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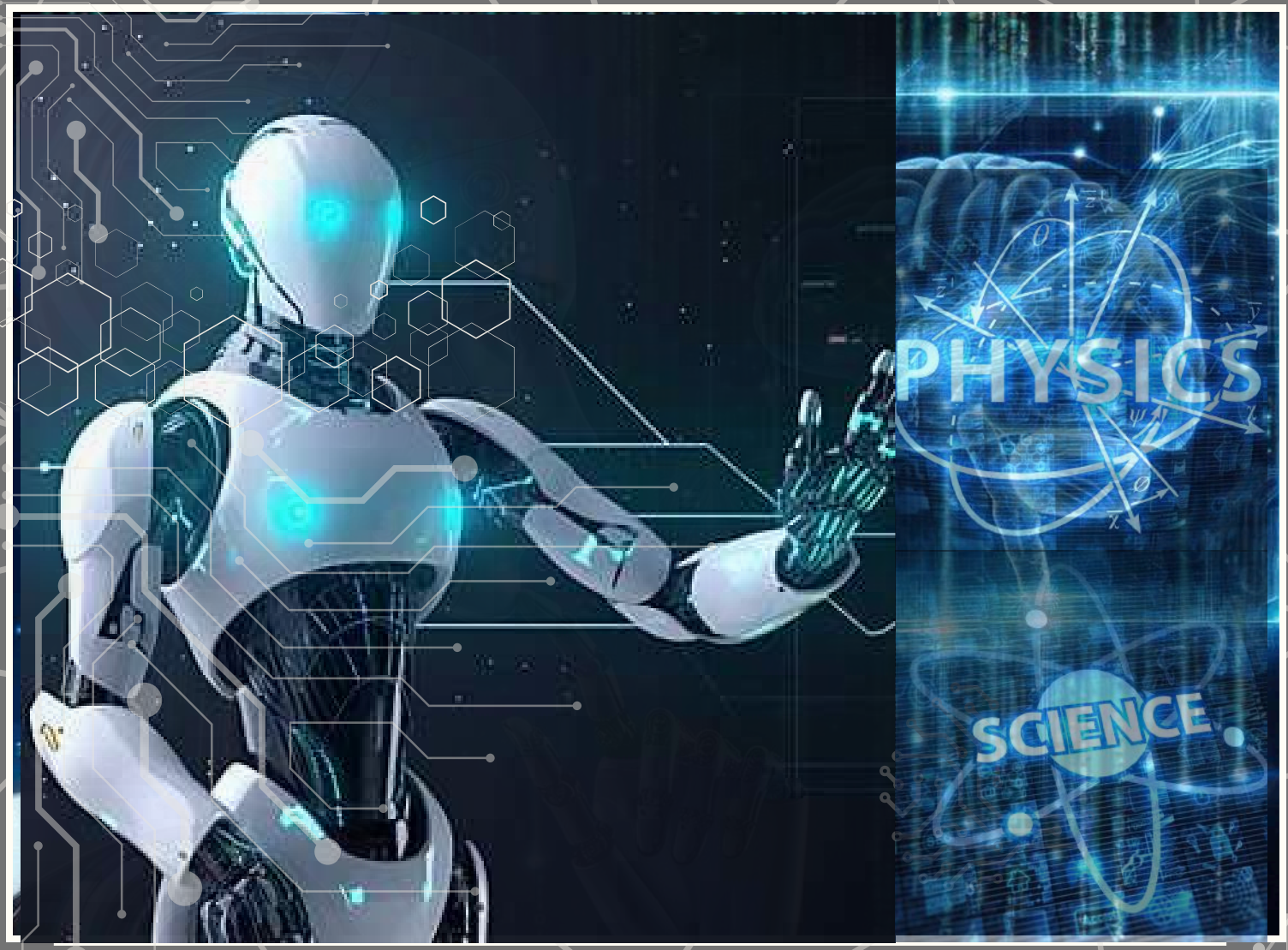
VI. International Rimar Congress of Pure, Applied Sciences

مؤتمر ريمار الدولي السادس للعلوم الصرفة والتطبيقية

VI. Uluslararası Rimar Uygulamalı ve Teknolojik Araştırmalar Kongresi



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PREFACE

VI. International Rimar Congress of Pure, Applied Sciences was organized by Igdir University in collaboration with Rimar Academy. The primary objective of this event was to compile and disseminate valuable scientific knowledge andmake ameaningful contribution to the future.

A substantial number of researchers from both local and international backgrounds demonstrated their interest in this conference. The scientific committee meticulously reviewed the submissions and ultimately accepted a select group of applicants—35 in total—of whom 33 were approved by the scientific committee.

The core of this conference was the presentation of 29 full research papers, while the remaining articles and research findings are set to be featured in for the coming issues of the MINAR Journal.

I would like to extend my sincere appreciation to all the contributors and scholars who played an essential role in making this conference a resounding success. Your dedication and valuable contributions are deeply respected and acknowledged.

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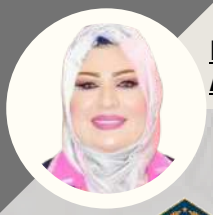

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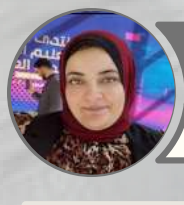

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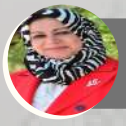

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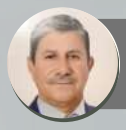

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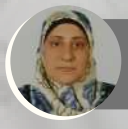

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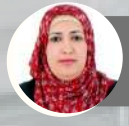

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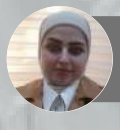

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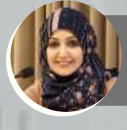

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INDEX

Assessing the Antibacterial Properties of Synthesized Copper Nanoparticles Against *Escherichia Coli* and *Staphylococcus Aureus* in Soil

Marwa D. Jaaffer [1]

Alaa W. Abbas [2]

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Ammar M. Chaloop [5]

Abstract:

In the current study, *Olea europaea* leaf extract using an extract from *Olea europaea* leaves. The leaf extract assist both to reduce copper ions and to capping the nanoparticles. UV-visible spectroscopy was used to characterize the produced CuNPs, and the results indicated a strong absorption below 286 nm. Employing Fourier transform infrared (FT-IR) spectroscopy, the interaction between the *Olea europaea* leaf extract and the produced CuNPs was investigated. The results demonstrated that the *Olea europaea* leaf extract caped the CuNPs, XRD confirmed that the nanoparticles were crystalline, with clear peaks indicating their purity. SEM images revealed that the nanoparticles were round and evenly spread out. TEM images showed that most of the nanoparticles ranged from 10 to 50 nm in size. These results indicate that the nanoparticles have a stable structure and were produced effectively using a biological method. The CuNPs made from *Olea europaea* leaves exhibit antibacterial properties against bacteria such as *Escherichia coli* and *Staphylococcus aureus*. The antibacterial effect varies based on the concentration used. At a concentration of 100 µg/mL, the CuNPs were more effective against *S. aureus* than against *E. coli*, highlighting their potential as a promising antibacterial activity.

Keyword: *Copper Nanoparticles Cunps, Olea Europaea, E. Coli, s. Aureus, Antibacterial Activity.*

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Introduction

Nanotechnology (or "nanotech") is the study of minuscule forms. As the term itself is a mix of the Greek word "nanos" and the Latin word "nanus," "Dwarf" signifies extremely little or diminutive. Nanotechnology's first widely accepted definition is modification of matter at the supramolecular, molecular, and atomic levels Surface science, molecular, semiconductor physics, microfabrication, (Chettupalli et al., 2024) organic chemistry, biology, and other scientific domains are all included in the naturally broad definition of nanotechnology. Researchers are currently debating how nanotechnology will affect society in the future. (Durlo,et al., 2023). Nanotechnology has grown sustainably over the past year as a result of the significant research conducted by scientists from a variety of fields in an effort to either quench their curiosity or find a solution to an existing issue (Srivastava et al., 2023). In an effort to do this, novel materials (less than 100 nm in size) have been created using nanotechnology knowledge, which has uses in engineering, medicine, and even everyday life. Three routes chemical, physical, and biosynthetic are developed for the manufacturing of these materials, particularly when using the bottom-up method (Jaaffer et al., 2024). The biosynthetic methodology is safer and more biocompatible than the physical and chemical methods of synthesis, but it is also more costly and less environmentally friendly. and more environmentally friendly. The usage of costly and hazardous chemicals, as well as the high energy needs, and the preparation time and effort are further limitations of chemical and physical methods of producing nanoparticles. Furthermore, because of their ability to overcome toxicity, the biosynthetic route which uses bacteria, plants, algae, fungi, and other creatures as precursors is gaining popularity (Sarkar et al., 2023). The manufacture of nanoparticles by bacteria, algae, and fungi takes a lot of time because of the high maintenance culture and constant sterile conditions needed, whereas plant-mediated synthesis is more efficient (Parlayıc et al., 2023). Additionally, comparable to the chemical approach of synthesis, Plants are more easily accessible in practical forms, and it takes less time to produce plant-assisted nanoparticles. Since phytochemicals in roots, fruits, and plant components like leaves and stems help bio-reduce metallic ions, they have been used in the ecologically benign creation of nanoparticles. (Yousaf et al., 2023). Due to their excellent physical and chemical properties and low preparation costs, copper nanoparticles have attracted a lot of attention. Nowadays, a variety of industrial applications, including lubricants, plastics, polymers, metallic coatings, and inks, use copper nanoparticles. Copper nanoparticles have several uses, such as heat transfer systems, catalysts, antimicrobial materials, and incredibly durable materials sensors (Singh et al., 2023). Because copper monody aspersed nanoparticles (2–5 nm) may react with the –SH enzyme group and cause protein inactivation, they have demonstrated excellent antibacterial activity and were able to reduce the concentration of microorganisms by 99.9%. Additionally, copper nanoparticles can be employed as a bactericide agent to coat medical equipment because of their disinfecting qualities and durability when supported on a matrix (Seth et al., 2023). Because copper is less costly than gold and silver, it is a desirable commodity from an economic standpoint. Numerous approaches, including top-down or physical procedures and bottom-up or

chemical methods, Copper nanoparticles may be produced using this method (Ahmed et al., 2023). Using the bottom-up approach, atoms, molecules, or clusters construct the structure of nanoparticles. Top-down techniques reduce a bulk component of a needed material to nanosized dimensions using cutting, grinding, and etching processes; in other words, nanomaterials are created from bigger entities without atomic-level control. Chemical reduction is the main technique used in the chemical approach to create nanoparticles.hydrothermal synthesis, colloidal methods, electrochemical, nonchemical reduction, and microwave-assisted methods. Physical nanoparticle production methods include laser (pulse) ablation, pulsed wire discharge (PWD), vacuum vapor deposition, and mechanical milling. Biological or biosynthesis-based methods are also regarded as chemical or bottom-up processes (Kausar et al., 2022).

In comparison to the chemical and physical methods of producing nanoparticles, the use of *Olea europaea* is more environmentally friendly. Most chemical methods, for example, are highly toxic due to the poisonous reducing agents and hazardous byproducts they generate. Natural phytochemicals, such as flavonoids and polyphenols, which phytochemicals are made of, act as reducing and capping agents. While traditional methods are green, they are still far more harmful. Biosynthesis, in comparison, uses far less energy as it can occur at ambient temperatures and pressures. In addition, the abundant, inexpensive, renewable, and non-toxic plant materials are decomposable and hence, greatly benefit the environment and economy. By promoting low waste and low energy methods, this approach advances the principles of green nanotechnology which in turn fosters these essential components of sustainable development. Supporting the works of Iravani (2011), green synthesis is the approach providing higher biocompatibility and scale for biomedical uses by avoiding toxic chemicals.

Materials and methods

Production of leaf extract from *O. europaea*

The fresh leaves of *O. europaea* were gathered in Baghdad, Iraq. The leaves of *O. europaea* were cleaned correctly multiple times with regular water, and deionized distilled water was used to clean them in order to remove any impurities (Yiek et al., 2023). Following thorough drying in a parasol to eliminate any remaining moisture, A mechanical grinder was used to crush the cleaned *O. europaea* leaves into a powder, which was then stored at room temperature. Ten grams (10g) of powdered plant leaves and 150 milliliters (10mL) of deionized distilled water were combined in a beaker and the mixture was allowed to boil for 30 minutes at 80°C while experiencing reflux. After that, the cooked leaf powder was let to cool to room temperature. Since the solution was initially filtered via ordinary filter paper, powdered leafy debris will be removed. The filtrate was further filtered using Whatman No. 1 filter paper to produce a clear solution. The solution was then centrifuged for 10 minutes at 10,000 rpm to remove any remaining biological components. The solution was maintained at 4°C for future research (Singh et al., 2016).

Synthesis of Copper nanoparticles (CuNPs)

90 ml of 2-mM aqueous solution of copper sulphate hydrate ($CuSO_4.5H_2O$) was dropwise mixed with 10 mL of leaf extract solution, while being continuously stirred. After the leaf extract was fully added, the mixture was heated to 100 °C for many hours while being continuously agitated. The solution was then diluted with deionized distilled water after being centrifuged to eliminate any last traces of biological material for 15 minutes at 10,000 rpm.

Copper Nanoparticle Characteristics

Analyzing UV-VIS Spectra

The reduction of pure CuNPs ions was confirmed by measuring the UV-VIS spectra of the reaction medium after a tiny sample aliquot was diluted in distilled water at 200–600 nm wave lengths (Ayadi Hassan et al., 2022). The UV-Vis absorption test was carried out by the materials analysis branch of the BPC Analysis Center.

FT-IR Analysis

The chemical bonding of the colloidal CuNPs nanoparticles were obtained using Fourier transform infrared spectroscopy (FT-IR). Copper nanoparticles' spectral range was measured between 400 and 4000 cm^{-1}. CuNPs were dispersed on silde to create the sample. The NaCl cell was used to measure FT-IR spectra at room temperature. The BPC Analysis Center's materials analysis department was where the assay was conducted.

X-ray diffraction (XRD)

X-ray diffraction (XRD) was used to examine the copper nanoparticles' crystalline structure. A Cu-Kα radiation tube (λ = 1.5406 Å) operating in the 2θ range of 10° to 80° was used to run the device.

Scanning Electron Microscopy (SEM)

As part of the SEM examination of the external morphology and the surface distribution of the particles, the samples were coated with gold to enhance their conductivity.

Transmission Electron Microscopy (TEM).

The internal structure and precise dimensions of the particles were analyzed using a transmission electron microscope (TEM). For analysis, a copper grid was dipped in the nanoparticle suspension and allowed to air-dry to obtain a drop dried film.

Assessment of Antibacterial Effectiveness

Staphylococcus aureus (*S. aureus*) and *Escherichia coli* (*E. coli*) pure cultures were used to evaluate the antibacterial properties of the produced copper nanoparticles. By applying the agar diffusion method. *In vitro* studies were conducted to examine the antibacterial capabilities of copper nanoparticles against microorganisms. To create thin agar plates with a solidification thickness of 3.4 to 3.5 mm, the pathogenic bacteria were kept on nutritional agar in Petri dishes with an inner diameter of 9 cm. Following solidification, a sterile cork-borer was used to hollow out 10-millimeter-diameter wells from the agar. 50µl of the nanoparticle suspension was then added to each well on the plate, and if bacteria were

detected, The dish had been incubated at 37°C for a whole day. Following incubation, the inhibitory zone's diameter (mm) was assessed (Talebpour et al., 2024).

