form of hydrolyzable tannins, and oxidized polyphenols can serve as capping agents **[11].** Gold nanoparticles (Au NPs) have been considered in several significant fields of research because of their amazing and adaptable chemical and physical properties. Many medicinal applications, including medication administration and tumor imaging, have made use of gold nanoparticles **[12]**. Therefore, it is of interest to assess the antioxidant and anti-inflammatory properties of *Terminalia chebula*gold nanoparticles.

Materials and Method:

Preparation of gold nanoparticles:

T. Chebula seed powder weighing one gram was combined with 100 mL of deionized water and heated to 90 °C in temperature-controlled water bath for 1 hour, cooled, and then passed through a 0.2-m cellulose nitrate membrane onto filter paper. 80 mL of 0.01 M HAuCl4 solution and 10 mL of *Terminalia chebula* aqueous extract were combined vigorously by hand shaking. Instantaneous visual colour changes from yellow to pinkish red were seen as Au NPs formed.

Anti-Inflammatory Activity:

Test Group:

10 µL, 20 µL, 30 µL, 40 µL and 50 µL of the nanoparticle solution were taken in 5 test tubes respectively. To each test tube 2 ml of 1% Bovine Serum Albumin (BSA) was added. 390 µL, 380 µL, 370 µL, 360 µL and 350 µL of distilled water was added to the test tube containing 10 µL, 20 µL, 30 µL, 40 µL and 50 µL of nanoparticles respectively.

Control Group:

2 mL of gold chloride was added to 2 mL of BSA solution.

Standard Group:

10 µL, 20 µL, 30 µL, 40 µL and 50 µL of Diclofenac Sodium was taken in 5 test tubes respectively. To each test tube 2 mL of 1% Bovine Serum Albumin (BSA) was added. The test tubes were incubated at room temperature for 10 minutes. Then they were incubated in a water bath at 55°C for around 10 minutes.

Absorbance was measured at 660 nm in the UV Spectrophotometer.

% Inhibition was calculated using the following formula:

% of inhibition **=** $(Control\ OD\ -\ Sample\ OD \div)\ Sample\ OD \times \mathbf{100}$

Antioxidant assay-DPPH method:

DPPH assay was used to test the antioxidant activity of biogenic synthesized silver nanoparticles. Diverse concentrations (2-10 µg/ml) of *Terminalia chebula* plant extract interceded gold nanoparticles were 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. BHT was employed as control.

The percentage of inhibition was determined from the following equation,

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

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Results:

Anti-inflammatory properties (Figures 1 and 2) of nanoparticles were higher than the standard values at 40µL, 50 µL concentrations. Percentage of inhibition was highest at 40 µL (62%) and 50 µL (72.5%) as given in Table 1. Inhibition rates for gold nanoparticles made from *Terminalia chebula*were 46.9% for 10 µL 56.9,% for 20 µL, 61.5% for 30 µL, 67.3% for 40 µL, and 72.4% for 50 litresµL. The standard showed 76.56% inhibition at 10 µL, 78.52% at 20 µL, 85.63% at 30 µL, 88.68% at 40 µL, and 93.15% at 50 µL. As a result, the highest level of inhibition, or 50 L, was found to be at higher concentration. The gold nanoparticles made from *Terminalia chebula*are comparable to the standard and show strong antioxidant activity (Table 2).

Table 1: Anti-inflammatory assay showed the following values at the end of the study:

S.NO	CONCENTRATION (µL)	STANDARD (% OF INHIBITION)	NANOPARTICLES (% OF INHIBITION)
1	10	76.59	46.71
2	20	78.95	56.78
3	30	85.76	61.92
4	40	88.79	67.89
5	50	94.51	72.43

