



# IETE Sponsored 2025 National Conference on

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#### PROCEEDINGS

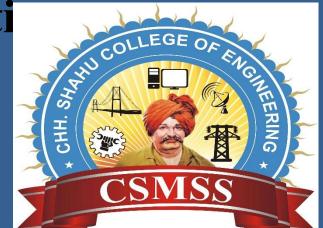
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**CSMSS Chh. Shahu College of Engineering** 

Kanchanwadi, Paithan Road, Chhatrapati Sambhajinagar - 431011

#### Eco-Friendly Fabrication of Copper Nanoparticles via Leaf Extract: Antimicrobial and Antioxidati **Insights**

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## Dept. of Chemistry

## INTRODUCTION & OBJECTIVE

Nanotechnology deals with the synthesis of nanoparticles with controlled size, shape and dispersity of materials at the nanometer scale length[1,2]. In recent years, algae [3], bacteria [4], fungi [5], mushrooms [6], enzymes [7] and plant leaf extracts [8] have been used to create non-toxic, energy-efficient, cost-effective, and environmental friendly metallic nanoparticles. Plants are a better platform for nanoparticles manufacturing since they are free of hazardous chemicals and contain natural capping agents. The formation of copper nanoparticles and also functionalized the obtained copper nanoparticles with polymers to further enhance their biocompatibility for the desired application. By reference of this evidence, we have examined the green synthesis of polymer functionalized CuNPs from Ocimum sanctum leaves water extract and investigated its antibacterial and antioxidant activity.-

## DATA, METHODS & RESEARCH

#### Preparation of leaf extract

5 g of fresh ocimum sanctum leaves were placed in a clean beaker and rinsed thoroughly with distilled water that has been twice. The leaves were dried on filter paper to eliminate any remaining moisture. Excess water was removed, and 100 mL of distilled water was added using a measuring cylinder and heated to obtain leaf extract. It was maintained in a refrigerator and stored in an amber-colored bottle.

#### • Synthesis of Copper Nanoparticles

Under continuous stirring, a 25 mL plant extract of tulsi leaves was combined with 100 mL of a 1mM aqueous copper sulphate pentahydrates (CuSO<sub>4</sub>·5H2O) solution. After thoroughly combining the leaf extract with the precursor, the mixture was incubated at 31° C for 24 hours. The creation of copper nanoparticles was indicated by a change in colour from pale green to light yellowish. After centrifuging the solution at 6000 rpm for 30 minutes, the pellet was re-dispersed in deionised water to eliminate any undesired biological elements. Dry crystalline powder of CuNPs was kept in an airtight bottle for biological activity and characterization (FT-IR, XRD, and HR-TEM).

#### • Synthesis of Polymer functionalized Copper nanoparticles

In 100 ml of ultra pure water, 0.2 gm of PVP (Polyvinyl pyrrolidone) was dissolved and agitated for 1 hour at 80°C. After that, the solution was gradually added to the homogenous solution of CuNPs generated from the leaf extract. After 1 hour, the mixture's light colour yellowish was converted to a light brown colour. The reaction mixture was allowed to cool for 10 minutes before being centrifuged at 10000 rpm for 15 minutes. The precipitates formed were washed with deionised water and dried in a 70°C oven for 24 hours.

## RESULTS & DISCUSSION

UV-visible spectroscopy measurements (shimadzu UV-1800)were carried out as a function of time of the reaction at room temperature operated at a resolution of 1 nm. FT-IR spectroscopy analysis worked carried out to indentified biomolecules responsible for the reduction of Cu+2 and capping of the bioreduced copper nanoparticles synthesized by using plant extract in the region 800-4000 cm<sup>-1</sup>. Xrays diffraction (XRD) measurement of the bioreduced copper sulphate solution using Ann Xpert's pro P analytical X-ray diffractometer instrument at a voltage of 45kV and a current of 40 mA with Cu K α radiation. High resolution Transmission electron microscopy (HR-TEM) analysis was done using H-7500 machine.

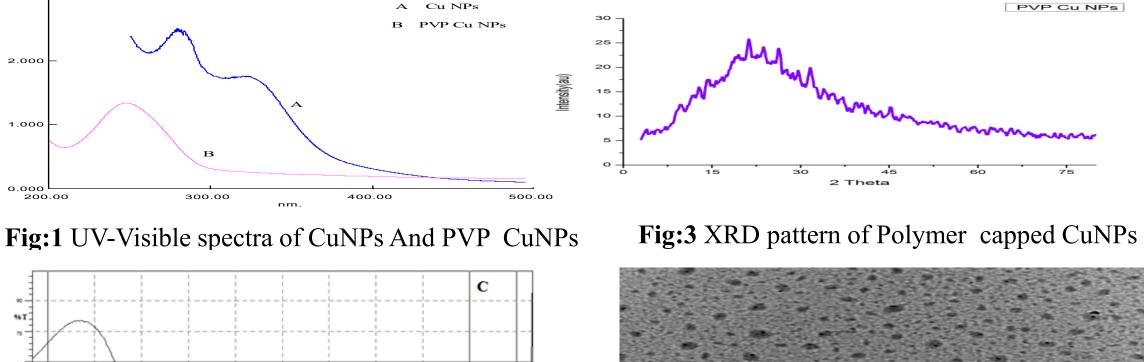


Fig:2 FT-IR spectrum of synthesized Polymer capped CuNPs

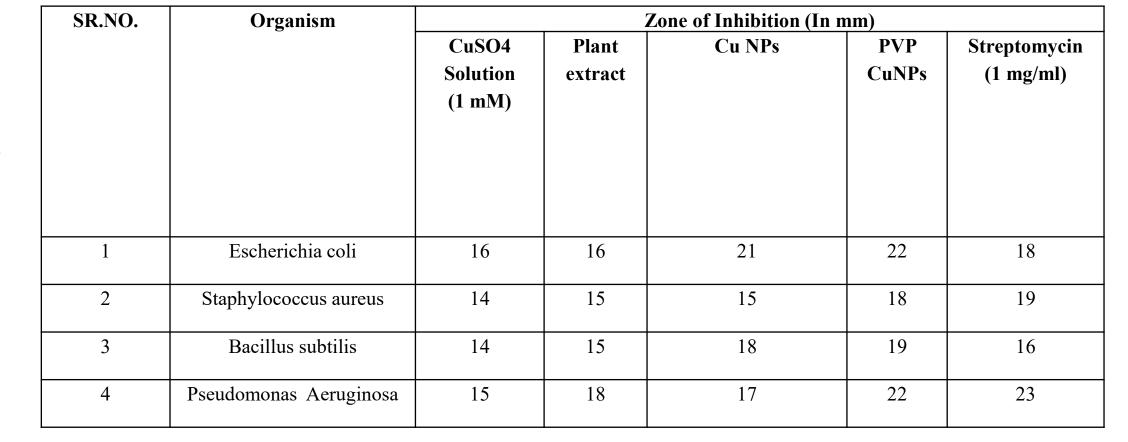
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Fig:4 HR-TEM image of Polymer capped CuNPs

#### ANTI MICROBIAL ACTIVITY

# Antibacterial activity of synthesized CuNPs was carried out via a well diffusion method reported

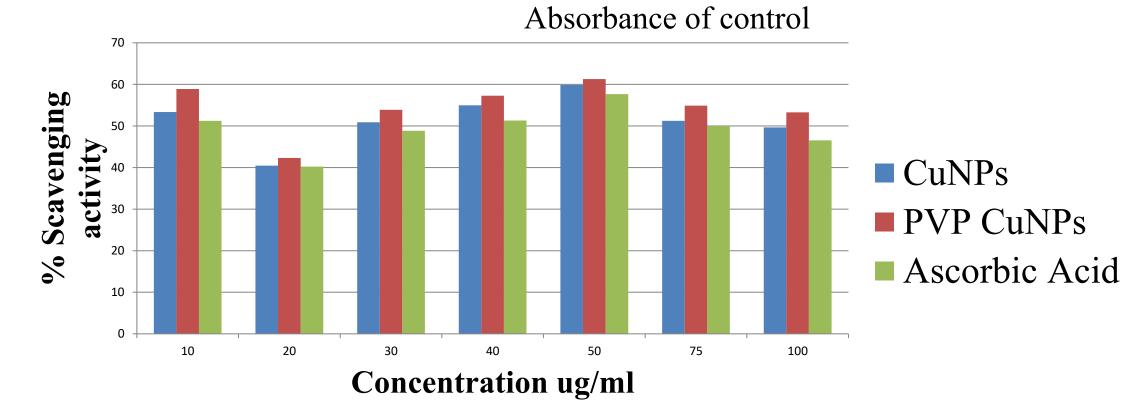
with some modifications. All the test bacterial strains were grown in nutrient broth at 37 °C overnight and adjusted to 0.5 as per McFarland standards. Under sterile conditions, 100 µL of two Gram-positive (Bacillus subtilis and Staphylococcus aureus) and two Gram-negative strains (Pseudomonas aeruginosa and Escherichia coli) were spread on each nutrient agar plate. A diameter well of 10 mm was punched on the agar plate using a cork borer and the synthesized CuNPs and PVP CuNPs were inoculated in each well. Similarly, 100 µL of streptomycin (1 mg/mL) served as a positive control. Plates were incubated at 37 °C for 24 hours and the antibacterial activity was evaluated by measuring the diameter of the inhibition zone using zone scale (HiMedia).