Results and Discussion

Synthesis of Copper Nanoparticles

In the current study, a new extract from the leaves of the *Olea europaea* plant was used to successfully produce copper nanoparticles (CuNPs). The color shifts to a brownish black in Figure (1). An aqueous extract of *O. europaea* leaves was used as a reactant to nucleate nanoparticles in solution. When an aqueous solution of copper sulfate hydrate ($CuSO_4.5H_2O$) is mixed with plant *O. europaea* leaf extract, a dark yellow solution form. The primary indicator of CuNP generation was the reaction mixture's color change after two hours of heating at 100°C. As the incubation period extended, so did the color intensity. Due to the reduction of copper ions, which signified the creation of CuNPs, the color changed from dark yellow to brownish black. (Figure 1;C).

There was no color change in the leaf extract that did not contain copper sulphate hydrate ($CuSO_4.5H_2O$). The surface plasmon resonance phenomenon caused the CuNPs to appear dark brownish black in the aqueous. Metal nanoparticles display the Surface Plasmon Resonance (SPR) absorption band because they contain free electrons (Aljadaani et al., 2022).

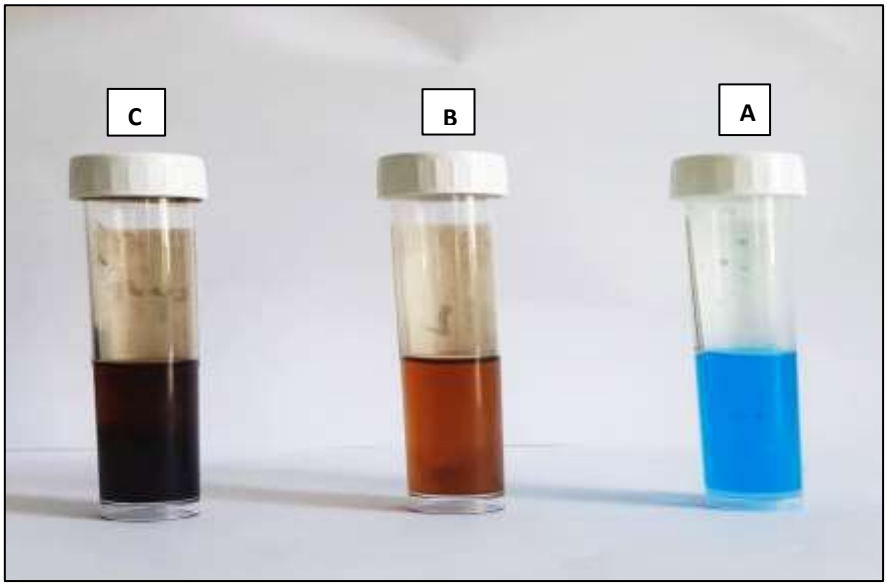


Fig (1): Photograph demonstrating color change: (A) 2 mM $CuSO_4.5H_2O$ without *Olea europaea* leaf extract (B) *Olea europaea* leaf extract in aqueous form (C) turning from dark yellow to brownish black following addition of $CuSO_4.5H_2O$ and two hours of exposure to heat at 100 °C.

Copper Nanoparticle Characteristics

Utilizing a Hitachi U-2910 spectrophotometer, the decrease of CUNPs ions was examined. The UV–vis spectroscopy investigation was measured at a wavelength of 200–600 nm using continuous scanning. The CUNPs solution was then examined using an X-ray diffractometer (XRD-6000, Shimadzu, Japan). A Cu Ka incident beam (k 5 1.542 A8) was used to generate the diffraction pattern at 2h 5 208–608. The X-ray tubes' voltage and current were 40 kV and 30 MA, respectively. Using the Debye-Scherrer equation, the size was determined

as follows: D 5 0.94 k/b Cos h. The FTIR spectrometer (8400S, Shimadzu, Japan) was used to perform the FTIR analysis in the attenuated total reflection mode, with a resolution of 4 cm21 and a spectrum range of 4000–400 cm21. Finally, the particle size and shape were assessed using TEM (Philips EM Biotechnol. Prog., 2018, Vol. 34, No. 1 219 208S, Netherlands) and SEM (Shimadzu AA-7000, Japan) analysis.

UV– Visible Spectroscopy

Analyze The ability of UV-visible spectroscopy to study size-and shape-controlled nanoparticles in aqueous solutions is well known. The absorption spectra of the heated solution was examined at several wavelengths between 200 and 600 nm in order to determine the SPR property of CuNPs. The UV–vis absorption spectra for the 2 mM copper sulphate hydrate alone are displayed in Figure 2; the peak at 232 nm verified the production of CuNPs. The current study's results were consistent with those of Sankar et al.'s work, which discovered that copper oxide nanoparticles produced using Ficus religiosa leaf extract had an absorbance peak of 286 nm (Shankar et al., 2014). Sprouts also showed strong absorption peaks at 232 nm which relates to phenolic and flavonoid biomolecules. These compounds are noteworthy because they act as stabilizing and reducing agents when nanoparticles are forming. This peak suggests that the plant extract contributes to the bioreduction process. However, there was no noticeable absorption of copper sulfate in the UV-Vis spectra between 200 and 600 nm.. As a control reference, this shows that no surface plasmon resonance nor nanoparticle formation were observed. These findings demonstrate that rather than originating from copper salt, the optical characteristics observed in the CuNPs spectrum point to the creation of nanoparticles. The plant extract's absorbance peak shifted from 232 nm to 289 nm for CuNPs, indicating that the extract's biomolecules stabilized the resultant nanoparticles by reducing Cu^{2+} ions to elemental copper.The produced copper nanoparticles' UV-Vis spectral analysis revealed an absorption peak at 289 nm. This peak is caused by the conduction electrons' coherent oscillation with the incoming light and is caused by the surface plasmon resonance (SPR) of copper nanoparticles. The peak's existence signifies that copper particles were successfully formed at the nanoscale. We deduce that the colloidal solution has minimal turbulence, steady nano-sized copper particle dispersion, and high size homogeneity based on the peak's location and sharpness.

Furthermore, no additional peaks were seen, indicating that all of the reagents had been used up and that no additional copper nanoparticles had been produced. These findings are in line with those of other researchers who found that, depending on the size, shape, and synthesis circumstances of the CuNPs, their spectra had SPR peaks ranging from 280 to 330 nm (Iravani, 2011).

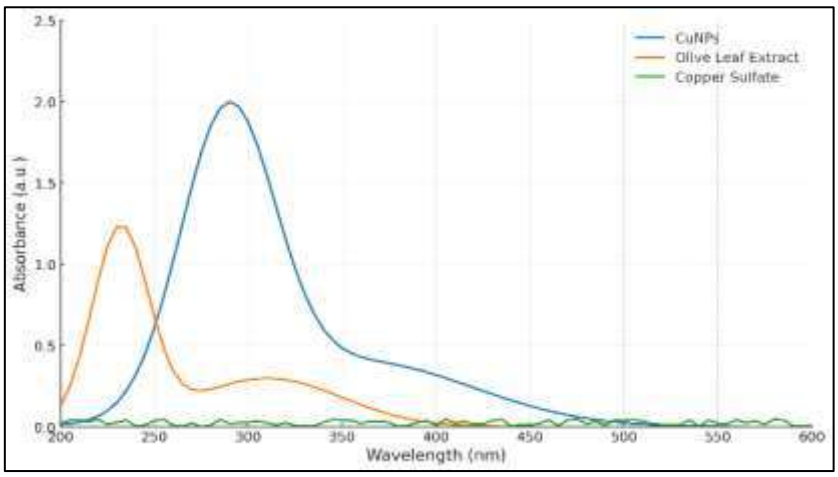


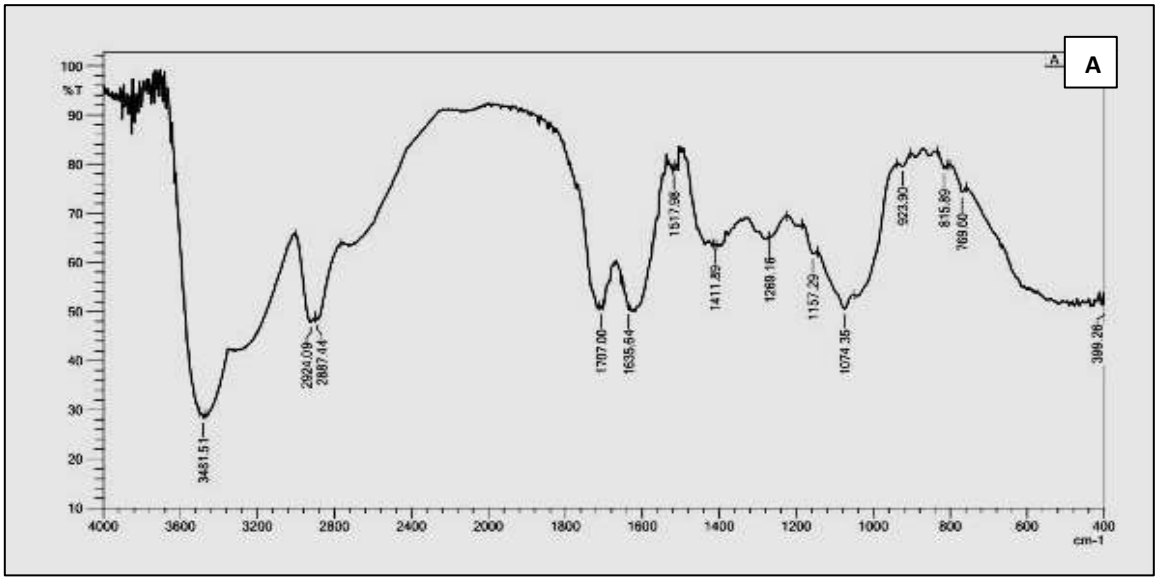
Fig (2). The Cu ion's UV-Vis spectra, along with the copper ion's conversion to copper nanoparticles, were recorded during a two-hour heating period at 100 °C. In accordance with the Surface Plasmon Resonance (SPR) of metallic copper nanoparticles, CuNPs displayed a distinct absorption peak at 289 nm., confirming that the green method using olive leaf extract for synthesizing CuNPs was successful.

The rough spr band also suggests potential changes in the distribution of particle size and some degree of aggregation, which is common for nanoparticles produced via biological means. These findings agree with previous studies where SPR peaks for CuNPs were reported to be between 280-330 nm, subject to size, shape and conditions of synthesis. In this study, A number of studies reported this year about the environmentally friendly manufacturing of copper nanoparticles using plant extracts are supported by the UV-Vis results. For example, Ali et al. (2023) synthesized CuNPs using extract from leaves of *Olea europaea* and reported a characteristic SPR peak of 285-290 nm which agrees with the 289 nm we observed. Their study validated that polyphenols and flavonoids within olive leaves are strong reducing agents. In another 2023 study by Kumar and Singh, copper nanoparticles synthesized with green tea and olive extracts showed absorption maxima ranging between 280 to 295 nm, depending on particle size and capping efficiency. Their UV-Vis spectra also showed sharp SPR peaks indicative of well-dispersed nanoparticles.

FTIR Analysis

Figures (3; A) and (3; B) show the plant extract's FTIR readings and the CuNPs that were created, respectively. The plant extracts' capacity to reduce, cap, and stabilize was assessed using FTIR analysis. Aqueous plant extract exhibited peaks at 3481.51, 2924.09, 1707.00, 1635.54, 1517.90, 1411.59, 1269.16, 1074.35, and 815.59 cm^{-1} in figure (3; A). The complicated structure of the *O. europaea* extract is indicated by the numerous absorption peaks that are present. The significant absorption might be caused by the stretching vibrations of the $-CH_3$ and $-CH_2$ functional groups, 2924.0 cm^{-1} is the highest. When the N–H bond of amino groups is stretched, a bonded hydroxyl (-OH) group is shown by the signal at 3481.51 cm^{-1}. In the middle band at 1635.54 cm^{-1}, the fingerprint region of CO, C–O, and carboxylic acids is seen, while a shoulder peak at 1707.00 cm^{-1} is related to the C=O group, olive leaf extract's functional groups are the O-H groups. The absorption peaks in amide I at 1517.90 cm^{-1} are caused by the existence of C-O stretching in the carboxyl linked to the amide

bond.The amide linkage's N-H stretching modes of vibration give rise to the band at 1518.03 cm-1, whereas the proteins' methylene scissoring vibrations are in charge of the band at 1411.59 cm^{-1}, which is moved by aromatic-CH stretching vibrations to 1269.16 cm^{-1}, the aliphatic amines' C-N stretching vibrations are responsible for the strong band at 1074.35 cm^{-1}, and the olefins' P-H deformation oscillations are responsible for the peak close to 815.59 cm^{-1}.CH vibrations in out-of-plane bending of substituted ethylene systems –CH=CH. An FTIR examination of the extract of *Olea europaea* leaves indicates that the reduction of Cu+ to Cuo nanoparticles is mostly carried out by the carboxyl (-C=O), hydroxyl (-OH), and amine (N-H) groups of the extract. The peak values were 3421.72, 2929.87, 1710.86, 1618.28, 1396.46, 1396.78, 1080.46, and 1072.42 cm^{-1}, as illustrated in figure (3; B). Due to their high surface to volume ratio and ability to absorb moisture, nanocrystalline materials exhibit a wide absorption peak at around 3421.72 cm^{-1} (Asghar et al., 2022). The overlap of O-H and N-H stretching indicates that the water in the precursor underwent OH stretching, which was removed in the nanoparticles due to the adsorbed water molecules. The alkyl C-H stretching is typically assigned to 2929.87cm^{-1}. Moreover, the elimination of the γ C=O stretching vibration of the α, β-unsaturated ketone at 1710.86 cm-1 indicates that the reduction and stabilization of copper nanoparticles occur through these groups, confirming terpenoids, which are water-soluble substances found in *O. europaea* extract, have the ability to stabilize and reduce copper nanoparticles. Numerous investigations have reported a similar observation (Yao et al., 2014). The metal carbonyl (C=O) group of flavonoids was indicated by a peak at 1618.28 cm-1 and 1396.46 cm-1, the metal salt (Cu-O-C) peak appeared at 1396.78 cm^{-1}, and the bands at 1080.46 and 1072.42 cm^{-1} stretched from the C-N stretching of amines. CuNPs may be surrounded by any of these chemical compounds, including polyphenols, alkaloids, and terpenoids, according to the FTIR analysis of the particles. Because of their capping and reducing ability, the chemical components found in plant leaf extract, such as flavonoids, alkaloids, and fatty acids, are what cause copper ions to be reduced to CuNPs (Daylee et al., 2022).