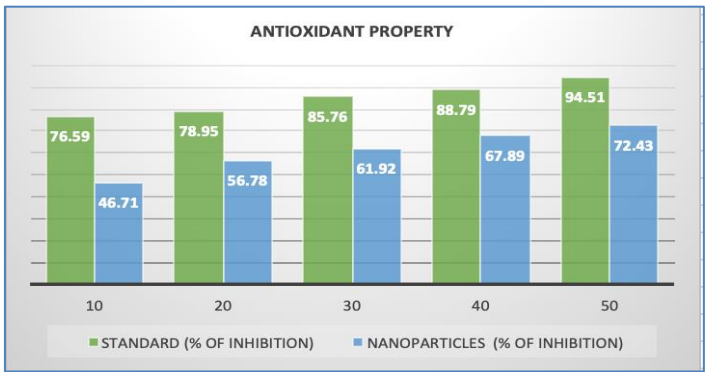

Figure 1: *Bar diagram depicting the antioxidant value on y-axis vs different concentrations of gold nano particles.*

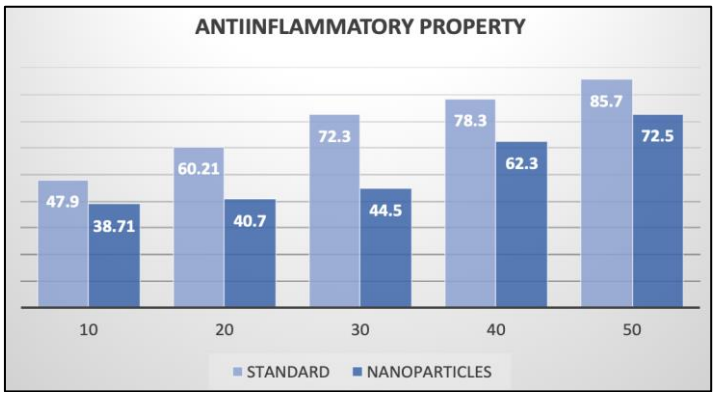

Figure 2: *Bar diagram depicting the anti-inflammatory value on y-axis vs different concentrations of gold nano particles.*

Discussion:

One of the main issues in contemporary medicine is the lack of efficient drug delivery methods with the capacity to enhance the therapeutic profile and efficacy of therapeutic agents. The synthesis of new nanomaterials made possible by developments in nanoscience and nanotechnology has resulted in the creation of a number of novel drug delivery methods. There has been a rapid evolution of nanoparticle synthesis recently as compared to the early part of the century **[17]**. Earlier conventional methods were used for the synthesis of the nanoparticles. Even though less time is utilized for synthesizing large quantities of nanoparticles using conventional physical and chemical methods, toxic chemicals are required as capping agents to maintain stability **[14]**. These methods resulted in toxicity in the environment due to use of toxic chemicals. Green Synthesis method was proposed and is widely used all over the world to avoid the use of such toxic chemicals. It is an eco-friendly method as well as it is highly cost effective **[18]**. We therefore undertook this study to evaluate the cytotoxicity of the copper and graphene oxide nano composite reinforced with amla extract. Antibacterial properties of the same composite were found to be excellent against oral microbes in the previous studies **[19-29]**.

Table 2: Anti-oxidant assay showed the following values at the end of the study:

S.NO	CONCENTRATION (µL)	STANDARD	NANOPARTICLES
1	10	47.9	38.71
2	20	60.21	40.7
3	30	72.3	44.5
4	40	78.3	62.3
5	50	85.7	72.5

It has been demonstrated that *Terminalia chebula* contains antioxidant, antibacterial, and anti-inflammatory properties. The results of a study showed that the antioxidant activity of the *T. Chebula extracts* and pure components examined was present in varied degrees. The antioxidant activity of each pure component was acquired by several methods and was deemed to be distinct **[30]**. The plant material studied, Terminalia chebula, demonstrated antibacterial activity in a study, as evidenced by its bioactive components, and the results suggest that they may be employed as an alternative antimicrobial agent against caries-causing germs.**[31]**. The *T. Cholula fruit's* ethanol extract was discovered to be the most efficient and displayed significant antibacterial activity. In a kill-kinetics investigation, the antibacterial activity of the ethanol extract was dose and time dependent. A phytochemical investigation revealed the presence of high amounts of phenolics and low concentrations of flavonoids and terpenoids. **[32].**

Conclusion:

Data shows that gold nanoparticles have exceptional anti-inflammatory and antioxidant properties. This can be included in the dental materials to improve the properties.