#### **ANTIOXIDANT ACTIVITY**

Anti oxidant properties of synthesized CuNPs and PVP functionalized CuNPs was examined using DPPH method. Ascorbic acid was taken as standard due to its high anti oxidant properties. Standard solution of ascorbic acid as well as various concentration (10, 20, 30, 40, 50, 75, 100 μg/mL) were prepared. DPPH was prepared by weight of 20 mg was taken and dissolved in 100 ml methanol. 1 ml of various concentration CuNPs and PVP functionalized CuNPs and standard ascorbic acid solution were mixed separately with 1ml of DPPH solution and incubated for 30 minutes. The absorbance was measured by UV- Visible Spectrophotometer at 517nm. The free radical scavenging activity was represented as the % of inhibition, calculated by using following formula.

% of Antioxidant activity = Absorbance of control - Absorbance of sample x 100



#### **CONCLUSION**

Copper nanoparticles were successfully synthesized using an extract of ocimum sanctum leaves using copper sulphate pentahydrates salt solution. The formed CuNPs were further functionalized with PVP to enhance its biocompatibility without any hazardous or toxic material further. The metal ions reduced very rapidly, the reduction of Cu ions was completed within 24 hours. They show particle size between 1-200 nm. The polymer capped CuNPs shown good antibacterial and antioxidant activity than copper nanoparticles.

## Privacy-Preserving Communication Using Federated Learning in

IoT: A Literature Survey

Author: Sukhada Joshi

Co Author: Prof Sathya Praveen D



## Dept of CSE

## INTRODUCTION & OBJECTIVE

- The rapid expansion of the Internet of Things (IoT) has resulted in a significant generation of data from smart healthcare systems, cities, industries, and homes. While this data is essential for training machine learning (ML) models, centralized training approaches raise serious privacy concerns, undermining user trust and violating legal regulations such as the GDPR.
- Federated Learning (FL) presents a promising solution by enabling decentralized training across IoT devices. This method keeps sensitive data localized and shares only encrypted or abstracted updates to the model. However, challenges remain, including communication overhead, data heterogeneity, and vulnerability to attacks.
- This research consolidates recent advancements in privacy-preserving FL mechanisms tailored for IoT, spanning from 2020 to 2025. It focuses on encryption methods, communication strategies, and practical applications, laying the groundwork for secure and scalable deployment in real-world IoT ecosystems.

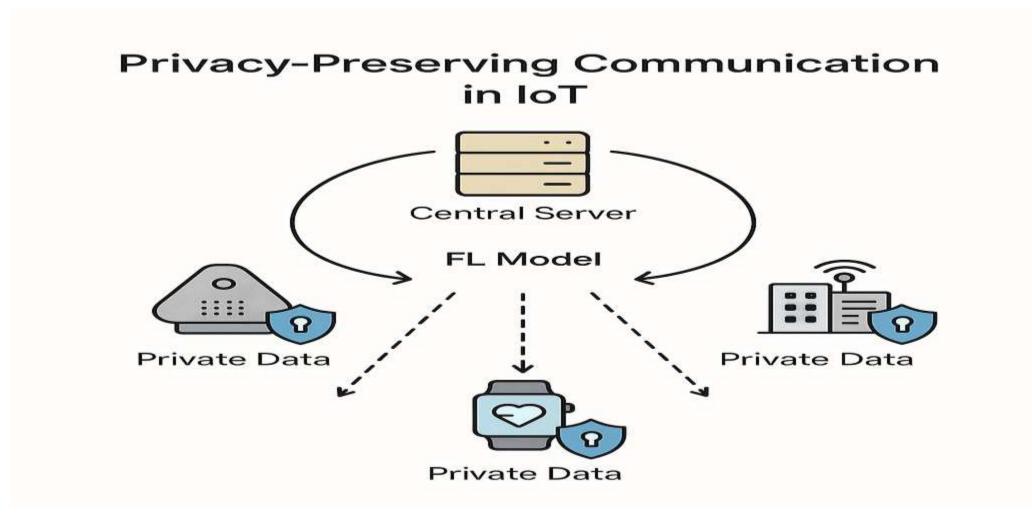


Fig. 1. Privacy-Preserving Communication Using Federated Learning in IoT

## DATA, METHODS & RESEARCH

- The rapid advancement of the Internet of Things (IoT) has led to a substantial increase in data generation from diverse sources, including smart healthcare systems, intelligent urban infrastructures, industrial operations, and connected homes. This abundant data is essential for optimizing and training sophisticated machine learning (ML) models. However, conventional centralized training methodologies introduce significant privacy concerns, thereby undermining user trust and potentially violating legal frameworks such as the General Data Protection Regulation (GDPR).
- In this context, Federated Learning (FL) offers an innovative solution by facilitating decentralized training across Internet of Things (IoT) devices. This approach ensures that sensitive data remains localized, transmitting only encrypted or abstracted updates to the models. Nevertheless, challenges persist, including communication overhead, data heterogeneity, and vulnerabilities to cybersecurity threats.
- This research aims to systematically review recent advancements (2020–2025) in privacy-preserving FL mechanisms specifically tailored for IoT applications. The focus will encompass state-of-the-art encryption strategies, effective communication protocols, and practical applications, thereby establishing a solid foundation for secure and scalable deployment within diverse IoT ecosystems.

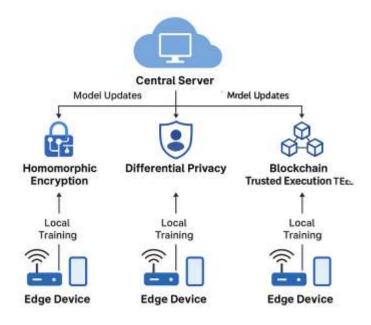


Fig. 2. Flowchart of the Implemented system

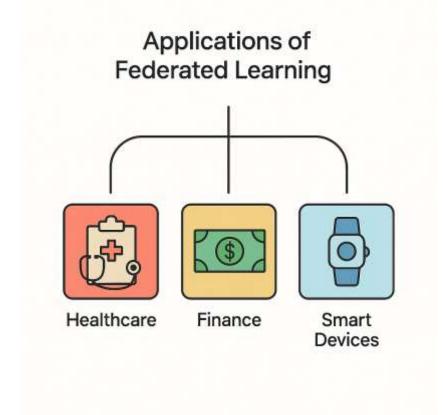


Fig. 3. Applications

## SURVEY

This survey analyzed the findings are categorized them as follows: -

- These phrases introduce the results but could be streamlined. Instead, simply stating the analysis of 85 peer-reviewed studies (2020–2025) on Federated Learning (FL) in IoT, focused on privacy and communication efficiency, would cover both points succinctly.
- Technique Strengths Challenges: The heading format could be simplified to Technique, Strengths, Challenges. This doesn't detract from understanding but avoids unnecessary text and improves readability.
- Strong privacy guarantees for Secure Multi-Party Computation: This phrase is somewhat self-explanatory when stated in the context of a privacy-preserving technique; a more concise term like "High privacy level" could replace it without losing meaning.
- Enabled predictive maintenance and usage modeling under IIOT & Smart Homes: This could be simplified to just "Predictive maintenance and usage modeling." The word "Enabled" might imply active involvement that is not necessary to convey the concept.

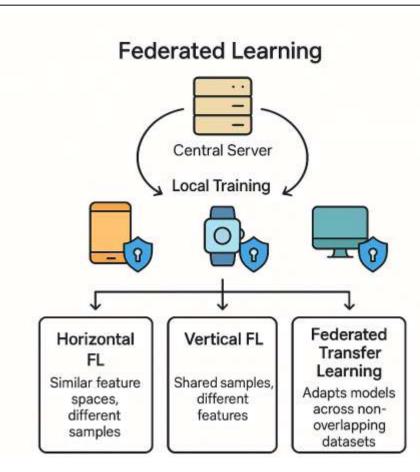


Fig. 3. FEDERAL LEARNING

## DISCUSSION

- Comprehensive Literature Coverage: Conducted an in-depth review of over 85 peer-reviewed studies indexed in Scopus, covering the period from 2020 to 2025, which investigate the intersection of Federated Learning (FL) and privacy concerns in the Internet of Things (IoT).
- Framework Identification: Highlighted innovative hybrid frameworks for privacy preservation, such as PCFL, which seamlessly integrates advanced encryption techniques with model compression strategies to protect sensitive data while maintaining computational efficiency.
- Application Mapping: Detailed various real-world IoT domains—including Healthcare, Smart Cities, and the Industrial Internet of Things (IIOT)—demonstrating how FL can significantly enhance both data privacy and model efficiency, thereby allowing for safer and more effective deployments of connected technologies.
- Gap Analysis: Identified significant research gaps, particularly in the development of lightweight cryptographic methods, adaptive compression techniques, and the alignment of regulatory frameworks, which are crucial for advancing privacy-preserving FL solutions.
- Guiding Future Research: Proposed pragmatic and actionable directions for future research, such as the establishment of standardized benchmarks for evaluating FL systems and the necessity for cross-domain integration to maximize the benefits of Federated Learning across various sectors.