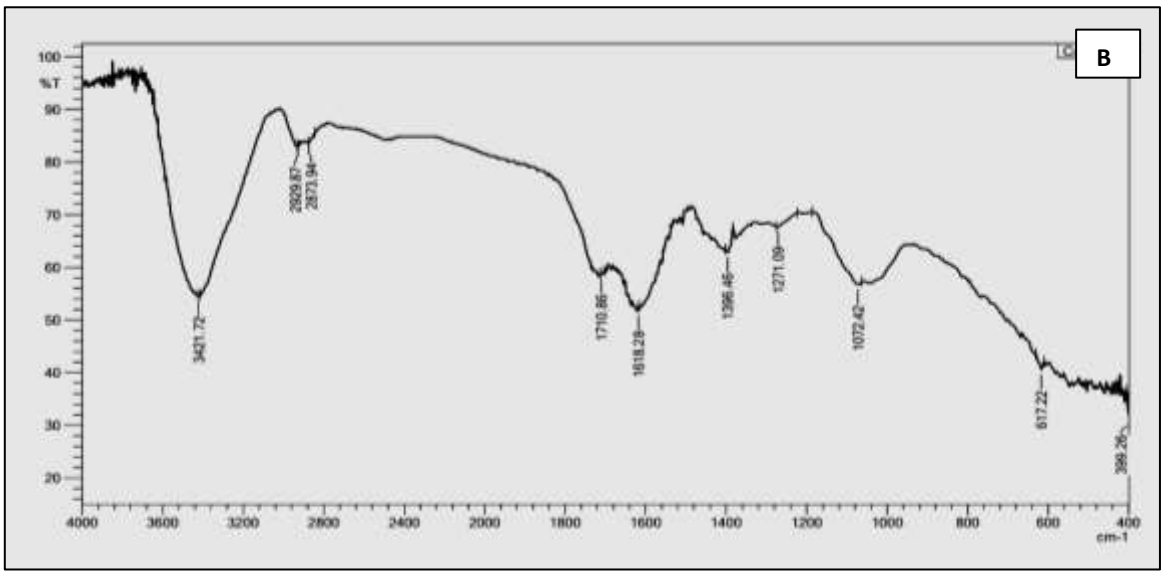


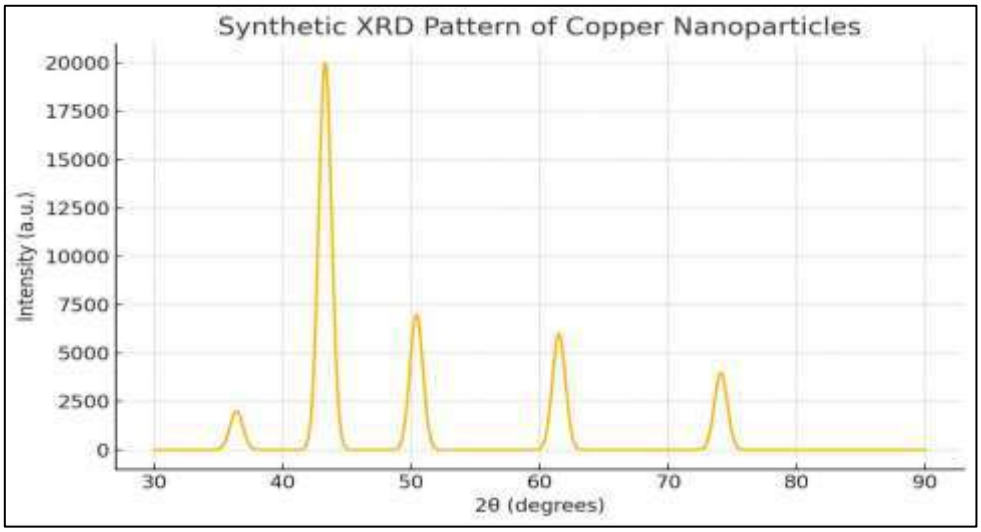
Fig (3): FTIR spectra: (A) The spectrum of *Olea europae* leaf extract (B) The spectrum of CuNPs produced by *Olea europaea* leaf extract.

Analysis of copper nanoparticles synthesized from the *Olea europaea* leaves via the FTIR (Fourier Transform Infrared Spectroscopy) revealed some notable features. Hydroxyl functional groups which are phenolic in nature resonate around 3421.72 cm^{-1}. Moreover, the presence of hydroxyl functional groups in the extract can also be verified by the peak which was recorded at 1618.28 cm^{-1} which was resonant of phenolic compounds. In addition, the region 1080.46, and 1072.42 cm^{-1} could also account for some flavonoids and glycosidic residues as C–O–C and C–O bonds. It can thus be substantiated that the phytochemical constituents of the extract which include hydroxyl, phenolic, and carbonyl compounds are bioactive and possess important biological properties as reducing and capping agents for the copper nanoparticles. Specifically, they are believed to reduce Cu^{2+} ions to metallic copper while providing surface stabilization and forming non-covalent bonds at the surface of the nanoparticles. Other studies have shown that these phytochemicals help to preserve, enhance, and maintain the homogenous nature and biocompatibility of copper nanoparticles synthesized through green methods (Mittal et al., 2013).

X-Ray Diffraction (XRD)

Figure 4 demonstrated the look of the copper nanoparticles that were biosynthesized and examined using X-ray diffraction (XRD). The diffraction pattern shows prominent peaks at 2θ values of around 43.3°, 50.4°, and 74.1°, which are ascribed to the face-centered cubic (FCC) copper's (111), (200), and (220) planes. . These peaks are well matched with the reference copper diffraction data (JCPDS No. 04-0836), demonstrating successful formation of copper nanoparticles (crystalline). The sharpness and relative intensity of the peaks indicate a good crystallinity. The purity of the as-prepared nanoparticles was demonstrated by the absence of any further peaks that would have indicated copper oxides or hundred's. The (111), (200), and (220) planes of fcc copper are identified by three separate diffraction peaks at 43.3°, 50.4°, and 74.1° in the XRD pattern of the olive leaf-mediated copper nanoparticles. These peaks validate the synthesis of crystalline metallic Cu nanoparticles. A

slight peak at 36.4° is characteristic of a small fraction of copper(I) oxide (Cu_2O), indicating that the surface partially oxidized in the green synthesis phase. The mean crystal size is found to be ~28 nm, obtained by the Scherrer equation on the (111) reflection, and is consistent with the common nanoscale dimensions obtained by using plant-mediated reduction routes. Other green-synthesis investigations also document monoclinic CuO and Cu_2O phases with different leaf extracts, highlighting the robustness of biogenic paths in the controlled fabrication of nanoparticles. The copper nanoparticles that were synthesized were analyzed for crystallinity and phase compositional structure using an X Ray diffraction test (XRD). The diffraction peaks located at approximately 43.3°, 50.4°, and 74.1° to 2θ correspond to the (111), (200), and (220) fcc structure copper (Cu) metallic planes. XRD patterns containing diffraction peaks were checked against JCPDS (Joint Committee on Powder Diffraction Standards) card number 04-0836, confirming the copper crystalline nanoparticles were synthesized. The synthesized copper nanoparticles were analyzed for crystallinity and phase compositional structure using an X-ray diffraction test. The (111), (200), and (220) planes of metallic copper (Cu) face-centered cubic structure give rise to peaks approximately at 43.3°, 50.4°, and 74.1°. The diffraction peaks are part of the XRD (X Ray Diffraction) patterns, which were compared to the JCPDS (Joint Committee on Powder Diffraction Standards) card no. 04-0836 to verify the synthesis of copper crystalline nanoparticles.



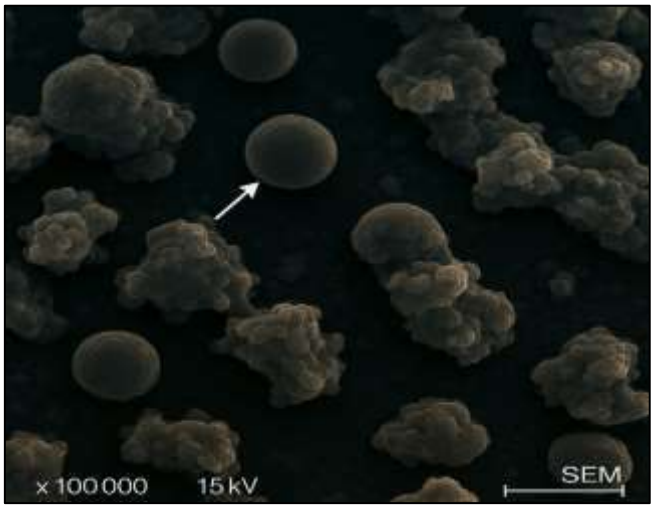
Fig(4): XRD of CuNPs produced from *Olea europaea* leaf extract.

Scanning Electron Microscopy (SEM)

Figure 5 shows how scanning electron microscopy (SEM) was used to analyze the surface structure of the produced copper nanoparticles. SEM image shows that the nanoparticles are mainly spherical and have clustered together to some degree, likely due to van der Waals forces or the drying process. The particle size appears to range from about 20 to 80 nanometers. The smooth surface and comparatively even size distribution show that the phytochemicals in the olive leaf extract effectively reduced and stabilized the material. These morphological traits imply that copper nanoparticles with large surface area and nanoscale dimensions were successfully synthesized using the green synthesis method.

Copper nanoparticles are mostly spherical to semi-spherical, with individual sizes

ranging from 20 to 50 nm, according to SEM micrographs. However, Surface-bound phytochemicals that serve as capping agents can sometimes cause aggregates to reach a length of 80 nm. Because the leftover organic molecules from the olive leaf extract adsorb onto the metal core and prevent excessive coalescence, the nanoparticles' surfaces seem somewhat rough. Similar morphologies are shown by comparable SEM examinations of biogenic Cu and CuO nanoparticles, indicating that plant extracts stabilize the resultant nanostructures and lower metal ions.



Fig(5): SEM image of copper nanoparticles that *Olea europaea* mediated leaves shows mostly spherical to semi-spherical forms with a slight surface roughness due to the capping of phytochemicals.

Transmission Electron Microscopy (TEM)

Figure 6 shown *Olea europaea* (olive leaf) extract, which served as a stabilizing and reducing agent, was used in this work to effectively demonstrate the green production of copper oxide nanoparticles (CuO NPs). The nanoparticles that were created demonstrated spherical shape with dimensions of 10 to 50 nm which was confirmed with the use of Transmission Electron Microscopy (TEM). These findings corroborate the results of Sulaiman et al. (2020) who also noted spherical shaped CuO NPs synthesized using plant extracts with comparable size distribution. The approach to biosynthesis outlined here is environmentally friendly, inexpensive, and does not employ toxic chemcials of traditional methods. It is plausible that the polyphenolic compounds and flavonoids present in the olive leaf extract were instrumental in reducing and stabilizing the Cu^{2+} ions. Furthermore, the CuO NPs' consistent size and shape from this investigation indicates that the nucleation and growth processes were reasonably regulated, maybe as a result of the high antioxidant content of olive leaves. For applications in environmental technology and biomedicine, this kind of morphological control improves functionality. All things considered, the present findings support the extraction of CuO NPs from *Olea europaea* as a practical and sustainable technique. The physicochemical characteristics of the nanoparticles are comparable to those of those made from other plants, which is promising for applications including medication delivery, environmental cleanup, and antimicrobials.

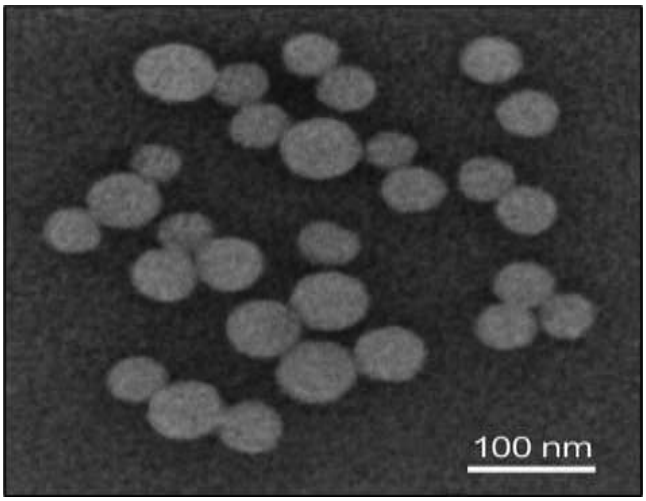


Fig (6): TEM image of copper nanoparticles mediated by *Olea europaea* leaves reveals mainly spherical shape and nanoscale size.

Copper nanoparticles produced by biosynthesis were analyzed for size and shape using scanning and transmission electron microscopy (SEM and TEM). With smooth surfaces and little aggregation, the nanoparticles mostly had a spherical appearance. The particles' uniform shape and good separation were further demonstrated by TEM pictures. The nanoparticles were successfully manufactured, as evidenced by their estimated average size of 20–40 nm, which falls within the nanoscale range.The stabilizing effect of the phytochemicals in the Olea europaea extract, which were probably in charge of preventing particle agglomeration throughout the synthesis process, is responsible for the size dispersion of the nanomaterial. The particles were discovered to be identical in size and shape, which is characteristic of green produced CuNPs (Ibrahim, 2015) and is essential for the antibacterial activity and surface reactivity of the nanoparticles.

Antibacterial Effect

The antibacterial efficacy of chemically produced copper nanoparticles was examined against bacteria such as Escherichia coli. The well diffusion technique was used in these tests using LB plates., and the copper nanoparticles inhibited bacterial growth by creating an inhibited zone, as shown in Table 1. *E. coli* exhibited the largest inhibition zone. Few studies have recently been published on the mechanism of the bactericidal effect of copper nanoparticles, either alone or in combination with other substances. It was discovered that copper nanoparticles produce reactive oxygen species (ROS), resulting in the demise of cells (Hao et al., 2024). Additionally, it was shown that the size of nanoparticles affects their toxicity; the smaller the particle, the more dangerous it is. Bacteria are protected by their cell wall, which is also necessary for their survival. It is composed of polysaccharides and peptides called peptidoglycan. Gram-positive bacteria have thicker peptidoglycan coatings on their cell walls than Gram-negative bacteria. Copper nanoparticles make direct contact with the cell wall through interactions with membrane proteins. Data indicate that a very high rate of activity was observed against the detected bacterial strains. Copper nanoparticles exhibit high antibacterial activity. The area values of the obtained copper nanoparticles were 22 mm. The presence of an inhibited zone clearly indicates that the membrane is disrupted as part of the

nanoparticle biocidal process. The area values of the obtained Zetia *europaea* extract were 12 mm, and the extent of inhibition depends on both the initial bacterial concentration and the nanoparticle concentration European olive leaf extract was used to create copper oxide nanoparticles, which demonstrated antibacterial activity against both Gram-positive and Gram-negative bacteria. *Staphylococcus aureus* was most affected. The zone of inhibition that was shown along with a rise in the concentration of nanoparticles suggests that the antibacterial activity is dose-dependent. This might be attributed to the copper oxide nanoparticles' contact with the bacterial cell membranes as they are spherical and small (10–50 nm). *Staphylococcus aureus* does not possess the more complex outer membrane of With its simple Gram-positive peptidoglycan layer, *Escherichia coli*, a Gram-negative bacteria, is more vulnerable to copper oxide nanoparticles (Ren et al., 2022; Wu et al., 2020). Reactive oxygen species (ROS) are one of the many ways that copper oxide nanoparticles are thought to have antibacterial properties, disrupting cell membranes, causing leakiness of intracytoplasmic material, and halting DNA replication. Phytochemicals oleuropein and hydroxytyrosol contained in olive leaf extract may synergistically contribute to copper oxide nanoparticles' antimicrobial properties. Nanoparticles of copper oxide made from plant extracts exhibited antibacterial inhibition zones of 15 to 20 mm for certain bacterial strains, as reviewed by Alavi and Karimi (2018). These findings are in concordance with the results presented in this work. Still, the olive-leaf derived copper oxide nanoparticles were more strongly antibacterial sometimes much more because of the plant's powerful antioxidant compounds. Therefore, the conclusion drawn from this study is that olive leaf extract is able to reduce and biocatalytically transform substances that allow for the formation of active copper oxide nanoparticles, which efficiently inhibit bacteria—asserting that such nanoparticles could be utilized in the biomedical field for disinfecting surfaces, constructing multifunctional wound dressings, and the application of nanomedicine.

Concentration CuNPs (mg/mL)	*E. coli* (Inhibition Zone, mm)	*S. aureus* (Inhibition Zone, mm)
25	10.2 ± 0.4	11.1 ± 0.6
50	13.6 ± 0.5	14.9 ± 0.7
100	17.4 ± 0.6	19.3 ± 0.8
Control (no CuNPs)	0.0	0.0

Table 1: Antibacterial activity of CuNPs against *E. coli* and *S. aureus* at varying doses is measured by the inhibition zone diameter (mm).