References:

[1] Rico CM *et al. J Agric Food Chem.* 2011 **59**:3485 [PMID: 21405020].
[2] Rajeshkumar S *et al. Journal of Nanostructure in Chemistry.* 2013 **3**:44 [http://dx.doi.org/10.1016/s2221-1691(12)60514-0].
[3] Malarkodi C *et al. Drug Invention Today.* 2013 **5**:1[https://doi.org/10.1016/j.dit.2013.05.005].
[4] Rajeshkumar S, *J Genet Eng Biotechnol*. 2016 **14**:195 [PMID: 30647615].

[5] Daniel MC & Astruc D. *Chem Rev.* 2004 **104**:293 [PMID: 14719978].
[6] Jamdagni P *et al. Journal of Nano Dimension* 2018 **9**:198.
[7] Callister WD Jr and Rethwisch DG. *Materials Science and Engineering: An Introduction. Wiley* 2018. **7**:980.
[8] Snehal Yedurkar M *et al. Materials Today: Proceedings*. 2018 **5**:22561 [https://doi.org/10.1016/j.matpr.2018.06.629].
[9] Mohapatra S *et al. J e med dent sci.* 2020 9:1859.
[10] Chang H and Tsai MH *Rev.Adv.Mater.Sci*. 2008 **18**: 734.
[11] Li H *et al. Journal of Crystal Growth*. 2005, **. 275**: 943 [https://doi.org/10.1016/j.jcrysgro.2004.11.098].
[12] Yusefi-Tanha E *et al. Sci Total Environ*. 2020, **715**:136994[PMID: 32041054].
[13] Abdolhosseinzadeh M & Khodamoradi N *Advanced Materials Research.* 2013, **. 829**: 187 [https://doi.org/10.4028/www.scientific.net/AMR.829.187].
[14] Abiodun-Solanke I *et al. Ann Med Health Sci Res.* 2014 **4**:S171 [PMID: 25364585].
[15] Guidelli EJ *et al. Spectrochim Acta A Mol Biomol Spectrosc*. 2011 **82**:140 [PMID: 21803643].
[16] Sanjeewa TABD *et al. Tropical Agricultural Research.* 2015, **. 25**:127 [http://dx.doi.org/10.4038/tar.v25i1.8036].
[17] Andersson M *et al. Langmuir.* 2005 **21**:11387 [PMID: 16285815].
[18] Chandran SP *et al. Biotechnol Prog*. 2006 **22**:577 [PMID: 16599579].
[19] Ketkar GN & Malaiappan S. *Plant Cell Biotechnology and Molecular Biology*. 2020 **31**:9.
[20] Asha P *et al. Environ Res*. 2022 **205**:112574 [PMID: 34919959].
[21] Shanmugam R *et al. Energy Sources Part A*. 2021 **43**:3064 [https://doi.org/10.1080/15567036.2020.1833112].
[22] Johnson J *et al. Hypertens Res*. 2020 **43**:360 [PMID: 31792346].
[23] Mathivadani V *et al. Acta Virol.* 2020 **64**:93 [PMID: 32180423].
[24] Uma Maheswari TN *et al. Braz Oral Res*. 2020 **34**:e002 [PMID: 32049107].
[25] Ma Y Karunakaran T *et al. Biotechnol Bioprocess Eng.* 2019 **24**:646 [https://doi.org/10.1007/s12257-019-0151-1].
[26] Ponnanikajamideen M *et al. Can J Diabetes.* 2019 **43**:82 [PMID: 30413371].
[27] Aurtherson PB *et al. Biomass Conversion and Biorefinery* 2021 [https://doi.org/10.1007/s13399-021-01551-5]
[28] Adhinarayanan R *et al. Energy Sources Part A*. 2020 **1**:18 [https://doi.org/10.1080/15567036.2020.1773967].
[29] Thanikodi S *et al. Therm Eng* 2020 **24**: 575.
[30] Cheng HY *et al. Biol Pharm Bull.* 2003 **26**:1331 [PMID: 12951481].
[31] Jamil K, *International Journal of Dentistry and Oral Health.* 2017. **3**:87 [http://dx.doi.org/10.25141/2471-657x-2017-9.0087].
[32] Bag A *et al. Asian Pacific Journal of Tropical Biomedicine.* 2012 **2**:1883 [http://dx.doi.org/10.1016/s2221-1691(12)60514-0].