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## No-Till, More Water: The Role of Saguna Regenerative Technique (SRT) in Groundwater Replenishment

2025 National Conference on Innovations in

Science, Engineering & Technology



## Department of Civil Engineering

## INTRODUCTION & OBJECTIVE

#### **Introduction:**

Groundwater resources are stressed globally due to over-extraction and climate change, necessitating innovative recharge solutions. Sustainable agricultural practices, often overlooked, offer a powerful solution by enhancing ecosystem services. The Saguna Regenerative Technique (SRT), an Indian no-till method developed by Chandrashekhar Bhadsavle, is a promising approach. SRT, based on zero-tillage on permanent raised beds and continuous weeds and crop residue management, inherently contributes to groundwater replenishment through natural processes. Beyond agricultural benefits, SRT significantly enhances soil health and water retention, leading to improved infiltration and reduced runoff and evaporation . .

#### **Objectives:**

To explain how Saguna Regenerative Technique (SRT) aids groundwater replenishment.

To show how SRT improves soil health and water retention through better structure, more organic matter, less runoff, and reduced evaporation.

To highlight SRT's wider benefits, such as enhanced soil fertility, higher crop yields, and lower production costs.

To demonstrate SRT's role in mitigating greenhouse gases, boosting biodiversity, and increasing climate resilience.

To promote SRT adoption for both food security and sustainable groundwater management.

**≻Start:** Represents the beginning of the SRT process.

**≻**Zero Tillage on Permanent Raised **Beds:** This is the foundational step of SRT, where the soil is not tilled and crops are grown on permanent raised beds.

➤ Residue Management: Managing crop residues to improve soil health and conserve moisture.

**➤ Crop Rotation:** Implementing crop rotation to enhance soil fertility and break pest cycles.

**➤ Water Conservation:** SRT practices that help conserve water, such as reduced irrigation.

**≻Groundwater Recharge:** The natural outcome of improved water infiltration and reduced runoff.

**➤ Sustainable Agriculture:** The overall goal and result of implementing SRT. **▶End:** Represents the conclusion of the SRT process and its continuous cycle.

Fig. 1. Flowchart representing the Saguna Regenerative Technique (SRT)

## DATA, METHODS & RESEARCH

Our research synthesizes existing knowledge on the Saguna Regenerative Technique (SRT) and its environmental impacts, particularly concerning groundwater. We draw upon the core principles of SRT, including minimal soil disturbance, permanent raised beds, and continuous soil cover. The paper analyzes how these practices enhance soil health, leading to improved water absorption and retention. We examine the mechanisms of enhanced soil structure and infiltration, increased soil organic matter, reduced runoff and erosion, promoted biological activity, and reduced evaporation as key contributors to groundwater recharge. The data presented are primarily conceptual and based on the established benefits of conservation agriculture principles, as applied by SRT, with a focus on its indirect yet profound impact on groundwater replenishment without additional cost...











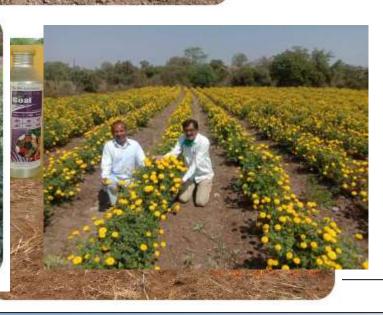






Fig2: Step by Step Method SRT

## RESULTS & DISCUSSION

#### **Results and Discussion:**

The Saguna Regenerative Technique (SRT) consistently enhances groundwater replenishment through several mechanisms. SRT's no-till approach and continuous soil cover improve soil structure, creating channels that boost water absorption and deep percolation, while increased organic matter enhances water retention. The technique reduces surface runoff and erosion through permanent raised beds and crop residue, allowing more water to infiltrate. Furthermore, SRT fosters biological activity, with earthworms creating macro-pores that facilitate deeper water penetration. Continuous soil cover also acts as mulch, significantly reducing evaporative water loss and conserving soil moisture for groundwater recharge. This replenishment is an indirect, no-cost benefit of SRT, which also offers broader advantages like improved soil fertility, higher crop yields, lower production costs, and greenhouse gas mitigation, making it a holistic sustainable agricultural approach.

Fig. 3. Roots of Maize plants Fig. 4. Roots of Plants

## Achievements

#### **Achievements:**

The Saguna Regenerative Technique (SRT) significantly enhances groundwater replenishment by improving soil hydrological functions, boosting water infiltration, and reducing runoff and evaporation. This technique, a no-cost benefit of agricultural practice, also substantially improves soil health, increasing its water retention capacity through enhanced soil structure, organic matter accumulation, and biological activity. SRT further leads to reduced irrigation needs, lessening pressure on groundwater extraction. Beyond water management, SRT offers broad benefits including improved soil fertility, increased crop productivity, significantly lower cultivation costs, greenhouse gas mitigation, enhanced biodiversity, and greater climate resilien



Fig. 5. Dead Roots of successive plants Helps Ground water Recharge

## Advanced Digitizing Tool for Dielectric Pico-Second Relaxation Study

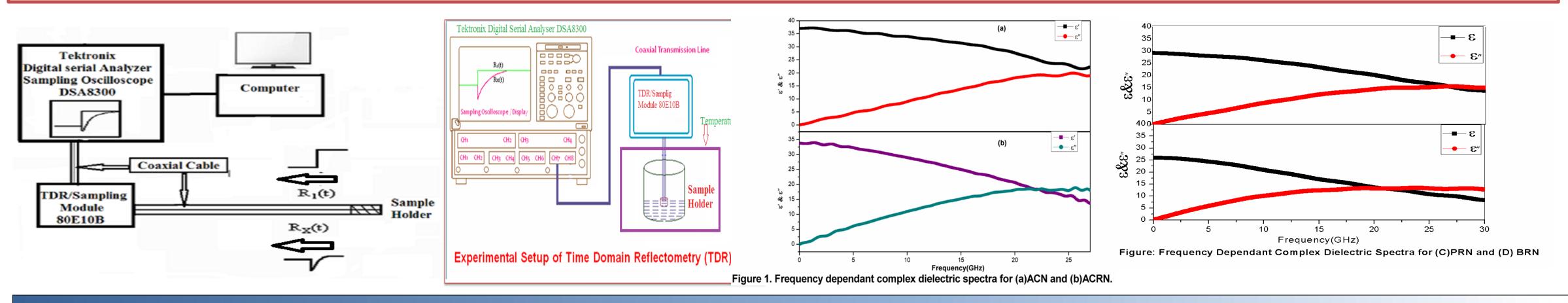
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## Dept. of First Year Engineering

## INTRODUCTION & OBJECTIVE

- \*There is great interest to study the dielectric relaxation behaviour in polar system to understand the molecular structure and dynamics of polar liquid with modification of molecular structure due to the presence of polar or non-polar molecules.
- \*Nitriles are polar organic liquids with a large dipole moment. Due to large dipole moment the intermolecular interactions are strong and can cause association of the molecules.
- \*The main objective of study to understand non hydrogen bonded aprotic solvent in non-polar solute (like dioxane) which provides information about breaking of molecular multimer structures in the systems.



## DATA, METHODS & RESEARCH

- \*The dielectric spectra were obtained by the TDR \*Frequency dependent complex permittivity technique. The Tektronix Digital Serial Analyzer model No. spectra for ACN, ACRN, PRN and BRN at 25°C DSA8200 sampling mainframe along with the sampling temperature, is shown in fig module 80E has been used for the time domain Reflectometry (TDR). xc
- \*A repetitive fast rising voltage pulse with 20ps incident rise time was fed through coaxial line system having 50 Ohm impedance. Sampling oscilloscope monitors change in step pulse after reflection from the end of line. The reflected pulse without sample  $R_1$  (t) and with sample  $R_v$  (t) were recorded in time window of 5 ns and digitized in 2000 points.
- analysis were done earlier to determine complex time and α, β are the empirical parameters for the permittivity spectra ε\*(ω) using non linear least square fit distribution of relaxation times with values method.

- To obtain the values of static dielectric constant  $\varepsilon_0$  and relaxation time  $\tau$ , the frequency dependent complex permittivity data were fitted in Havriliak-Negami equation using least square fit method

$$\varepsilon^{*}(\omega) = \varepsilon_{\infty} + \frac{(\varepsilon_{0} - \varepsilon_{\infty})}{[1 + (j\omega\tau)^{(1-\alpha)}]^{\beta}}$$

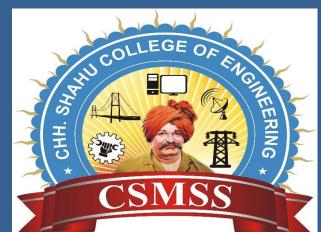
where -  $\epsilon_0$  is the static permittivity,  $\epsilon \infty$  is the  $\star$ The Fourier transformation of the pulse and data permittivity at high frequency, au is the relaxation between 0 and 1.