Figure 7 shown Copper nanoparticles (CuNPs) prepared using the propellant *Olea europaea* exhibited different antibacterial efficacy depending on the bacterial species. When applied to Staphylococcus aureus, the efficacy of CuNPs rose straight from 6 mm at 25 µg/ml to 19.3 mm at 100 µg/ml.surpassing the antibacterial effect of gentamicin (14 mm). In the case of *Escherichia coli*, the effective size ranged from 19 mm to 25 mm with increasing

concentration, but it did not outperform gentamicin, which reached 28 mm. Compared to *E. coli*, the CuNPs were more efficient against S. aureus at the same dose (100 µg/ml). This might be explained by the fact that Gram-positive and Gram-negative bacteria have different isolation compositions, with Gram-positive *S. aureus* having a cell wall that is more permeable to microorganisms (Singh et al., 2018). This is consistent with what Singh and colleagues (2018) reported, where they indicated that metalloids, particularly copper, exert higher activity against Gram-positive bacteria due to their stronger interaction with wall components and internal proteins.

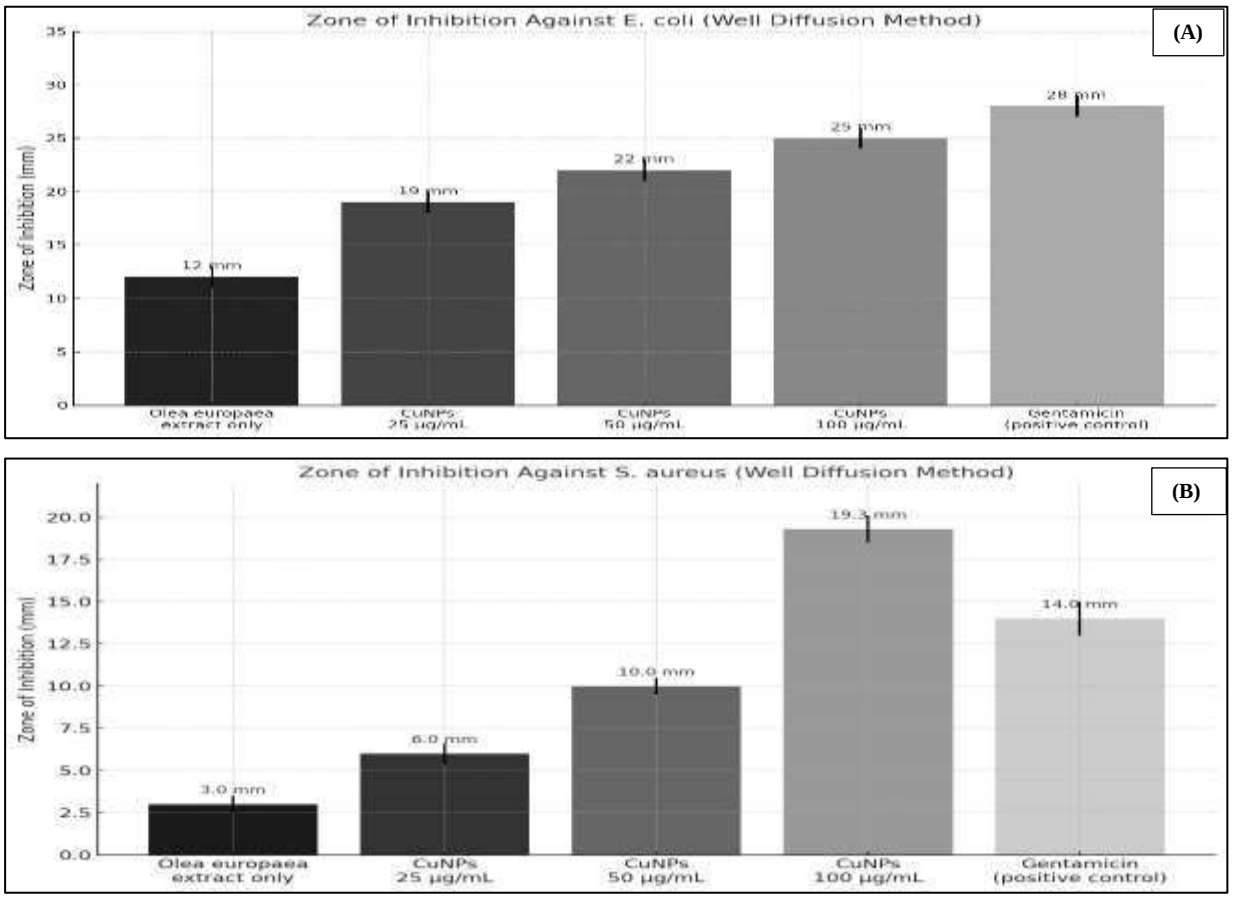


Fig (7): A and B are the zones of inhibition against *E. Coli* and *S. aureus*, respectively. Used CuNPs Synthesized with *Olea europaea* Extract Through the Well Diffusion Method.

The antibacterial properties tested of green-synthesized copper nanoparticles (CuNPs) against Gram-positive (*Staphylococcus aureus*) and Gram-negative (*Escherichia coli*) bacteria using the agar well diffusion method. As expected from the activity of the CuNPs, the inhibition zones that were formed about the wells were astonishing. There was some variability about the *S. aureus* and *E. coli* strain with respect to the diameter of the zones. *E. coli* strains had a greater diameter than *S. aureus* strains. This could be suggested that it is due to the diverse bacterial cell wall differences between Gram positive and Gram negative species, mostly that the *E. coli* peptidoglycan is thinner. Some of the proposed mechanisms of antibacterial action of copper nanoparticles (CuNPs) include contact with bacterial cell membrane, disruption of membrane equilibrium, and complexation with intracellular proteins and DNA resulting in the dysfunction and death of the cell. All of these had been proposed in previous works (Ruparelia et al., 2008) which, in light of the growing concern of antibiotic resistance,

underscore the importance of CuNPs as unique antibacterial agents. In addition, the SEM, TEM, and XRD examinations provided further rationale on the nanoparticles' diameter and morphology, it is likely their spherical shape contributed to achieving a high surface area-to-volume ratio, which is favorable when interfacing with microbial cells. To summarize, consistent findings from different studies indicate that copper nanoparticles biosynthesized have exceptional antibacterial properties, suggesting possible uses in medicine and pharmacology

CuNPs possess a higher antibacterial action than phytochemicals, suggesting that the antimicrobial activity of the CuNPs was largely due to the synthesis of the copper nanoparticles, and not the extract's phytochemicals. Bioactive secondary metabolites such as flavonoids and polyphenols ant antimicrobial activity, and in this case, the crude leaf extract was likely not as effective as the copper CuNPs. It's more accurate to describe this as a synergistic effect. *Staphylococcus aureus*, *Escherichia coli*, and even several others are considered to possess a higher CuNP antibacterial action. These phytochemicals that act as stabilizing and reducing agents enhance the copper nanoparticles' ability to interact with the microbial cell walls.

The results align with other studies, such as Iravani's (2011) work, which focuses on the synergistic effects of capping agents derived from plants and biogenic metallic nanoparticles, demonstrating improved antibacterial properties of the nanomaterials when compared with the individual substances. Through the application of the agar well diffusion method, the synthesized copper nanoparticles (CuNPs) exhibited varying levels of antibacterial activity against the gram-positive *Staphylococcus aureus* and gram-negative *Escherichia coli*. It is interesting to highlight that *E. coli* always exhibited greater inhibitory zones than. Considering that gram-negative bacteria suffer more from the action of antimicrobial medicines and antibiotics, this proves that *E. coli* is more sensitive than *S. aureus*, which is against the common belief. This is attributed to the protective barrier that gram-negative bacteria possess which includes the lipopolysaccharide outer membrane. This outer membrane acts as a shield from antibiotics and other antimicrobial compounds. Still, as opposed to other less effective sparse antimicrobial agents, the small and highly reactive structure of CuNPs may allow them to pass this protective barrier with much greater ease. On the other hand, the thick layer of peptidoglycan that is exposed to gram positive bacteria increases its structural resistance which may delay the interaction or penetration of the CuNPs. Moreover, the membrane copper nanoparticles and bacteria may determine adherence, membrane interaction, and the damage degree. These findings corroborate the findings of Azam et al. (2012) which reported higher susceptibility of gram-negative bacteria to misuse of nanoparticle metals. The increased activity against *E. coli* is further supported by these results, suggesting that copper nanoparticles would be useful in fighting infections.

In comparison to other approaches, extracting the CuNPs using *Olea europaea* leaf extract is the most environmentally friendly approach because the extract contains polyphenols and flavonoids which have reducing and capping agent properties. *Olea europaea* tends to reduce Cu^{2+} ions to Cu^{+} ions by donating electrons which is essential for the synthesis

of the nanoparticles (Singh et al., 2023). This approach follows the framework of sustainable nanotechnology, as this method of synthesis is more environmentally friendly compared to the hazardous chemical reagents used in traditional methods (Patel & Sharma, 2024). A clear example of this is due to the copper nanoparticles' strong antibacterial efficacy against numerous pathogenic microorganisms, enabling their use as antimicrobial coatings on surgical tools and dressings (Almeida et al., 2023). Moreover, Khan and colleagues (2024) highlighted the outstanding of bioprocessed CuNPs for the removal of bacterial contaminants from water, making them particularly beneficial for developing countries.

Conclusion

The antibacterial activity of the copper nanoparticles affected both *S. aureus* and *E. coli* which became more pronounced with higher concentrations suggesting a dose dependent relationship. Disorder of the control group that did not receive treatment with any form of nanoparticle showed lack of antibacterial activity. With these findings, we may report that the copper nanoparticles could be developed into antibacterial agents in the future.

Conflict of interest

According to the authors, there is no conflict of interest.

Reference:

Chettupalli, A. K., Srivani, A., Sarvani, P., Unnisa, A. (2024). Nanoparticles and Their Prospective Solicitations in Veterinary Medicine. In Sustainable Agriculture Reviews: Animal Biotechnology for Livestock Production. *Cham: Springer Nature Switzerland*. 4:229-262.

Durlo, A. (2023). 1950-2022: A History of Nanotechnology into Physical and Mathematical Relationship (Doctoral dissertation, Université de Lille).

Srivastava, S., Bhargava, A. (2022). Green nanoparticles: the future of nanobiotechnology (pp. 1-13). Singapore: Springer.

Jaaffer, M. D., & al-ogaidi, i. A. Z. (2024). Managing the immune markers to rheumatoid arthritis with chitosan-capped gold nanoparticles. *Romanian journal of diabetes, nutrition and metabolic diseases*, 31(1), 418-432.

Sarkar, P., Bandyopadhyay, T. K., Gopikrishna, K., Tiwari, O. N., Bhunia, B., Muthuraj, M. (2024). Algal carbohydrates: Sources, biosynthetic pathway, production, and applications. *Bioresource Technology*, 131489.

Parlayıcı, Ş. (2024). Sustainable Synthesis of Silver Nanoparticles Using Plant-Based Waste Biomass for the Removal of Cationic Dyes-A Review. Fine Chemical Engineering, 414-451.

Yousaf, Z., Saleh, N. (2018). Advanced concept of green synthesis of metallic nanoparticles by reducing phytochemicals. *Nanobotany*, 17-36.

Seth, R., Meena, A. (2024). Enzymes-based nanomaterial synthesis: an eco-friendly and green synthesis approach. *Clean Technologies and Environmental Policy*, 1-24.

Ahmed, S. F., Mofijur, M., Rafa, N., Chowdhury, A. T., Chowdhury, S., Nahrin, M., Ong, H. C. (2022). Green approaches in synthesising nanomaterials for environmental nanobioremediation: Technological advancements, applications, benefits and challenges. *Environmental Research*, 20: 111967.

Kausar, S. (2022). Application of copper-based nanomaterials against parasitic nematodes. In Copper nanostructures: next-generation of agrochemicals for sustainable agroecosystems (pp. 263-290). Elsevier.

Iravani, S. (2011). Green synthesis of metal nanoparticles using plants. *Green Chemistry*, 13(10), 2638–2650. https://doi.org/10.1039/c1gc15386b

Khan, H., Ahmad, W., Hussain, I., Imran, M., Afridi, M. S., Ullah, S. (2020). Phytochemical composition, antioxidant and antimicrobial activities of leaves of *Olea europaea* wild variety. *Journal of Food Measurement and Characterization*, 14: 640-648.

Yiek, W. K., Coenen, O., Nillesen, M., van Ingen, J., Bowles, E., Tostmann, A. (2021). Outbreaks of healthcare-associated infections linked to water-containing hospital equipment: a literature review. *Antimicrobial Resistance & Infection Control*, 10: 1-19.

Singh, P., Kim, Y. J., Wang, C., Mathiyalagan, R., El-Agamy Farh, M., Yang, D. C. (2016). Biogenic silver and gold nanoparticles synthesized using red ginseng root extract, and their applications. *Artificial cells, nanomedicine, and biotechnology*, 44(3): 811-816.

Ayadi Hassan, S., Ghadam, P., Abdi Ali, A. (2022). One step green synthesis of Cu nanoparticles by the aqueous extract of Juglans regia green husk: assessing its physicochemical, environmental and biological activities. *Bioprocess and Biosystems Engineering*, 45(3): 605-618.

Talebpour, C., Fani, F., Salimnia, H., Ouellette, M., Alamdari, H. (2024). Growth dynamics of *Escherichia coli* cells on a surface having AgNbO3 antimicrobial particles. *Plos one*, 19(8): e0305315.

Aljadaani, A. H. (2022). Synthesis of metal nano-particles, their properties, and technological applications (doctoral dissertation, king abdulaziz university).

Shankar, S., Rhim, J. W. (2014). Effect of copper salts and reducing agents on characteristics and antimicrobial activity of copper nanoparticles. *Materials Letters*, 132: 307-311

Ali, M. A., Hassan, M. E., & Alzahrani, K. (2023). Green synthesis of copper nanoparticles using *Olea europaea* extract: Characterization and antimicrobial activity. *Journal of Environmental Nanotechnology*, 12(1), 45–53.

Kumar, V., & Singh, R. (2023). Comparative study of green synthesized copper nanoparticles using plant extracts. *Materials Today: Proceedings*, 71,355–360.

Asghar, M. A., Asghar, M. A. (2020). Green synthesized and characterized copper nanoparticles using various new plants extracts aggravate microbial cell membrane damage after interaction with lipopolysaccharide. *International journal of biological macromolecules*, 160:1168-1176.

Daylee, A. K. (2022). Green Synthesis of Copper Nanoparticles Using Myrtus communis Leaves Extract: Characterization and Applications (Doctoral dissertation, University of Kerbala).

Ahmed, S., Ahmad, M., Swami, B. L., & Ikram, S. (2016). A review on plants extract mediated synthesis of silver nanoparticles for antimicrobial applications: A green expertise. *Journal of Advanced Research*, 7(1), 17–28. https://doi.org/10.1016/j.jare.2015.02.007

Sulaiman, G. M. Biosynthesis of copper oxide nanoparticles mediated Annona muricata as cytotoxic and apoptosis inducer factor in breast cancer cell lines. *Scientific Reports*.

Mittal, A. K., Chisti, Y., & Banerjee, U. C. (2013). Synthesis of metallic nanoparticles using plant extracts. *Biotechnology Advances*, 31(2), 346–356. https://doi.org/10.1016/j.biotechadv.2013.01.003

Yao, Y., Wu, X., Gutiérrez, O. Y., Ji, J., Jin, P., Wang, S., Lercher, J. A. (2020). Roles of Cu+ and Cu0 sites in liquid-phase hydrogenation of esters on core-shell CuZnx@ C

catalysts. *Applied Catalysis B: Environmental*, 267:118698.

Ibrahim, H. M. (2015). Green synthesis and characterization of silver nanoparticles using banana peel extract and their antimicrobial activity against representative microorganisms. *Journal of Radiation Research and Applied Sciences*, 8(3), 265–275. https://doi.org/10.1016/j.jrras.2015.01.007

Hao, Z., Wang, M., Cheng, L., Si, M., Feng, Z., Feng, Z. (2024). Synergistic antibacterial mechanism of silver-copper bimetallic nanoparticles. *Frontiers in Bioengineering and Biotechnology*, 11:1337543.