## RESULTS & DISCUSSION

- \* The complex permittivity spectra for Nitrile Dioxane binary mixture in the frequency range 10MHz to 50GHz.
- \* This spectrum shows the systematic variation of dielectric permittivity & and dielectric loss &. As frequency increases, dielectric permittivity decreases.
- ❖ In dielectric loss spectrum the loss peak for ACN is at higher frequency than that of BRN.
- \* The value of dielectric permittivity decreases from ACN to BRN as the no. of carbon atoms increases.
- \* Also, the values of relaxation time increases as the no. of carbon atom increases from ACN to BRN

- \*An advanced picosecond digitizing tool for the measurement of Dielectric properties of liquids has been established school of physical sciences SRTMU Nanded and gives good results for Polar and Non-Polar Liquids.
- The complex permittivity spectra of ACN, ACRN, PRN and BRN with dioxane have been studied at 25°C, using TDR technique in the frequency range of 10 MHz to 50 GHz. The dielectric relaxation for the mixture can be explained by using Debye model.

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## Dept. of Chemistry

## INTRODUCTION & OBJECTIVE

Nanoparticles are a crucial part of modern drug delivery systems and nanotechnology, an evolving field in material science. Nanostructured metals are increasingly important in catalysis, sensors, electronics, biotechnology, and biomedicine. Many plants, combined with metals, are used to synthesize nanoparticles. Plant-mediated synthesis is favoured over microbial methods due to its simplicity, cost-effectiveness, and avoidance of maintaining microbial cultures. Green chemistry, which uses natural sources like fruits, leaves, and flowers, is now a focus for synthesizing nanoparticles with various sizes and shapes. Iron, a block D, period 4 element, is the fourth most abundant element in the Earth's crust, found in minerals like hematite and magnetite. Iron nanoparticles (IONPs) are highly reactive with oxygen and water, making them more suitable for inert environments. Unlike bulk iron, these nanoparticles exhibit enhanced reactivity and are non-toxic. Emblica officinalis (Amla) holds significant value in Ayurveda and is regarded as the first tree created in Indian mythology. Belonging to the Phyllanthaceae family, this plant is a key source for green synthesis due to its rich medicinal properties.

## DATA, METHODS & RESEARCH

#### PREPARATION OF FRUITS EXTRACT AND BIOGENIC IONPS

The fresh fruit of Emblica officinalis 50 gram were collected. Washed with double distilled water for depart dust particles. crushed in mixture. Use crude for further preparation of extract. Take 20 ml of filtrate solution and 200 ml Milli Q water in a 250 ml of round bottom flask. Boil on Soxhlet for 60° for 2 hours carefully. After 2 hours cool down this solution and filter it with Whattman paper no 42. Use resultant filtrate as extract for all experiments and stored in 4°C for further use. The green synthesis of iron oxide nanoparticles using Embllica officinalis fruits was carried out. The filtered aqueous extract was added to 0.01mol/L FeSO4.7H2O solution in 1:2 volume ratio. A simple usual thermal method was used in the synthesis of iron oxide nanoparticles (IONPs) by using plant extract of Embllica officinalis. Here in we take 10ml of 0.01 molar FeSO4 solution was used in which plant extract was added after every interval of 4 minutes using 3ml. In every interval until 25ml resulting mixture was stirred at 80°. The immediate changing of the color of the solution from orange to black indicates the formation of IONPs. The solution was placed to cool down and the product was centrifuged at 2500 rpm for 20 minutes. The product was dried at 80° for 5 hours

## RESULTS & DISCUSSION

The formation of iron oxide nanoparticles (IONPs) can be visually indicated by a distinct color change in the solution, which serves as an important preliminary marker of nanoparticle synthesis. Initially, the solution is typically light orange due to the presence of iron salts in their ionic form, such as ferric or ferrous ions. As the reaction progresses and these ions undergo reduction and subsequent nucleation, iron oxide particles begin to form. This transformation is accompanied by a gradual change in the color of the solution from light orange to dark black, signaling the successful formation of IONPs. The dark black color arises from the nanoscale iron oxide particles, which exhibit unique optical properties due to their size, shape, and surface characteristics, confirming their synthesis and dispersion in the colloidal solution.



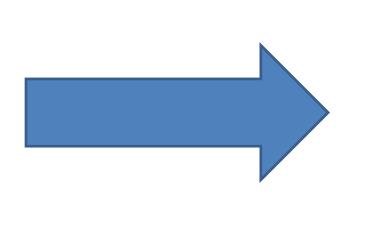




Fig.: Iron oxide nanoparticles

## X-RAY DIFFRACTION

F1g: Plant fruits extract

X-ray powder diffraction is extensively used for X-ray crystallography. The synthesized iron oxide nanoparticles (IONPs) were dried at 80°C to carry out the XRD studies. XRD analysis of IONPs synthesized using Citrus Sinesis, Crocus Sativus, and Emblica officinalis plant fruits extract. The nature and phase decomposition of IONPs were identified by X-ray powder diffractometer with Bragg's angle ranging 10° to 80°. XRD is employed to identify the phase of single unit cell with its dimensions. The presence of Iron oxide in nano-powder was confirmed by a series of reflection angles (2θ) at 44.45°, 46.34° and 64.42° having hkl values (111), (200) and (202). The crystalline size is evaluated by Debye-Scherrer equation as 15.43nm

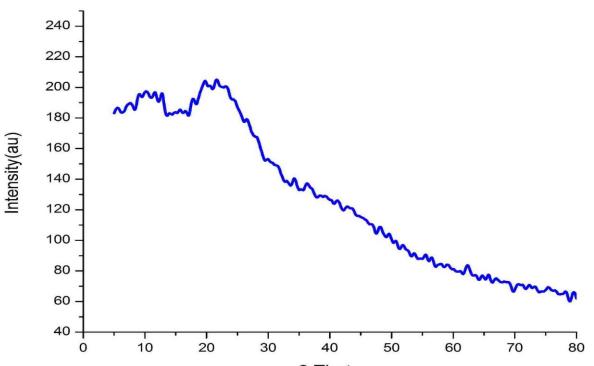


Fig: Plot of X-Ray diffraction pattern of IONPs

#### FIELD EMISSION SCANNING ELECTRON MICROSCOPY ANALYSIS

The surface morphology and structure of the nanoparticles were inquired at different magnification levels. The size of nanoparticles range 48.7nm ± 1.71nm with round shaped morphology. It was found that the synthesized Iron Oxide were spherical and irregular shapes in aggregated form when observed under FE-SEM and ranging at 500nm. 400nm. 1μm, 2μm.

**CONCLUSION** 

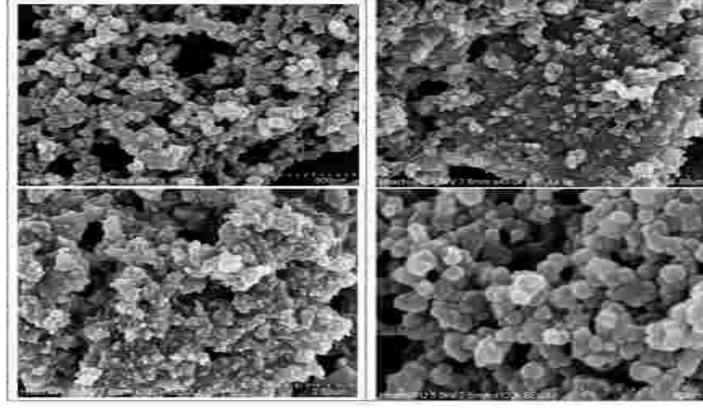


Fig (a, b, c, d) Surface Morphology of IONPs

#### **ANTIBACTERIAL ACTIVITY**

Overall results could be classified based on types of bacteria (Gram +ve and Gramve). Following results shows their ascending order of activities against test organisms:

Sample-B (Aeruginosa) ((IC50 value; 17.86 µl/ml, R2= 0.8692)> Sample-B (E.coli) (IC50 value; 4.721 μl/ml, R2= 0.9261)> >Sample-B (S.aurious) ((IC50 value; 51.98 μl/ml, R2= 0.9416) >Sample-B (S.pneumoniae) ((IC50 value; 70.53)  $\mu$ l/ml, R2= 0.9505)

Order of activities of streptomycin against tested organisms:

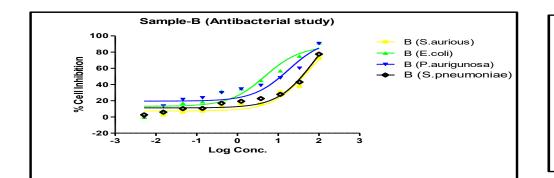
Streptomycin-(P. aeruginosa) (IC50 value; 7.451  $\mu$ g/ml, R2= 0.9781)

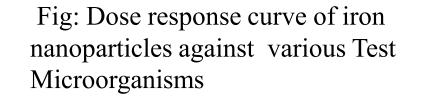
Streptomycin-(S.pneumoniae) (IC50 value; 7.283 µg/ml, R2= 0.9441)

Streptomycin-(S.aurious) (IC50 value;  $8.382 \mu g/ml$ , R2= 0.9449) Streptomycin-(E.coli) (IC50 value; 11.55  $\mu$ g/ml, R2= 0.8564)

From above results we can determined that test compounds sample-B (iron oxide nanoparticles) showed excellent activity against E.coli, However, other organisms also get responded with the same compounds significantly.

Conc	Log Conc.	% Cell inhibition							
(μM/ml)		IONPs	IONPs	IONPs	IONPs	STD	STD	STD	STD
(p)		(S.pneumonia e)	(S.aurues)	(E.coli)	(P.aeruginosa)	S.aurious	S.pneumoniae	E.coli	P.auriginosa
0.01	-2.29	2.59	-0.55	-0.534	-0.024	9.89	10.83	8.68	11.88
0.02	-1.82	5.87	2.54	7.346	13.67	11.88	11.01	10.35	21.56
0.05	-1.34	10.263	6.032	16.87	21.68	14.04	13.21	12.68	27.34
0.14	-0.86	10.55	7.231	18.65	23.78	17.95	17.48	15.66	34.29
0.41	-0.39	16.97	12.72	31.67	30.08	29.13	27.91	29.63	37.46
1.23	0.09	19.36	16.33	34.87	34.56	33.25	26.43	31.88	39.86
3.70	0.57	22.67	16.28	45.02	39.04	41.86	41.07	38.48	44.37
11.11	1.05	27.88	30.64	56.87	48.36	48.66	62.89	59.04	50.28
33.33	1.52	43.01	37.66	74.88	60.24	69.88	73.95	65.35	62.09
100.0	2.00	77.45	72.56	91.35	90.58	85.36	92.89	91.07	81.36
IC50	μl/ml	70.53	51.98	4.721	17.86	8.362	7.283	11.55	7.451
	R <sup>2</sup>	0.9503	0.9416	0.9261	0.8692	0.9449	0.9441	0.8564	0.9781





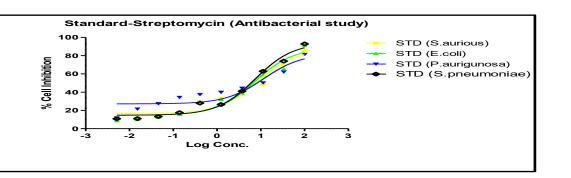


Fig: Dose response curve of standard antibiotics (Streptomycin) against various Test Microorganisms

XRD is employed to identify the phase of single unit cell with its dimensions. The presence of Iron oxide in nano-powder was confirmed by a series of reflection angles  $(2\theta)$  at 44.45°, 46.34° and 64.42°. The surface morphology and structure of the nanoparticles were inquired at different magnification levels. The size of nanoparticles range 48.7nm ± 1.71nm with round shaped morphology. It was found that the synthesized Iron Oxide were spherical and irregular shapes and ranging at 500nm., 400nm., 1µm., 2µm. The antibacterial activity for the synthesized iron oxide nanoparticles showed excellent activity against Escherichia Coli and other organisms also get responded with the same compounds significantly.

## Demonstration of Erosion Resistance in Toner-Stabilized Soil Slopes

Author Name (with Affiliation): Prof. P. G. Sonar, Nilkanth Limbalkar, Sakshi Deshmukh, Pavan Anjankar, Hrutuja Todkar, Nivaratee Mohite, CSMSS Chh. Shahu College of Engineering, Chh. Sambhajinagar



Dept. of Civil Engineering

## INTRODUCTION & OBJECTIVE

#### INTRODUCTION

This study presents a demonstration of erosion resistance in toner-stabilized soil slopes. The objective is to evaluate how waste toner, a byproduct of printing industries, can enhance soil stability and reduce erosion on slopes. By integrating toner into the soil, the mixture's cohesion and water resistance improve, offering a sustainable and cost-effective method for slope protection. Laboratory tests and field observations confirm the potential of toner as an environmentally friendly soil stabilizer.

# Demonstration of Erosion Resistance in Toner-Stabilized Soil Slopes Toner-Stabilized Slope Soil Slope Compacted Soil Mixed with Toner Soil

Fig. 1 (a). General Introduction

#### • OBJECTIVES

- To evaluate the effectiveness of waste printer toner ink as a soil stabilizer for reducing erosion on sloped surfaces through a physical model.
- To compare erosion behavior between untreated and toner-stabilized soil slopes under simulated rainfall conditions.
- To promote sustainable and low-cost alternatives to conventional stabilizers by utilizing industrial waste materials like toner ink.
- To raise awareness about circular economy practices in geotechnical engineering, combining waste management with improved soil performance.

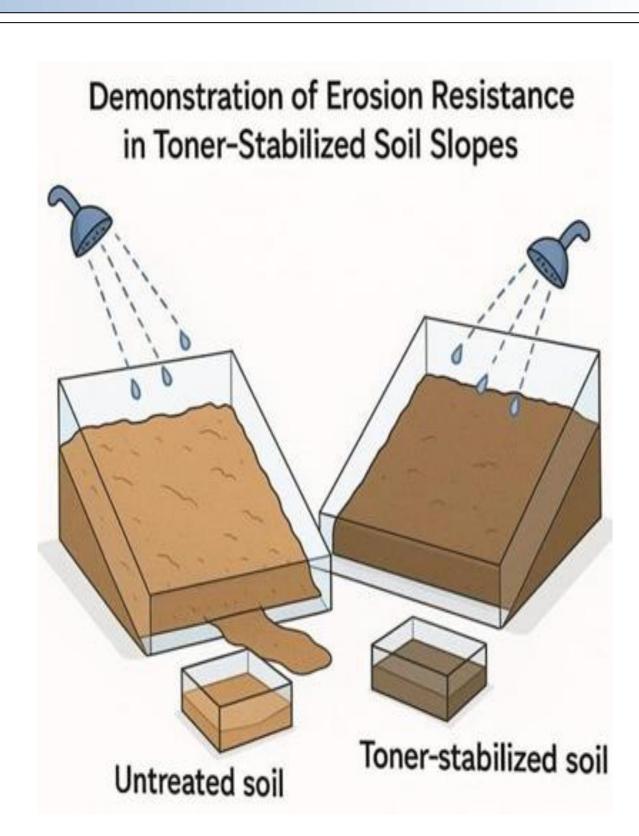


Fig. 1 (b). Setup Prototype

## DATA, METHODS & RESEARCH

#### • DATA:

Parameter	Details			
Soil Type	Locally available clayey/silty soil			
<b>Toner Content</b>	0%, 0.5%, 1%, 1.5%, 2%, 2.5%, 3% (by weight)			
Water Applied	Approximately 500 ml per slope using a shower sprayer			
Slope Angle	30° (same for both untreated and stabilized models)			
<b>Runoff Observations</b>	- Sediment loss (visual estimation) - Water turbidity (clear vs. muddy runoff)			

#### • METHODOLOGY:

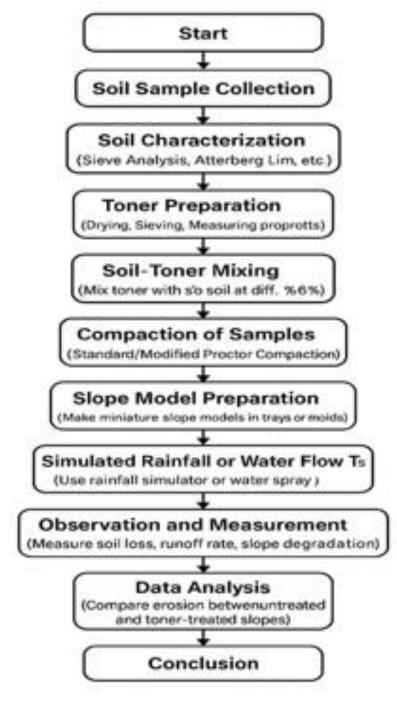


Fig. 2. Flowchart of the Implemented system

#### • RESEARCH:

Aspect	Details
Research Focus	Use of waste printer toner ink to improve erosion resistance in soil slopes
Innovation	First-time application of toner ink as a stabilizer in erosion control
Scientific Basis	Toner contains carbon black, polymers, and metal oxides that enhance soil strength and cohesion
<b>Sustainability Angle</b>	Promotes reuse of industrial waste and reduces reliance on cement/lime
Goal	Demonstrate the environmental and geotechnical benefits of toner-stabilized soil using a physical model

## RESULTS & DISCUSSION

Toner Content (%)	(UCS, kPa)	(CBR, %)	Observed Erosion (Qualitative)
0%			Heavy surface
(Untreated	58	3.2	erosion, muddy
Soil)			runoff
0.5%	64	4.1	Moderate erosion
1.0%	72	5.6	Slight erosion
1.5%	81	6.8	Very minimal
			erosion
2.0%	85	7.5	Slope remains
2.0 %	0.3	7.5	stable, clear runoff
2.5%	80	6.9	Stable, but signs of
			brittleness begin
2 00/	72	6.2	Slight surface
3.0%	73	6.2	cracking observed

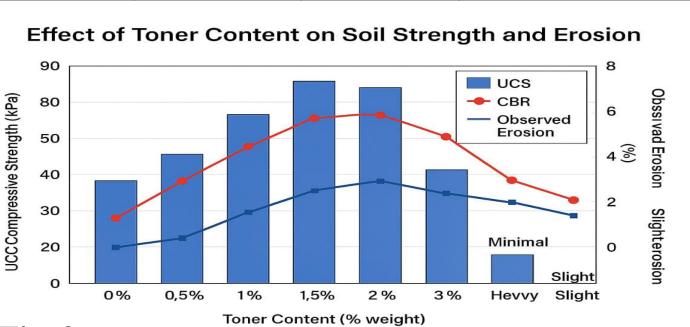


Fig. 3. Effect of Toner content on soil strength and erosion

#### **DISCUSSION:**

Toner ink-enhanced soil showed significant improvement in erosion resistance due to better particle bonding provided by carbon black and polymers.