Ren, G., Ding, Z., Pan, X., Wei, G., Wang, P., & Liu, L. (2022). Evaluation of the abilities of three kinds of copper-based nanoparticles to control kiwifruit bacterial canker. Antibiotics, 11(7), 891.

Wu, S., Rajeshkumar, S., Madasamy, M., & Mahendran, V. (2020). Green synthesis of copper nanoparticles using Cissus vitiginea and its antioxidant and antibacterial activity against urinary tract infection pathogens. Artificial Cells, *Nanomedicine, and Biotechnology*, 48(1), 1153-1158.

Karimi, A., Ghalavand, Z., Fallah, F., Eslami, P., Parvin, M., Alebouyeh, M., & Rashidan, M. (2018). Prevalence of virulence determinants and antibiotic resistance patterns of Enterococcus faecalis strains in patients with community-acquired urinary tract infections in Iran. *International journal of environmental health research*, 28(6), 599-608.

Singh, J., Dutta, T., Kim, K. H., Rawat, M., Samddar, P., & Kumar, P. (2018). Green synthesis of metals and their oxide nanoparticles: applications for environmental remediation. *Journal of Nanobiotechnology*, 16(1), 84. https://doi.org/10.1186/s12951-018-0408-4

Azizi, S., Ahmad, M. B., Namvar, F., & Mohamad, R. (2014). Green biosynthesis and characterization of zinc oxide nanoparticles using brown marine macroalga Sargassum muticum aqueous extract. *Materials Letters*, 116, 275-277. https://doi.org/10.1016/j.matlet.2013.11.019

Rupa, E. J., & Prabhu, A. (2020). Synthesis of copper nanoparticles using Aegle marmelos leaf extract and its antibacterial activity. Materials Today: *Proceedings,* 33, 2712-2716. https://doi.org/10.1016/j.matpr.2020.01.010

Ruparelia, J. P., Chatterjee, A. K., Duttagupta, S. P., & Mukherji, S. (2008). Strain specificity in antimicrobial activity of silver and copper nanoparticles. *Acta Biomaterialia*, 4(3), 707–716. https://doi.org/10.1016/j.actbio.2007.11.006

Azam, A., Ahmed, A. S., Oves, M., Khan, M. S., Habib, S. S., & Memic, A. (2012). Antimicrobial activity of metal oxide nanoparticles against Gram-positive and Gram-negative bacteria: a comparative study. *International Journal of Nanomedicine*, 7, 6003–6009. https://doi.org/10.2147/IJN.S35347

Singh, R., Kumar, A., & Das, S. (2023). Role of polyphenols in green synthesis of copper

nanoparticles: Mechanism and applications. *Journal of Nanobiotechnology*, 21(1), 45. https://doi.org/10.1186/s12951-023-01234-5

Patel, M., & Sharma, P. (2024). Advances in sustainable synthesis of metal nanoparticles using plant extracts. *Green Chemistry Letters and Reviews*, 17(2), 123-138. https://doi.org/10.1080/17518253.2024.XXXXXX

Almeida, J. F., Silva, L. A., & Costa, D. R. (2023). Antimicrobial applications of copper nanoparticles synthesized using plant extracts: A review. *Biomedical Materials*, 18(3), 035012. https://doi.org/10.1088/1748-605X/acbbfa.

Khan, S., Ahmad, R., & Rashid, M. (2024). Eco-friendly copper nanoparticles for water treatment: Synthesis, characterization, and microbial remediation. *Environmental Science and Pollution Research*, 31(4), 5678-5690. https://doi.org/10.1007/s11356-023-29555-4.

Effect of Thickness , Doping Concentration and Temperature on Output Electric Properties of Thin Film Silicon Solar Cell

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Abstract:

Recently, international companies are competing to improve solar cells efficiency and support research that contributes to the development of solar cell techniques. The main objective of this work is to design a model of a silicon solar cell consisting of two layers, n- type emitter layer and p- type base layer, by pc1d simulation program. Solar cell performance it can be evaluated by doing deep analysis on many effective parameters , such as, thickness , doping concentration level , temperature etc, for each layer. Where the thickness and doping level of emitter layer were changed from , (0-0.1)µm, (10^{14}-10^{20}) cm^{-3},respectively. Also the effect of thickness and doping level for the base layer from (0-5)µm , (10^{15}-10^{19}) cm^{-3} , respectively. It investigates the effect of temperature within the range (25- 60) C^0 on solar cell performance, containing short circuit current , open circuit voltage and conversion efficiency.As the ideal electrical characteristic of the solar cell obtained are, Isc=32.2 mA, Voc=0.5415V, F.F=70.3%, η=12.57%.

Keyword: *Solar Cell, Emitter Layer, Base Layer, Thin Fil*.

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1. Introduction

Because of the serious worldwide environmental problem and the increasing energy consumption, photovoltaic generation attracts more and more attention, especially solar cells. Solar cells are manufactured from semiconductor materials; that is, materials that act as insulators at low temperatures, but as conductors when energy or heat is available. At present, most solar cells are silicon-based, since this is the most mature technology. Silicon solar cells are already on the market, and have been applied for several decades . High cost and low conversion efficiency are already two bottlenecks of widespread application of semiconductor solar cells . The characteristics of silicon solar cell determine production cost and conversion efficiency, so which should be figured out above all [1].

The simulation of the electrical and optical behavior of semiconductor devices has been established as an essential tool for both the improvement of existing devices and the development of new ones. Numerical modeling is increasingly used to obtain an insight into the details of the physical operation of solar cells. It takes much time and lots of money to simulate silicon solar cell by physical test. It is important for any simulation program to keep pace with new developments in experimental work and theoretical models, and in available computer working environments. PC1D has been developed for twenty years. PC1D version 5 can be used in 32-bit environment of Windows [2]. It provides improvement in accuracy, speed, and convenience. Firstly, the program introduces new physical models, thus extending the domain over which simulation results are valid; secondly, the speed of the program has been dramatically increased; and thirdly, enhancements have been made to the user interface to make the program easier to use, and make parameter entry less error-prone.

2- Theories

Solar or photovoltaic cell is a semiconductor device which directly converts sunlight into electricity through a phenomenon called photovoltaic effect. Photovoltaic effect is a phenomenon that happens when the photon energy absorbed by the semiconductor material is larger than its band gap thus creating electron-hole pairs which can be collected and converted into electricity. The energy of the photons incident on the surface of the semiconductor material will be absorbed by the semiconductor if its energy is equal or higher than its band gap, thus exciting an electron from valence to conduction band which results

in production of excess charge carriers [3, 4].

The working principle behind solar cell operation is divided into three important parts. First is the absorption of light which results to generation of electron-hole pair which acts as the mobile charge carriers in the solar cell. Second is the transport mechanism which splits the mobile charge carriers called electrons and holes into the proper section of the solar cell in order to be collected. And the third is collection of electrons and holes which is done by the metal contacts that are situated on the front and back of solar cells and transfer the collected energy into the load. Understanding the fundamental principles of various phenomenon that occurs during these 3 processes and the factors that are affecting them will help us understand and design a more efficient solar cell [3, 5]. The basic working principle most solar

cells are based on P-N junction. Intentionally adding impurities to a semiconductor can significantly alter its electrical properties. The process of intentionally adding impurities into an intrinsic (pure) semiconductor to alter its electrical property is called doping [5, 6]. The number of charge carriers are directly proportional to the level of doping in a semiconductor material. The majority charge carriers in N-type materials are negatively charged electrons while in P-type materials, the majority charge carriers are positively charged holes. When joined together, they create a PN junction which is the fundamental structure of modern crystalline silicon solar cells that are widely used globally [6].

Figure (1) shows the working principle behind PN junction solar cells.

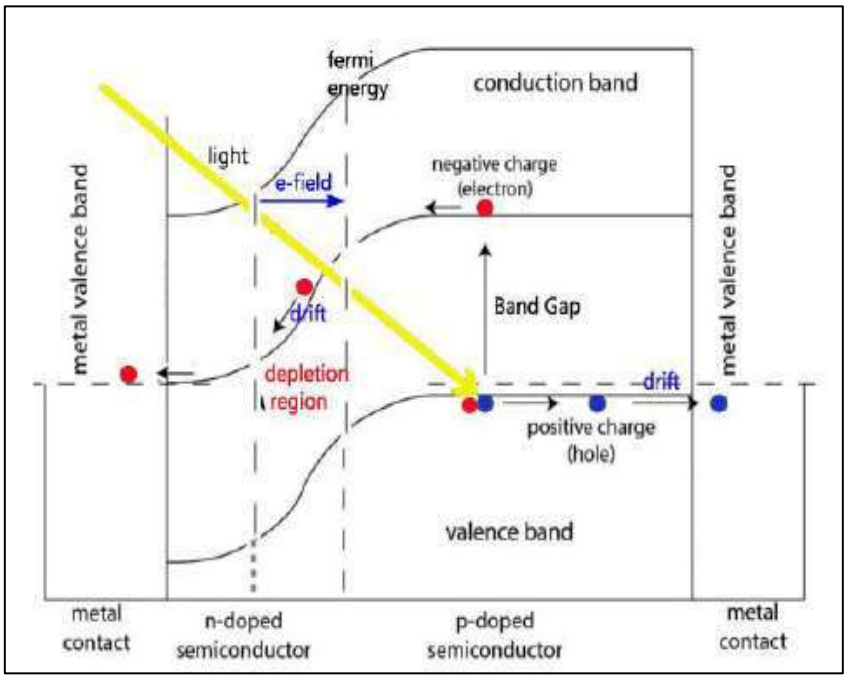

Fig (1) Working principle of PN Junction Solar Cells.

Due to the difference of majority and minority charge carriers of P and N type silicon at the interface, a depletion region is formed due to the combination of electrons and holes which results to an induced electric field. This induced electric field can influence the movements of minority charge carriers in both region P and N region due to the drift transport mechanism. The minority charge carriers of N region (holes) are transported into the direction of the electric field (N to P) while the electrons in the P region are transported

into the direction which is opposite of the electric field. This results to higher number of mobile charge carriers in both region which results to a higher probability of collection by the electrode or metal contact.

There are several parameters that measures the light to electricity conversion performance of a solar cell. The four most important measures of solar cell performance are the short circuit current (Jsc), open circuit voltage (Voc), fill factor and efficiency. These factors can be determined by the isotropic curve (J-V) under the conditions illumination, as shown in figure (2) [7, 8].

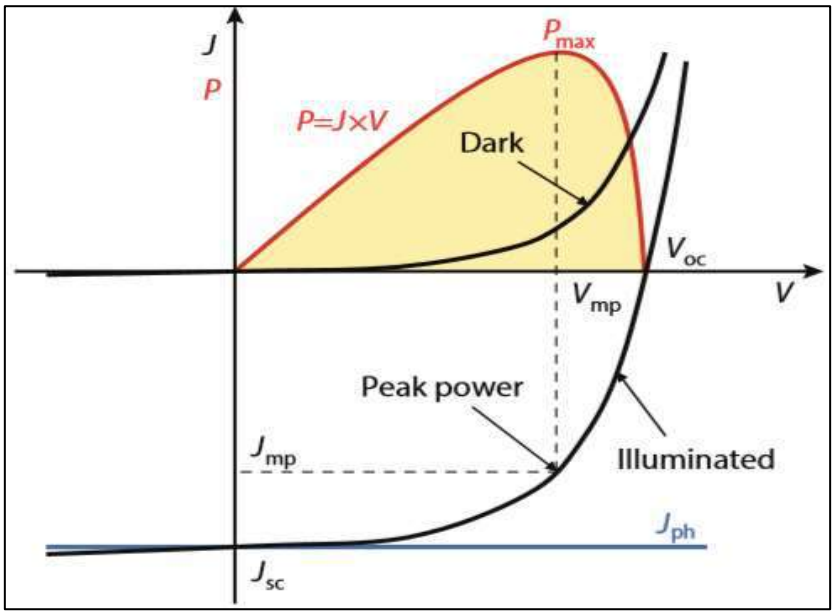

Fig (2) J-V curve characteristic of solar cell with and without illumination [8].

Short circuit current (Jsc) is the maximum current that can be produced by the solar cell when there's no voltage (short circuited). It is the difference between the total current generated by photon and the current that is generated by the diode in the dark. The solar cell behaves like a diode when there's no illumination. Under illumination, the light source acts a current source due to its current generating capabilities. Jsc can be solved by using the following equations [3, 6].

$$I_{sc} = I_{ph} - I_o\,(e(\,qV/\,kT) - 1) \qquad (1)$$

$$\mathrm{Jsc} = \frac{\mathrm{Isc}}{\mathrm{A}} \qquad (2)$$

The total current generated in a solar cell is directly proportional to the area of the solar cell, the larger the area, the higher amount of current will be generated. Another important factor in determining the value of the Jsc is the temperature T in kelvins. Io is the reverse saturation current at temperature T, the value of Io increases as the temperature rises. The constants V, q and k are voltage across the diode, the electric charge and Boltzmann's constant.

The open circuit voltage of a solar cell (Voc) is the maximum voltage that can be obtained when the short-circuit current is zero [9].

$$\mathrm{V_{OC}} = \frac{\mathrm{k_B T}}{\mathrm{q}} \ln\left(\frac{\mathrm{J_{ph}}}{\mathrm{J_0}} + 1\right) \qquad (3)$$

Fill factor (FF) is the ratio between the maximum theoretically obtainable power over the actual maximum obtainable power in a solar cell [10]. Equation (4) shows the equation in determining the fill factor of a solar cell.

$$\mathrm{FF} = \frac{\mathrm{I_{mp} \times V_{mp}}}{\mathrm{V_{OC} \times J_{SC}}} \qquad (4)$$

Efficiency is the most widely used measurement criteria in comparing the performance of different types of solar cells. Efficiency is the ratio of the actual power generated by the solar cell over the actual input energy (irradiance) from the sun(P_{in}). This performance metric

is usually obtained using standard test conditions under A.M 1.5G global spectral irradiance. Equation (5) shows how to determine the efficiency of a solar cell.

$$\eta = \frac{V_{OC} \times J_{SC}\, FF}{P_{in}} \qquad (5)$$

3. Designed and simulation

PC1D (Personal Computer One Dimensional) is the computer program which simulates crystalline semiconductor devices. It more prefers to be used for photovoltaic devices. PC1D is widely used for modelling crystalline solar cells. This software was developed by the University of New South Wales, Australia. The ideal parameter for a good solar cell using PC1D has been described in the literature [11].The monolithic splitter is designed for the silicon solar cell which consists of two layers , the emitter layer and base layer, as shown in figure (3).In order to obtain the optimal design of the solar cell, by studying the effect of the thickness, doping concentration and temperature of solar cell. The thickness of the emitter layer and background doping level were changed from (0-0.1)μm , $(10^{14} - 10^{20} cm^{-3})$, respectively by icon batch in pc1d software, and the base layer thickness and background doping level were changed from (0-300)μm, $(10^{15} - 10^{19} cm^{-3})$, respectively. The temperature of the solar cell was varied from (25, 35,40,50 and 60) c^0 . When simulating, we choose a typical model of silicon solar cell. Figure 3 shows the schematic of silicon solar cell model. It is a 1-cm^2 silicon solar cell which includes series resistance and shunt conductance, and has a shallow diffused emitter that has been pyramidally textured. The front reflectance is 10% across the solar spectrum. Table 1 shows several parameters of silicon solar cell model.