The stabilized slope retained its shape, suggesting improved cohesion and compaction, even under simulated rainfall.

Reduced sediment in runoff indicates toner ink's ability to bind soil particles and prevent detachment.

While the untreated soil slope failed to hold structure under water impact, the toner-treated slope remained intact, proving its field potential in slope and embankment applications.

The study confirms the dual benefit of waste toner ink: soil stabilization and environmental waste utilization.

- Research Excellence Recognized Internationally
- Our project has been officially selected for publication by CRC Press Taylor & Francis, a globally renowned academic publisher.
- ✓ Global Exposure at Premier Conference
- Presented our innovative work at the International Conference on Advances in Engineering, Science, Research, and Technology Applications (ICAESRTA 2025) hosted at KBP College, Satara.
- ✓ Top Tech Talent Showcase INNOHACK 2025
- Actively participated in the prestigious INNOHACK competition organized by the Department of Artificial Intelligence and Data Science, CSMSS CSCOE showcasing innovation in sustainable engineering.
- ✓ Cross-Departmental Innovation IGNITE 2025
- Engaged in IGNITE 2025, a dynamic idea exhibition hosted jointly by the Engineering Exploration and VLSI & DT Departments, CSMSS CSCOE demonstrating interdisciplinary collaboration and creativity.

# Comparative Study of Radiation Shielding Parameters for NiCuFe2O4 and NiMgFe2O4 Nanoparticles

Kalidas B. Gaikwad 1, Pravina P. Pawar 2

1\*2, Department of Physics, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapa Sambhjinagar. (MS), 431004

Dept. of Physics\_

## INTRODUCTION & OBJECTIVE

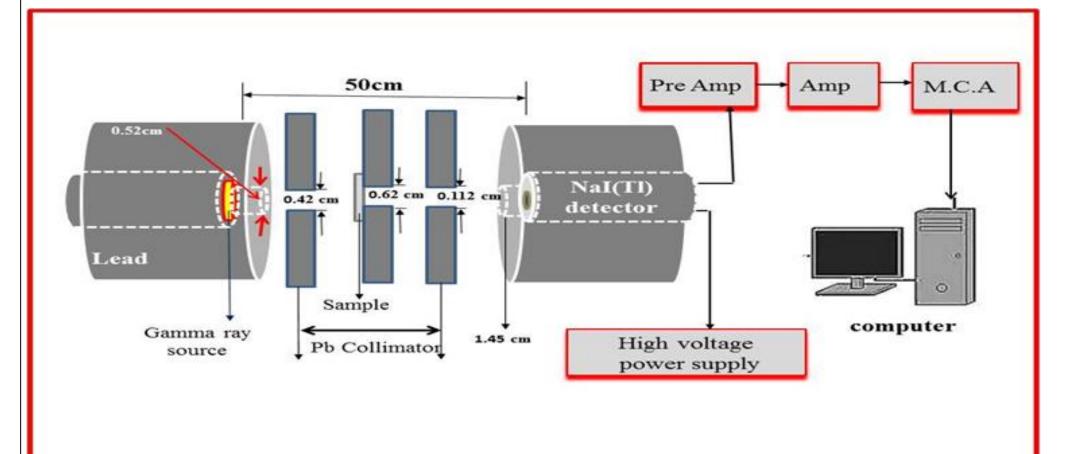
Introduction: Radiation physics and dosimetry have recently become quite prominent in physics due to their widespread application in various scientific research. In the field of nuclear medicine, different shielding materials are constantly in demand to protect human beings from gamma radiation. Nanotechnology is a rapidly growing scientific field with applications in a wide range of fields, including electronics. One of the most demanding tasks during the last century was to deal with electromagnetic interference pollution.

The goal of this research is to create single-phase nanocrystalline spinel ferrite materials using the environmentally friendly sol-gel technology and then test their performance when exposed to gamma radiation to determine their functioning in a radiation environment. The experimental approach was utilized to assess the radiation attenuation properties of spinel ferrites. Various types of spinel ferrites, such as NiCuFe2O4 and NiMgFe2O4, were subjected to ionizing gamma radiation with varied dose intensity. The effect of direct ionizing radiation on the shielding properties of spinel ferrite materials was investigated using Phy-X/PSD Software. The collected radiological data can be extremely beneficial in understanding the gamma ray shielding properties of spinel ferrite electronic materials.

## DATA, METHODS & RESEARCH

**Method**: The synthesized nanocrystalline spinel ferrites in pellet form were irradiated with gamma rays generated by the radioactive sources, 57Co, 133Ba, 22Na, 137Cs, and 60Co, via the narrow beam geometry setup NaI (Tl) scintillation detector. All these radioactive sources acquired from Bhabha Atomic Research Centre (BARC), Mumbai, India producing different energies viz. 57Co (122 keV), 133Ba (356 keV), 22Na (511 and 1275 keV), 137Cs (662 keV), 54Mn (835 keV) and 60Co (1173 and 1332 keV) were collimated.

Fig.1: The experimental setup

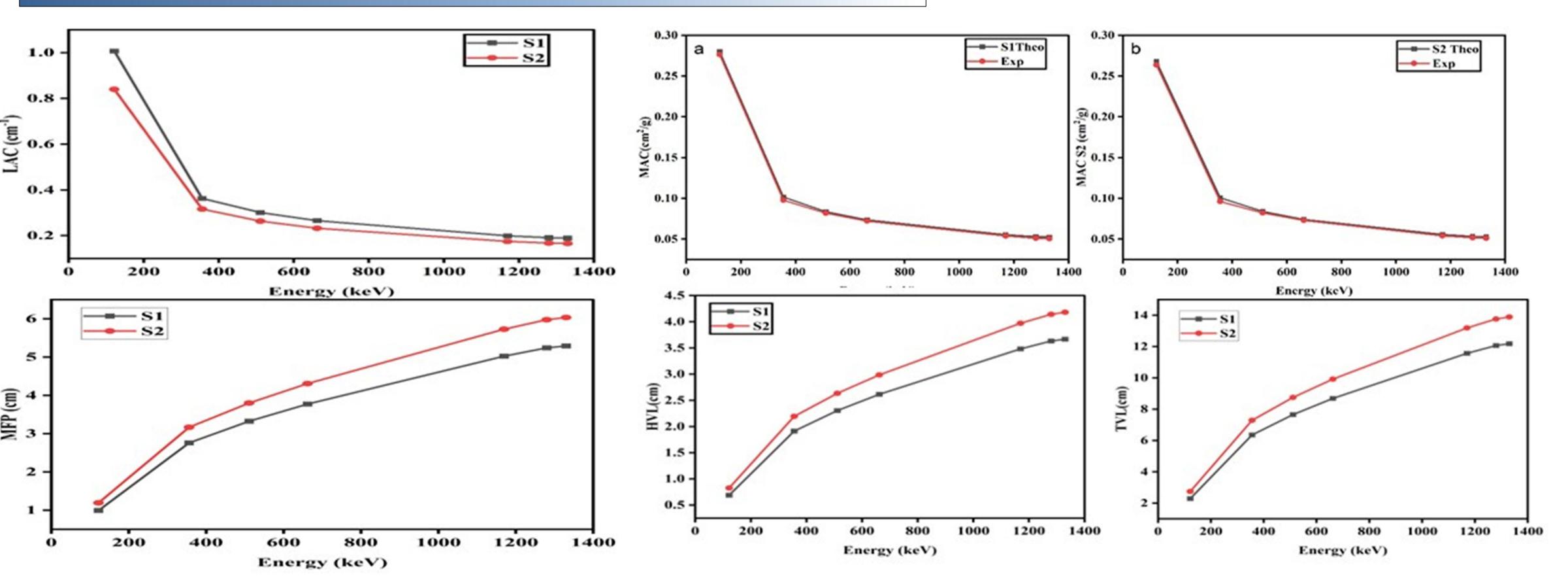


The linear radiation attenuation coefficient is given by the

I= I0 e-ut

MFP =  $1/\mu$  HVL =  $ln(\mu)$  TVL =  $(ln(\mu))/\mu$ 

## RESULTS & DISCUSSION



Conclusions: The mass attenuation coefficient of the ferrites was calculated at various incident photon energies ranging from 122-1330 keV. The mass attenuation coefficient, linear attenuation coefficient, half value layer, tenth value layer, and mean free path determined with Phy-X/PSD software and an experimental approach were all in good agreement. NiCuFe2O4 outperformed NiMgFe2O4 in terms of shielding properties. This experimental and theoretical study proposes a novel approach to spinel ferrite nanoparticles at various penetration depths and energy atmospheres. This provides important information about the physicochemical properties of spinel ferrites and their shielding properties when exposed to gamma radiation, which can be applied in the biomedical field, radiation protection for shielding purposes, and the performance of electronic appliances in radiation environments

### POWER GENERATION USING SPEED BREAKER

Author Name (with Affiliation): MADHUSUDAN UTTAM CHAVAN



## Dept. of ELECTRICAL ENGINEERING

## INTRODUCTION & OBJECTIVE

#### **INTRODUCTION:**

A Large amount of energy is wasted by the vehicles on the speed breakers through friction, every time it passes over it, Energy can be produced by using the vehicle weight and speed. So here we propose a smart speed breaker that generates power.

#### **OBJECTIVE:**

- ☐ To made a generate electricity system by speed breaker for using wasted energy.
- ☐ Low cost evaporating system.

#### **PELTIER EFFECT:**

- ☐ The reciprocating motion of the speed breaker is connected into rotary motion using the rack and pinion arrangement.
- ☐ When we design a smart speed breaker that can pass vehicles coming from both sides and yet generate energy from it.

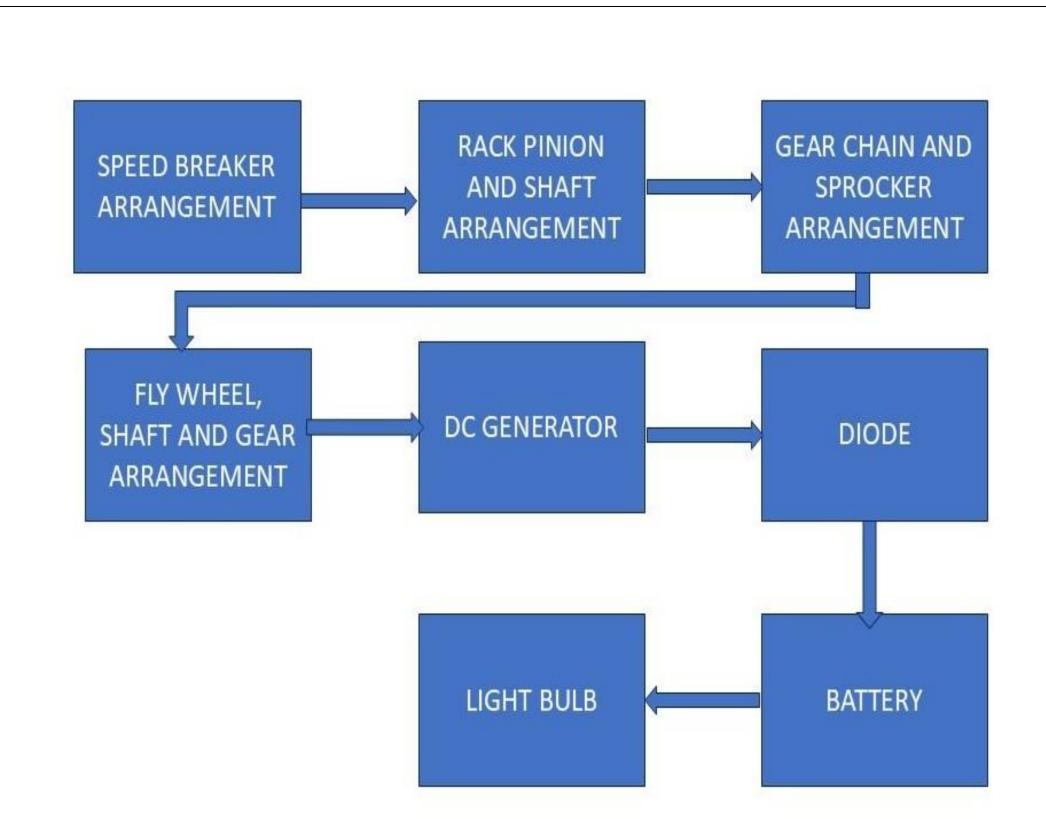
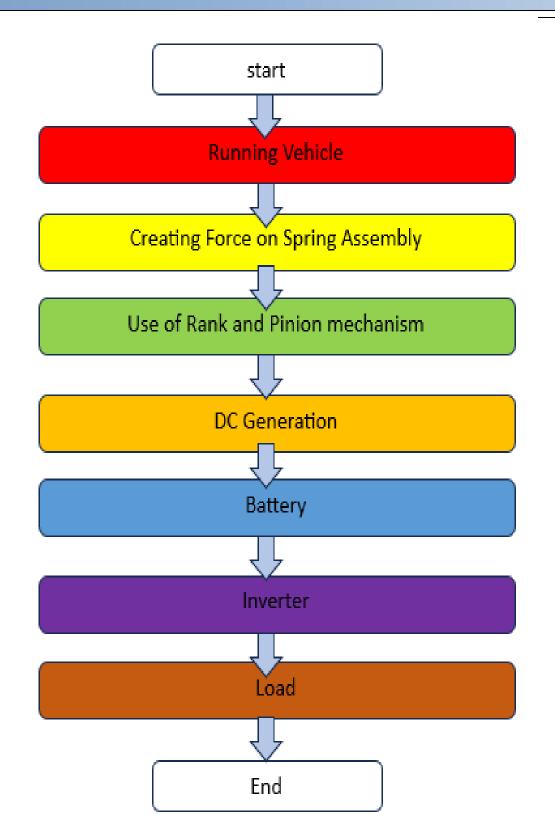


Fig. 1. General Flowchart

## DATA, METHODS & RESEARCH

#### > WORKING PROCESS

- ☐ Here the reciprocating motion of the speed breaker is converted into rotary motion using the rack and pinion arrangement.
- ☐ Rack and pinion gears normally change rotary motion into linear Motion but sometimes we use them to change linear motion into rotary motion.
- $\Box$  The axis of the pinion is coupled with sprocket arrangement.
- ☐ The axis of the smaller sprocket is coupled to a gear arrangement.
- ☐ Finally the gear arrangement is coupled with the generator.



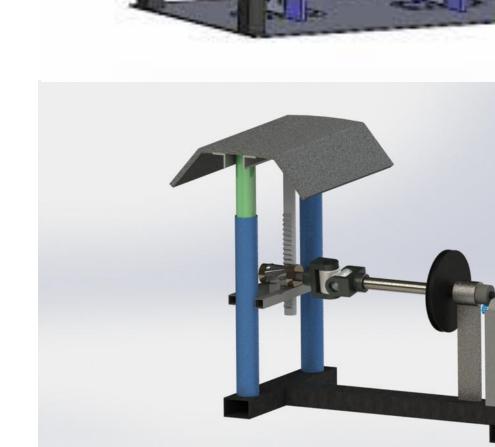


Fig. 2. Flowchart of the Implemented system

Fig. 3. Project Photo

## RESULTS & DISCUSSION

#### > CONCLUSION

- ☐ After studying, it can be concluded to use wasted energy and generate electricity.
- ☐ By doing proper arrangement we may generate high power electricity from road traffic.

#### > <u>DISCUSSION</u>

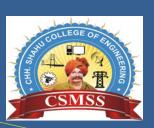
- ☐ This method provides an efficient way to generate electricity from the kinetic energy of moving vehicles in roads, highways, parking lots etc.
- ☐ Advanced WPT: Enhance wireless charging efficiency (>90%) and range (up to 30 cm) for broader EV adoption.



- □ Participated in IGNITE 2025 DESIGN INNOVATE COMPETITION.
- ☐ Participated in AVISHAKAR EVENT in 2023-24

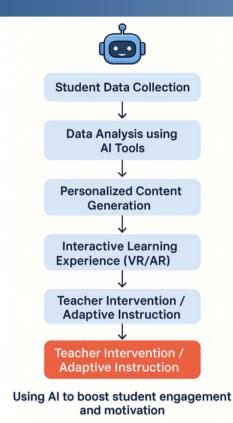
#### "Boosting Student Motivation through AI in Education"

Author Name: S.Kirti Shobhita (student) & Dr. Kavitha Thakur(Guide), Asst professor from St Mary's College.



#### **Dept. of Commerce**

#### **INTRODUCTION & OBJECTIVE**



- Artificial Intelligence (AI) is transforming the education sector by enhancing learning experiences, personalizing instruction, and improving student outcomes.
- This study aims to explore how AI-based tools impact student engagement and motivation by offering interactive, personalized, and data-driven educational solutions.