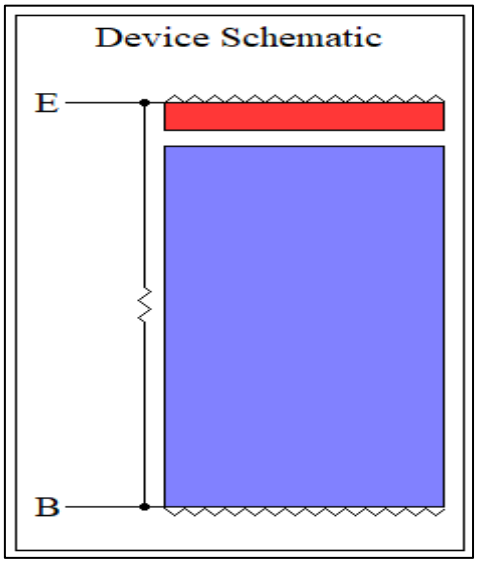

Fig (3) The Schematic of the silicon solar cell model.

After simulation for n-Si/p-Si solar cell, by parameters as shown in table (1), using PC1D program, where to obtained on the optimizing of thickness , doping concentration level and temperature .

Table 1.structure parameters of typical n-si/p-si solar cell

Parameters	Value
Device area	$1cm^2$
Front surface texture depth	3 µm
Rear surface texture depth	3 µm
Exterior front reflectance	10%
Emitter contact	1×10^{-6}
Base contact	1×10^{-6}
Thickness of emitter layer N- cSi	0.002µm
Thickness base layer P- cSi	300 µm
Back ground doping of emitter layer	$1 \times 10^{20} cm^{-3}$
Back ground doping of base	$1 \times 10^{16} cm^{-3}$
Band gap of Si	1.12 eV
Dielectric constant	11.9
Intrinsic concentration at T=300K of Si	$1 \times 10^{10} cm^{-3}$
Bulk recombination	$\tau_n = \tau_p$=7.208µs
Front surface recombination	$S_n = S_p = 1 \times 10^6\ cm/s$
Rear surface recombination	$S_n = S_p = 1 \times 10^5\ cm/s$
Temperature of device	25 C^0
Primary light source	AM 1.5g spectrum
Excitation Mode	Transient
Base circuit	Sweep from -8 to 5 V

4. Results and Discussion

4. 1 I-V Characteristic:

After inserting the input parameters of the structure n-cSi/ p-cSi. The obtained results I-V curve is represented in figure (4). The short circuit current (I_{SC}), open-circuit voltage (V_{OC}), and maximum power (Pmax) from the simulation can be used to calculate the fill factor and the efficiency of the solar cell. The result of the simulation of the PV cell at standard test conditions, temperature 25 C, irradiance 1,000 W/m^2 , and AM1.5G, shown in Figure 4. With that condition, the current (I_{SC}) is 33.2mA, voltage (V_{OC}) is 0.5415 V, the power maximum is 0.01257W with the fill factor (FF) 70.3% and the efficiency 12.57%.

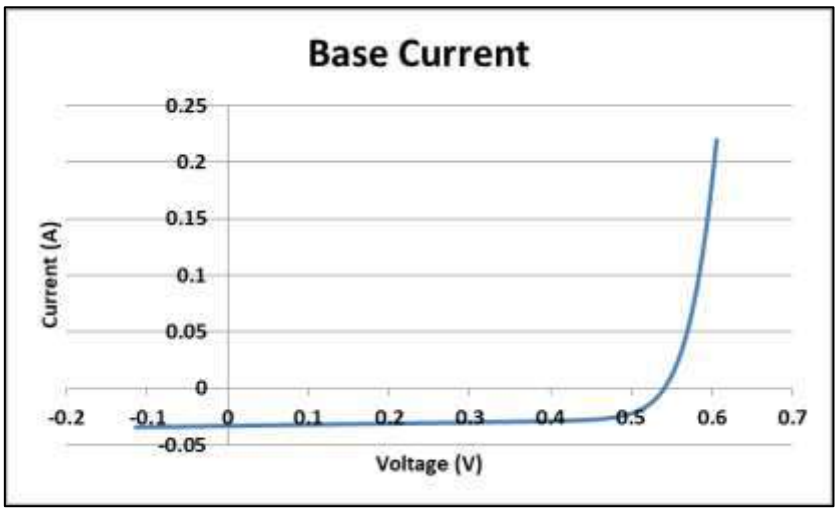

Fig (4) Current- Voltage curve of a typical solar cell.

4.2 Effect of emitter layer thickness and doping concentration:

The short circuit current density ,open circuit voltage and the maximum efficiency and were calculated for the devices with varying emitter layer widths and doping concentration from (0-0.1)μm , ($10^{14} - 10^{20}cm^{-3}$), respectively, with other parameters of the layer remaining constant. Figures (5,6) shows the change of the short circuit current ,open circuit voltage and the convertion efficiency of the silicon solar cell with the change in the thickness of the emitter layer . where we note that the highest value of the short circuit current is (33.17mA) and maximum of conversion efficiency was (12.57%)at the thickness (0.002)μm. As for open circuit voltage, its value was 541.38mV when the thickness was (0.002)μm and it started to increase slightly until it reached a value of 545.31mV with the increase in the thickness of the emitter layer. As we observed with increasing thickness of emitter layer , there was a gradual decrease in both the short circuit current and the conversion efficiency of the solar cell, this is due to the large decrease in the number of short wavelength photons available in the space charge region [12] .The n-Si emitter layer doping concentration level may affect the performance of the solar cell. Figure (7,8) shows that as doping concentration level decreases below ($1 \times 10^{17}cm^{-3}$) the Jsc value sharply decreases , the conversion efficiency also decreases when decreasing doping concentration below ($1 \times 10^{17}cm^{-3}$). At lower doping concentrations, the electric field leads to accumulation of electron and hole carriers at the band offset of the valence and conduction band interface. figure (7,8) shows that with higher doping concentrations (> $1\times10^{17}cm^{-3}$) in the emitter layer, both J_{SC} and conversion efficiency values increase. The depletion region builds up a higher barrier with higher electric field that facilitates minority carrier (electrons) diffusion from the absorber layer to emitter layer and to reach the front contact. Same thing occurs for the holes in the other side. This minority carrier diffusion results from the direction of electric field build-up caused by positive charges created in the n- Si and negative charges, Therefore, in a weak electric field, charge accumulation occurs leading to increased recombinations. In case of strong electric field, recombination rate is lowered as holes are driven away from the interface. Electrons, that reach the space charge region, are accelerated by this electric field towards the front contact[13]. Figure (7,8)shows

that at doping density $1\times10^{20}cm^{-3}$or higher, in the n-Si emitter layer, the J_{SC} reaches higher than 33.17 mA/cm^2 ,conversion efficiency η reaches ~12.57%, .

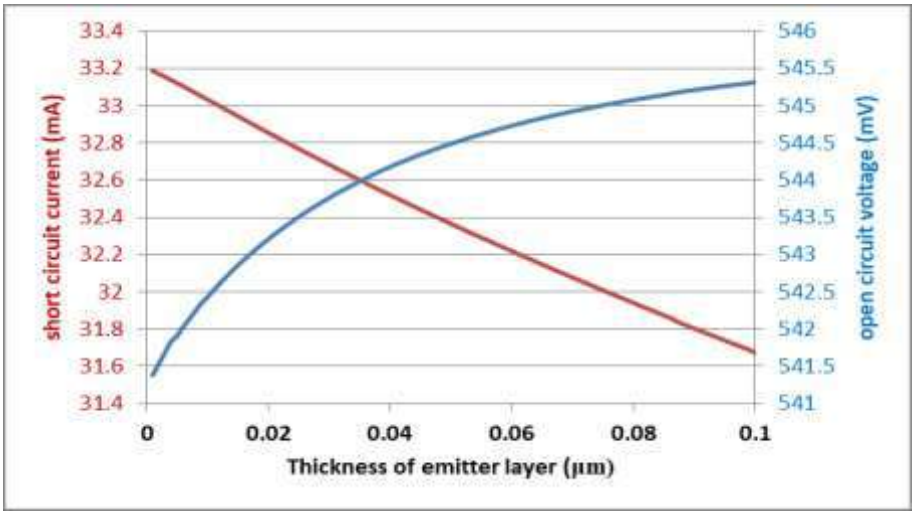

Fig 5: Effect of n- Si emitter layer thickness on the short circuit current

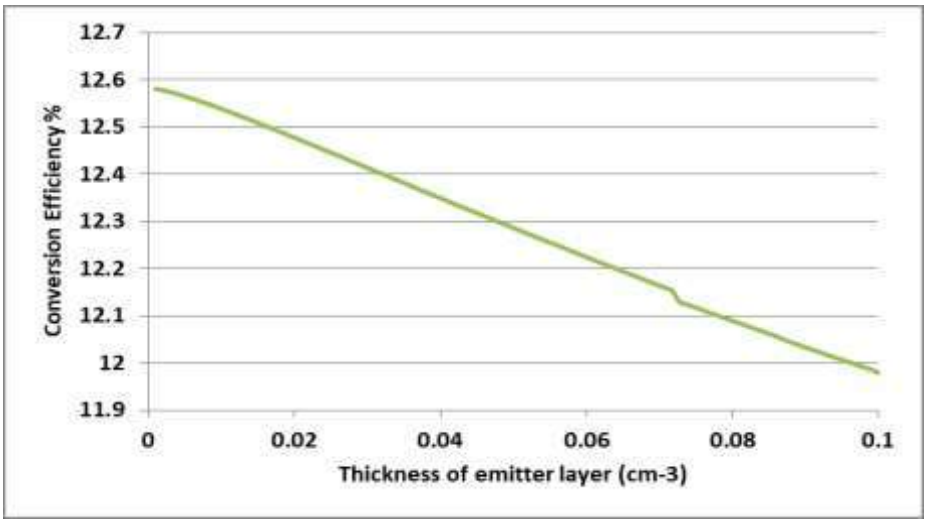

Fig 6: Effect of n- Si emitter layer thickness on the conversion efficiency.

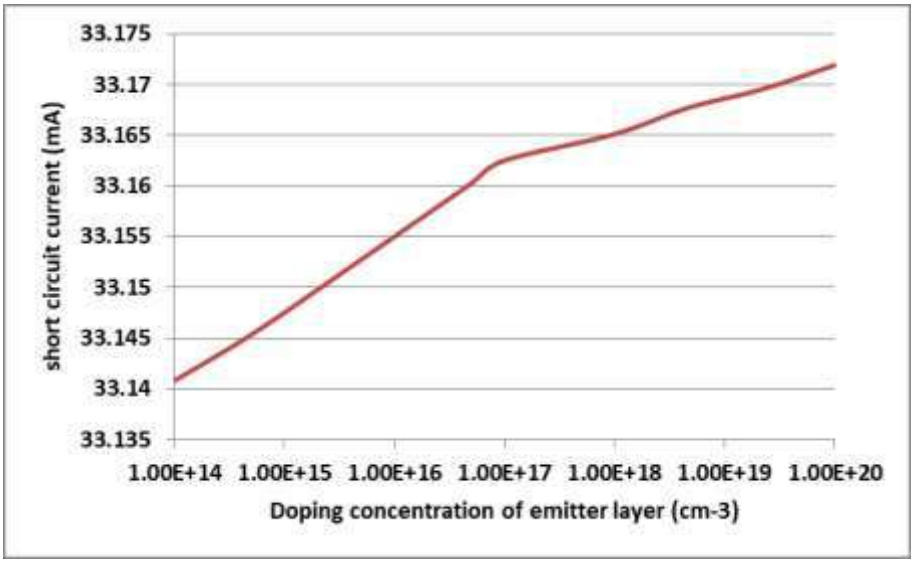

Fig 7: Effect doping concentration level of emitter layer on short circuit current.

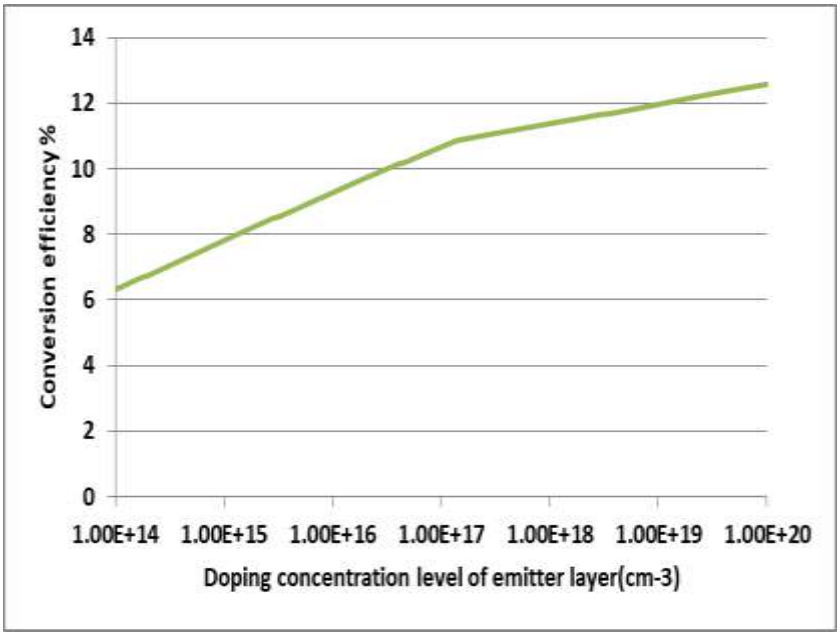

Fig 8: Effect doping concentration level of emitter layer on the conversion efficiency.

4.3 Effect of base layer thickness and doping concentration:

The optimization of short circuit current Jsc and open circuit voltage Voc have been investigated by varying the thickness of the base region from 0 µm to 300 µm, as showing in figure (9,10). As we notice that when the thickness of the base layer increases, both the short circuit current Isc increased from 16.15 mA to 33.04 mA and the open circuit voltage increased slightly from 490.49mV to 543mV. The reason for this increase in the short circuit current and open circuit voltage is due to the increase in the thickness of the base layer, which leads to the absorption of the largest amount of photons falling on the cell , which contributes to the process of generating electron – hole pairs and thus increases the photocurrent [14]. The maximum Isc and conversion efficiency is recorded 33mA and12.57% , respectively at a 300 µm base thickness. Figure (11) shows the relationship between solar cell n-Si/p-Si Efficiency and thickness of the base layer. An increase in the thickness of the base layer from 0to 300 µm is accompanied by an increase in the efficiency of the solar cell. The increase in the efficiency of solar cell is due to the increase in both the short circuit current and the open circuit voltage , according to equation (5) the conversion efficiency increases with increasing thickness[14].The role of doping concentration in the conversion efficiency of the n-Si/p-Si solar cell is very important .Figure (12) shows the effect of doping concentration levels on efficiency .Doping levels rang from ($10^{15} - 10^{19}\mathrm{cm}^{-3}$) . Where we notice from the figure (12) that the maximum efficiency of the solar cell was 12.57% with the doping concentration $10^{16}cm^{-3}$ and after this doping , the efficiency gradually decreases with increase in the doping concentration. The base layer with a higher doping density level possesses the high open circuit voltage and lowers the resistance, but it may also damage the lattice crystal [12]. Resulting in lower solar energy conversion efficiency cell with increase of doping concentration of the base region.

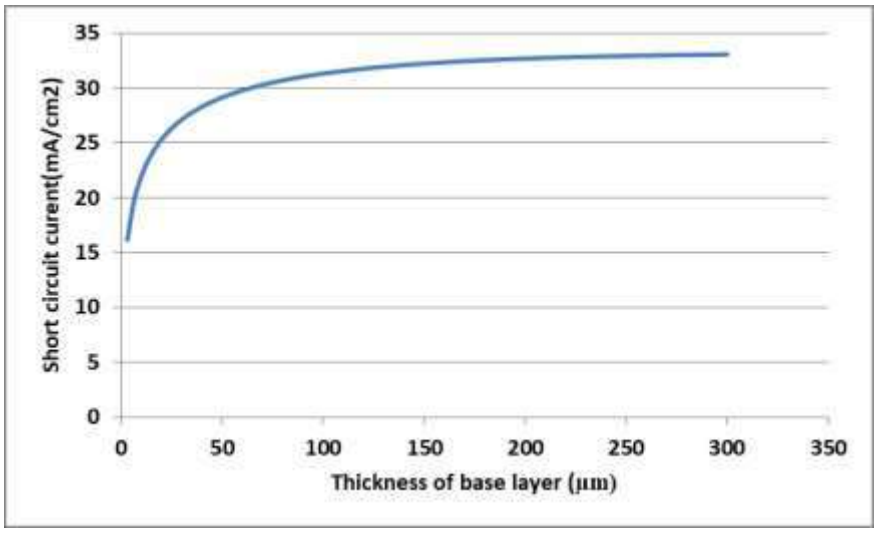

Fig 9: short circuit current as a function of base layer thickness

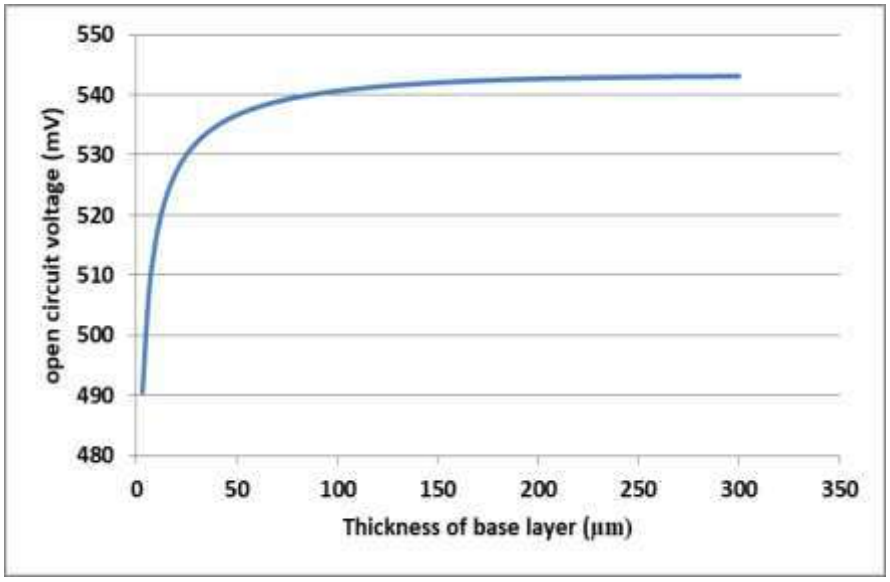

Fig 10: open circuit voltage as a function of base layer thickness

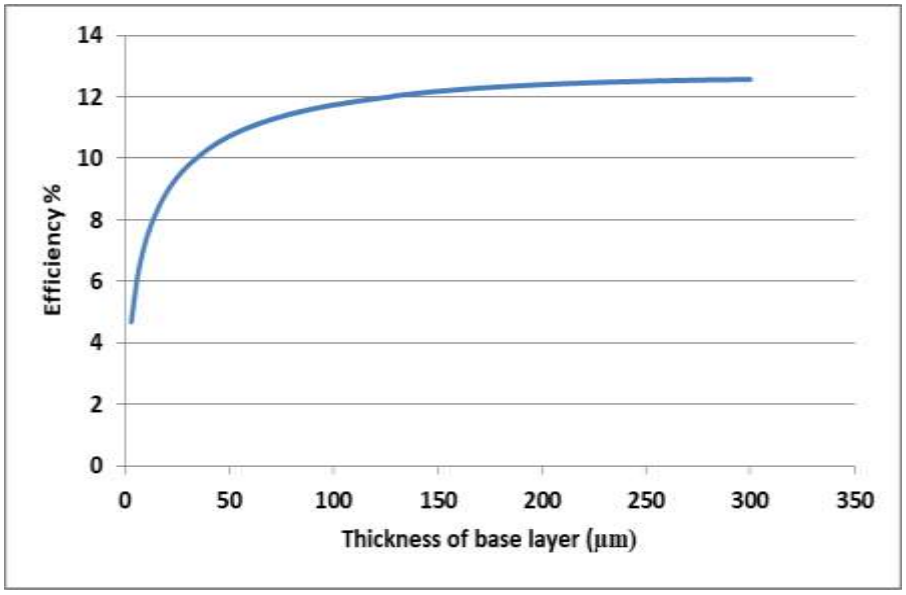

Fig 11: conversion efficiency as a function of base layer thickness

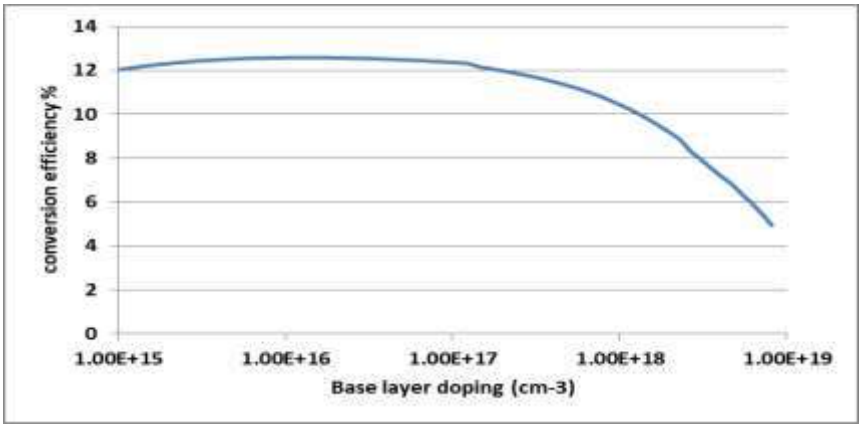

Fig 12: conversion efficiency as a function of the base layer doping concentration

4.4 The effect temperature on the out put electric parameters of n- Si/p-Si solar cell:

In this research we apply different temperature and the result of the I-V curve shown in Figure 13. The range of the temperature is 25 C° to 60 C°. It is shown that the temperature affects the current and the voltage of the solar cell. It means also the fill factor and efficiency affected. The most important parameter of silicon solar cell efficiency is open circuit voltage (Voc). It is function of temperature which shown in equation (3). The Voc decreases as temperature increased as shown in Figure (14). The voltage is inversely proportional with the temperature. Since the temperature increases, the voltage will decrease. However, the current is directly proportional to the temperature as shown in Figure (15). The temperature increase will slightly increase the current of the solar cell. This is because of the more electron-hole pairs excited in the devices. The conversion efficiency of the solar cell gradually decreases with increases of temperature from 25 C° to 60 C° , due to increase of open circuit voltage according to the equation5, as shown in figure (16). summarized the results of the PC1D simulation, it is more clear that temperature affects the performance of the solar cell. Since the temperature rises, the performance will decrease. It includes efficiency, the open-circuit voltage and short circuit current . The best performance gain at 25 C° where the efficiency is 12.57% with the open circuit voltage(0.5415 V) and short circuit current is 0.0332 A. The effect of the temperature is the result of an inherent characteristic of a silicon solar cell [15].

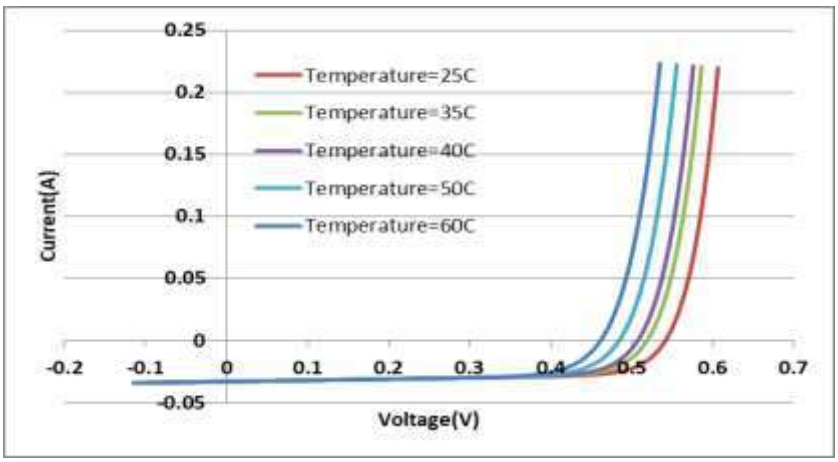

Fig 13: I-V curve under different temperatures

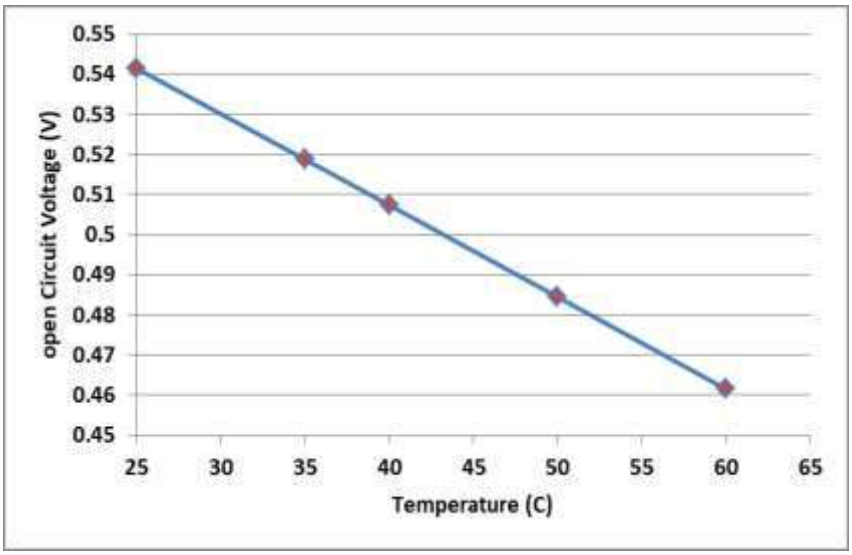

Fig 14: open circuit voltage as a function of temperatures

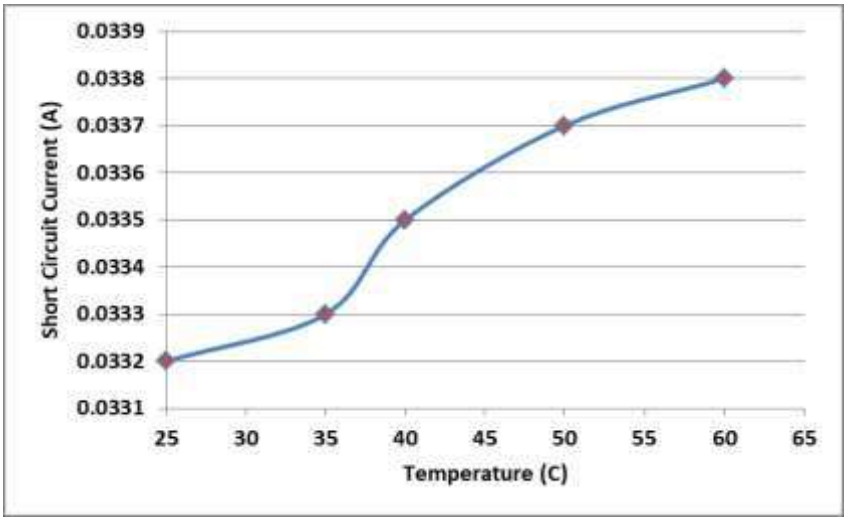

Fig 15: Short circuit current as a function of temperatures

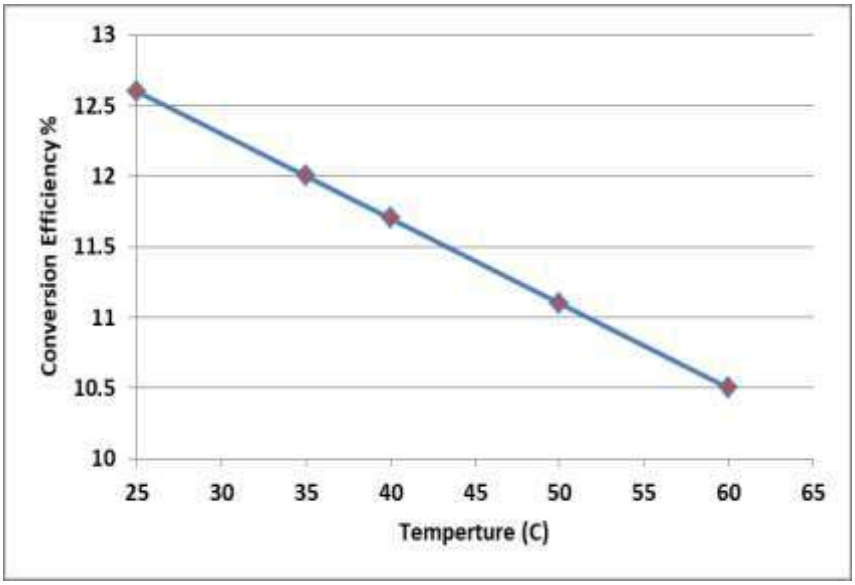

Fig 16: Conversion efficiency as a function of temperatures

5. Conclusions

In the work, the simulation of a silicon solar cell has been done by the PC1D program. The performance of the solar cell can be obtained from the equation of the conversion efficiency. By studying the effect of each of thickness and impurities concentration for the n-si emitter region , where the best performance of the solar cell was at the thickness and impurities concentration at 0.002µm, $10^{20}cm^{-3}$, respectively. So that it turns out that the emitter region must be very thin, in order to allow the passage of most of the photons of light falling on the cell to the base region and then the process of generation electron- holes pair . The optimum values for thickness and impurities concentration in the base region were 300 µm, 10^{16}cm^{-3} ,respectively. The increase of the solar cell temperature led to a decrease in the open circuit voltage and conversion efficiency. On the other hand, an increase in temperature can leads to a slight increase in the short-circuit current of the silicon solar cell.

Reference:

[1] J. Chuan, L. Tianzea , Z. Xia and H. Luan " Simulation of Silicon Solar Cell Using PC1D", Advanced Materials Research Vols. 383-390. pp 7032-7036.(2012).

[2] Haug, Halvard, et al. "A graphical user interface for multivariable analysis of silicon solar cells using scripted PC1D simulations." *Energy Procedia* 38 (2013): 72-79.

[3] Co-encadreur, M. Zerrirgui Djamal MCB. "Analyse de l'impact des différentes couches antireflets sur l'efficacité de conversion d'une cellule solaire en mono-silicium."2020.

[4] Solanki, Chetan Singh. Solar photovoltaics: fundamentals, technologies and applications. Phi learning pvt. Ltd., 2015.

[5] Lopez-Varo, Pilar, et al. "Device physics of hybrid perovskite solar cells: theory and experiment." *Advanced Energy Materials* 8.14 (2018): 1702772.

[6] O. Isabella, K. Jäger, A. H. M. Smets, R. van S. A.C.M.M., and M. Zeman, Solar Energy: The Physics and Engineering of Photovoltaic Conversion, Technologies and Systems. UIT Cambridge, 2016.

[7] O. O. Ogbomo, E. H. Amalu, N. N. Ekere, and P. O. Olagbegi, "A review of photovoltaic module technologies for increased performance in tropical climate," Renew. Sustain. Energy Rev. vol. 75, no. March, pp. 1225–1238, 2017.

[8] Ahmed, Iman Mohsen, Omar Ibrahim Alsaif, and Qais Th Algwari. "The General Properties of Solar Cells Generations-Quantum Dot as Study Case." *NTU Journal of Engineering and Technology* 2.3 (2023).

[9] P. Singh n , N.M. Ravindra," Temperature dependence of solar cell performance-an analysis", Solar Energy Materials & Solar Cells. Vol.101, pp.36-45, (2012).