**Flowchart** 

#### DATA, METHODS & RESEARCH

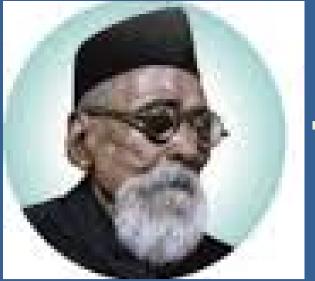
The foundation of AI in education relies on collecting diverse types of data such as:

- Student performance metrics
- Engagement logs from AI-based platforms
- Behavioral and interaction data (clicks, time spent, etc.)
- Application of machine learning algorithms to analyze student engagement patterns.
- Implementation of natural language processing (NLP) to enhance accessibility and feedback mechanisms.
- AI tools were evaluated for their ability to deliver personalized learning, improve content delivery, and automate administrative tasks.

#### **RESULTS & DISCUSSION**

- Increased engagement with interactive tools (e.g., VR history lessons, AR science simulations).
- Personalized pacing and content boosted motivation in students who struggled with traditional methods.
  - Challenges identified:
  - 1. Data privacy concerns
  - 2. Dependence on technology
  - 3. Cost and resource limitations

- Enhanced personalization led to improved student motivation.
- Teachers saved time through automation of administrative and grading tasks.
- Developed a framework for ethical and responsible AI integration in classrooms.
- Contributed to scalable, equitable access to quality education through technology.



# MAHARSHI KARVE STREE SHIKSHAN SAMSTHA'S CUMMINS COLLEGE OF ENGINEERING FOR WOMEN, NAGPUR

## LOCKING AWAY CARBON: NATURE'S SILENT GUARDIAN



#### INTRODUCTION

Due to the fast pace of industrialisation and globalisation, number of ndustries and vehicles in cities is getting increased.



It ultimately results in causing air pollution and various health issues (Asthma, cancer and respiratory diseases)





#### GOAL/SOLUTION

**SIMPLE** 

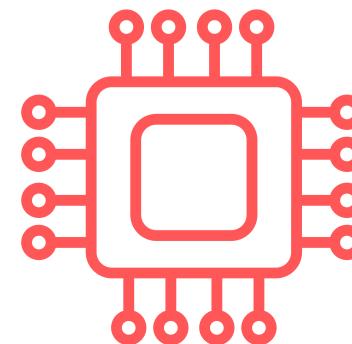


EFFECTIVE + EFFICIENT + ECONOMICAL





#### **ABSTRACT**



Here, I have tried to develop an innovative hardware solution for Locking away the unburnt carbon present in the atmosphere mainly with the help of my Electronics knowledge.

#### SURVEY

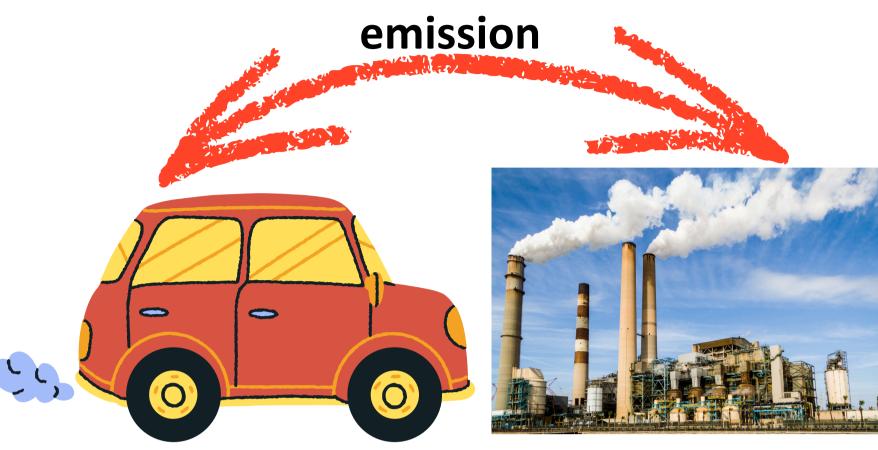






#### METHODS AND MATERIALS

There are majorly two sources of carbon



Please have a look at the below given pictures







#### **COMPONENTS REQUIRED**

- Peltier Plate Module
- MQ-135 Gas Sensor
- Inlet and Outlet fan
- PVC pipe like structure
- HEPA filters
- Air conditioning
- Solar Panel
- Battery

#### **DISCUSSION**

## PELTIER PLATE MODULE

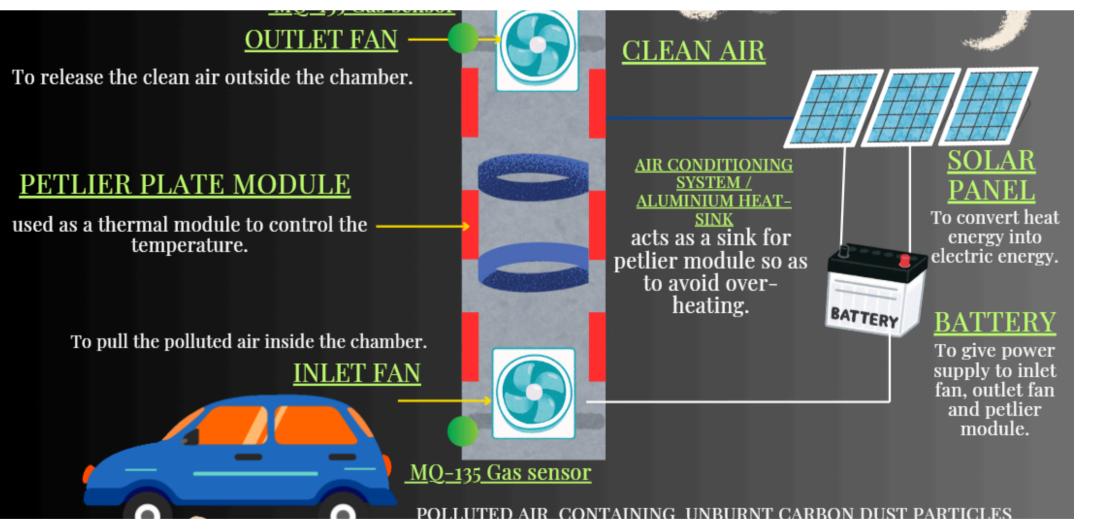
It is basically a thermoelectric module which has both heating and cooling effect in a single module.

## MQ-135 GAS SENSOR

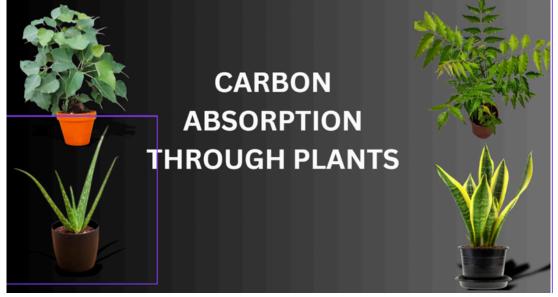
It detects the presence of carbon containing gases present in the atmosphere.

INSTALLATION
LOCATION OF
PROJECT ie, ON
THE DIVIDERS
OF ROAD





**CIRCUIT DIAGRAM AND WORKING** 





#### **ADVANTAGES**

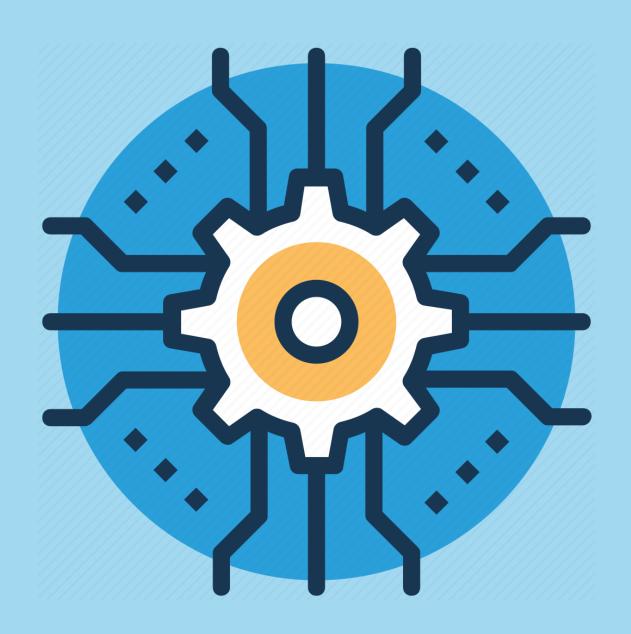
- Cost efffective.
- Reduces air pollution.
- Simple Structure.
- Simple operation.
- Reduces health problems.
- Requires less space.
- Operates on solar panel so, no external power supply is needed to operate it.

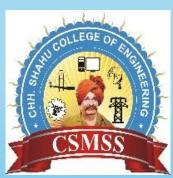
#### **FUTURE SCOPE**

- The collected carbon particles can be sold directly to the cosmetic industry, beverage industry, pharmaceutical industry, etc.
- We can use the similar concept in chimnies of industries by doing certain modifications in it so as to reduce the industrial carbon pollution.
- The accumulated carbon can be collected and dumped deep inside the earth, which further gets converted into coal and fossil fuels.

#### RESULT

Reduce carbon contents present in air at both gaseous and particle level. It will ultimately result in declining number of health issues.





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