[10] K. Jäger, O. Isabella, A. H. M. Smets, R. van S. A.C.M.M., and M. Zeman, "Solar Energy Fundamentals, Technology, and Systems," Green Energy Technol., no. 9783319030739, pp. 159–214, 2014.

[11] M. Belarbi, A. Benyoucef, B. Benyoucef, "Simulation of the Solar Cells with PC1D Application to Cells Based on Silicon", Advanced Energy: An International Journal. Vol 1.pp1-10, 2014.

[12] H. Naim , D. K. Shah.et al." An In-Depth Optimization of Thickness of Base and Emitter of ZnO/ Si Heterojunction-Based Crystalline Silicon Solar Cell: A Simulation Method", Journal of Electronic Materials. Vol. 51. pp. 586–593 (2022) .

[13] N. SELMANE , A. CHEKNANE , H. S. HILAL. "A numerical simulation to achieve a high efficiency Influence and optimization of thickness and doping concentration of emitter layer of heterojunction solar cells", Journal of sciences and engineering sciences, vol.09, no.02,2020.

[14] P. Lin, L. Lin,et al. "Numerical Simulation of Cu2ZnSnS4 Based Solar Cells with In2S3Buffer Layers by SCAPS-1D" , Journal of Applied Science and Engineering,vol.17,No.4,pp.383-390,2014.

[15] F. Dincer, M.E. Meral. Critical Factors that Affecting Efficiency of Solar Cells. Smart Grid and Renewable Energy, 1: 47-50. 2010.

The Effect of a Cold Aqueous Extract of the Plant Rosa Damascene and Punica Granatum on the Bacteria that Cause Urinary Tract Infections in Diabetic Patients

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Abstract:

Urinary tract infections (UTIs) are a major problem for people with diabetes (DM) as there is no doubt that individuals with diabetes have a higher risk of urinary tract infections (UTIs) than those without the condition. People with diabetes have a high level of glucose in their urine, which increases the susceptibility of the urinary system to infections and the occurrence of urinary tract infections. Many medicinal plants are recognized as a valuable provider of naturally occurring antimicrobial compounds that can effectively replace these problematic bacterial infections. The best option is to use medicinal plants, according to the recommendations of the World Health Organization (WHO) many plants have found use due to their antibacterial qualities, which stem from phytochemicals generated during the plant's secondary metabolism. The study *in vitro* showed the antibacterial properties of a wide range of secondary metabolites found in plants, such as flavonoids, alkaloids, tannins and phenolic compounds. The research was conducted at the National Center for Diabetes Treatment and Research of Mustansiriyah University in Baghdad, Iraq, by taking urine samples from diabetic patients with urinary tract infections for this study between October 2023 and February 2024. The samples were handled carefully in the laboratory according to the correct protocols to avoid contamination. Bacterial species in urine were classified using standard urine culture (SUC), biochemical assays, and additional techniques (cultural characteristics, vitek2system). Forty-five samples were taken, of which samples were positive for bacterial culture and samples

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were negative. When plant extracts were tested against a variety of isolated bacteria, isolates significantly influenced the outcomes (76.66% of female diabetics and 23.33% of male diabetics). *Escherichia coli* (60%) were the most common bacteria found in diabetics and *Staphylococcus aureus* (16%) . *Pseudomonas aeruginosa* and *Staphylococcus lugdunensis 10 percent , Enterococcus faecalis (6.66%), and* 3.33 percent for *Staphylococcus lentus* . Two distinct plant extracts were used to examine aqueous extracts of the inhibitory effects of Rosa damask and Bonica granatum against the clinical isolates of the bacterium *Enterococcus faecalis*, *S.subtilis*, *S.aureus*, and *E.coli*. The results showed that the inhibitory effect of aqueous extracts increases with the concentrations of the extracts against bacteria. In terms of increased bacterial sensitivity to certain antibiotics, plant extracts are commonly used to treat bacterial infections. The purpose of this investigation was to confirm this benefit.

Key words: *Urinary Tract Infections (UTI), Diabetes Mellitus (DM), Multidrug-Resistant (MDR).*

Introduction

One of the most prevalent bacterial illnesses in primary care are urinary tract infections (UTIs), which are also among the most common diseases with a rising resistance to antibiotics [1]. Females are twice as likely as males to get urinary infections, and the frequency rises with age[2]. This is linked to women's short urethral tubes and the anus's near proximity to the urethral entrance, which facilitates bacteria's easier entry into the urethra. [1]. Chronic diabetes-related problems such as peripheral vascular disease and neuropathy (sensorimotor and autonomic) can also result in skin ulcerations with subsequent bacterial infections [3]. An abundance of evidence suggests that UTIs are more common in diabetics than in non-diabetics [4]. Patients with DM have higher rates of UTIs of all kinds, such as bacteriuria or upper urinary tract infections, and hospitalizations for pyelonephritis or bilateral kidney infections are more common in DM patients than in non-DM patients [5]. UTI in diabetes people as a result of factors such elevated blood glucose levels, which facilitate the growth of an environment that is prone to infection in the urinary tract [6]. Urinary tract infections are primarily caused by E.coli bacteria, which account for 90–50% of isolated species[7]. This is because of their surface features, which enable them to cling to urinary tract epithelial cells. Less frequent forms of bacteria that cause infections include Enterobacter spp and Proteus spp and the Klebsiella spp [8]. Herbs have been used medicinally throughout history, and it's probable that this is how modern medicine originated. Historically, and even now, a substantial source of medicinal substances comes from compounds obtained from plants [9]. Novel bioactive components from medicinal plants must be found and isolated quickly, as evidenced by the rising incidence of drug-resistant diseases [10]. Ingredients derived from therapeutic plants may provide novel, straightforward methods of battling harmful microbes [11]. A plethora of therapeutic plants have been identified as important sources of naturally occurring antimicrobial chemicals, offering a viable substitute that may be efficacious in addressing certain bacterial illnesses. The World Health Organization (WHO) states that the greatest source of different kinds of pharmaceuticals would be medicinal plants. Due to phytochemicals produced during the plant's secondary metabolism, many plants have been utilized for their antibacterial propertie. Many different types of secondary metabolites including flavonoids, tannins, alkaloids and phenolic chemicals are abundant in plants and have been shown to have antibacterial qualities in *vitro.* Numerous phytotherapy texts address infectious problems such as skin infections, respiratory illnesses, gastrointestinal disorders and UTI with a variety of medicinal plants [12]. Worldwide, the use of plants as medical sources is growing due to their natural origins, accessibility in nearby areas, lower cost of purchase, ease of administration and potential for less side effects. In order to separate the active plant material (such as alkaloids, flavonoids, terpenes, saponins, steroids, and glycosides) from the inert or inactive material, medicinal plants must be extracted using the appropriate solvent and a traditional extraction procedure [13]. Furthermore, the extraction techniques have a major influence on the phytochemical content recovery. There are numerous laboratory methods available for extracting plant components. These can be broadly divided into two groups: traditional extraction techniques like maceration, percolation

and infusion, and unconventional or sophisticated techniques including supercritical fluid extractions, microwave assisted extraction, and ultrasonic assisted extraction [14]. However, there are therapeutically useful medicinal plants that have anti-inflammatory properties and little to no adverse effects [15].One of the most significant species of flowers in the Rosaceae family is Rosa damascene. Although this herb may thrive in a variety of climates, low-temperature, dry and semi-arid environments are the ideal for it. Damasq Syria's Damascus was the birthplace of Rose [16].. One of the most well-known decorative plants used in perfume manufacturing is Rosa damascena. It has a fragrance effect in addition to a number of pharmacological characteristics, such as analgesic, astringent, antioxidant, antibacterial, and antimicrobial. Menstrual bleeding, stomach ache, and other conditions are treated with this plant [17]. The Punicaceae family comprises pomegranates. There are deciduous shrubs there. Afghanistan, China, Iran, India, Pakistan, and the United States are the countries where pomegranates are typically grown [18]. The pomegranate (*Punica granatum* L.) skins make up around half of the fruit's weight; they are thrown away as waste after not being eaten. In comparison to pomegranate juice and seeds, the peels are higher in bioactive substances like hydrolyzable tannins, flavonoids, proanthocyanidins and polyphenols [19]. The biologically active components of pomegranate fruits include acids, sugars, vitamins, minerals, and phenolic compounds, which are powerful antioxidants. Pomegranate extracts therefore exhibit a variety of biological characteristics, including antioxidant, anti-inflammatory and anti-cancer effects [20]. The current study aimed to determine the inhibitory activity of aqueous extracts of Rosa damascene and Punica granatum against clinical isolates of bacteria.

Material and methods

Samples Collection

Study design: Between October 2023 and February 2024 , the National Center for Diabetes Treatment and Research at Mustansiriya University served as the site for this trial. diabetes individuals with urinary tract infections were discovered to be aged between 10 and 70.

Sample collection and processing: A sterile tube was used to collect urine samples from diabetic individuals. Next, in order to avoid contamination, the samples were processed in the laboratory using the correct protocols. All of the participants' clinical symptoms were gathered using a standardized questionnaire. The plant was cleansed, rinsed with plenty of water, and then gently dried on paper towels. Rosa damascene and Punica granatum were purchased from the local market in the Baghdad Province, Iraq.Plant extracts' ability to combat a variety of isolated bacteria is being tested.

Bacterial isolates and Cultivation: An overnight incubation at 37°C for a loopful of broth was preceded by a microbiological investigation using suspended bacteria on Blood and MacConkey agar plates. An infection with severe bacteriuria is indicated by a colony count greater than 10^5 CFU/mL.

Microbiological Analyses: The automated characterisation of the Vitek 2 made it possible to determine the antibiotic susceptibility of the bacterial isolates and identify them. Isolated colonies from well-known plates were also used to achieve this goal.

Prepare the cold aqueous extract: Mix the extract in a centrifuge at 3000 rpm for 15 minutes, filter the mixture after 50 g of the plant's dry powder was weighed, combined with 500 ml of distilled water, and allowed to sit at room temperature for 24 hours. Afterwards, the mixture was filtered through multiple layers of medical gauze to remove any remaining impurities and plankton. The filtrate was next filtered using Whatman No. 0.1 filter sheets, put in a Petri dish at 40 °C, and allowed to dry out. The sterile plain tube were then carefully sealed and stored in the refrigerator until they were needed [21].

Testing the inhibitory effectiveness of plant extracts on isolated bacteria

Utilizing Plant Extracts for Antimicrobial Tests Using the agar well difusion method, extracts from several plants were tested for antibacterial properties overnight at 37°C on (MHA) plates. The bacterial suspension was created after introducing several bacterial colonies to (BHIB) to activate the bacteria. A comparison was made between the bacterial suspension's 1.5 x 10^8 cells/ml count and the McFarland solution [22]. Next, we bored 8 mm holes in the surface of the culture medium, and we filled each one with 50 µl of different concentrations (50, 100, 300, and 500), with sterile distilled water in the control hole. The extract's effectiveness was determined by measuring the millimeter-scale zone of inhibition around the hole. Inhibition was discovered using a ruler.

Statistical analysis: To compare different groups with one another, the acquired data were put through a t test. The findings were presented as mean ± standard deviation (SD). $P < 0.05$ is regarded as statistically significant. SPSS (v20) was used to do the statistical analysis.

Results and discussion

Between January 2023 and March 2024, about 45 samples were taken from patients of various ages at the National Diabetes Center of Mustansiriyah University in Baghdad Province, Iraq, for this investigation.

In this analysis, patients were categorized into three age groups: under 30 years old (<30y), between 30 and 40 years old (30y-40y), and above 50 years old. Enrolled were 45 diabetic patients (41.75±19.26), consisting of eleven (22.7%) men and thirty-four (77.3%) women. Both symptomatic and asymptomatic cases of DM bacteriuria were seen throughout the community. According to Table 1, 27 individuals (59.1%) do not have high blood pressure, while 18 individuals (40.9%) have. Out of the total patients, 37 individuals (81.1%) did not report any additional medical issues, while 18 patients (18.2%) disclosed having any. All patients had a UTI, with severity ranging from moderate to serious, based on our results.

Table 1: Demographic characteristics of study

Demographic characteristic (N=45)		N	%
Gender	Female	34	77.3
	Male	11	22.7
	Total	45	100.0
Does the patient suffer from high blood pressure?	No	27	59.1
	Yes	18	40.9
Does he suffer from UTI?	Low	11	25.0
	Middle	18	38.6
	High	16	36.4
Does the patient suffer from other diseases?	No	37	81.8
	Yes	8	18.2
Age		45	41.75±19 26

Gender had a statistically significant impact on the incidence of UTI in diabetics (76.66% female and 23.33% male). Urinary tract infections are more common in diabetic women than in men, according to this study's findings, which are consistent with Zubair *et al* [23] and are displayed in Table (2) **Table 2: Percentage of infection with bacterial isolates and patient sex**Sex	Bacterial isolates	%
Female	23	76.66
Male	7	23.33
Total	30	100

To differentiate between Gram-negative and positive isolates Initially, the colonies were determined by their size and phenotypic characteristics on the MacConkey and central blood agar centers The findings revealed that (11) isolates were Gram-positive bacteria and (19) isolates were Gram-negative bacteria. Furthermore, (15) of samples reported no bacterial growth on any of the cultures. [24]. Typically, routine urine cultures are unable to find any

microorganisms [25]. Urine culture plates with a single bacterial species' CFU/mL of more than 10^5 were considered to have significant bacteriuria. Any organ or function inside the body might be harmed by *E.coli* infections, which are prevalent in diabetics [26].features of the bacteria used in VITEK 2 diagnosis [27]. The highest rate of infection with *E.coli* bacteria was 60%, then *S.aureus* bacteria was at a rate of 16%, and *Enterococcus faecalis* bacteria was at a rate of 6.66 among diabetic patients. This is consistent with [2] in terms of infection with *E.coli* bacteria at a higher rate than the rest of the types of bacteria, which had lower rates, as they were *Staphylococcus lugdunneusis* at a rate of 10%, while the bacteria *Staphylococcus lentus* and *Pseudomonas aeruginosa* at a rate of 3.33. as shown in figure (1).

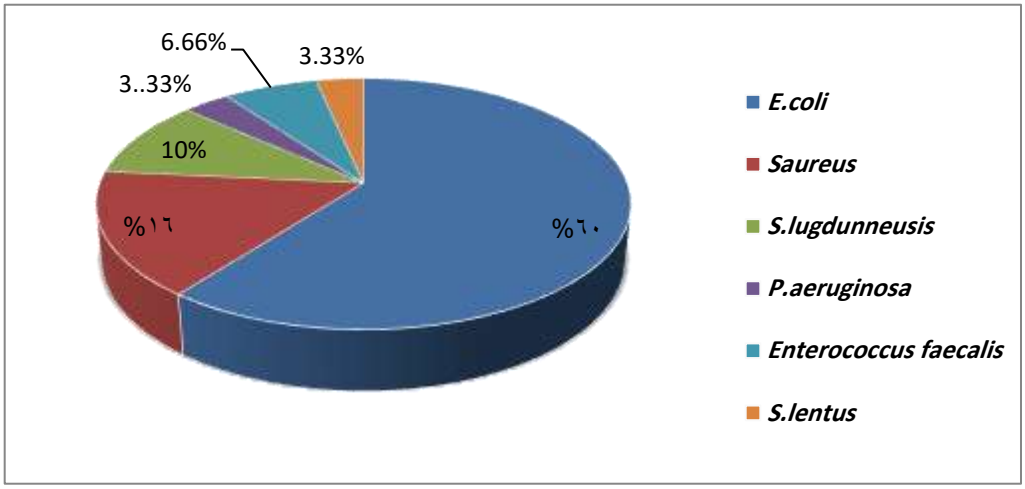

Fig 1: Isolation of bacteria from diabetic patients with UTI.

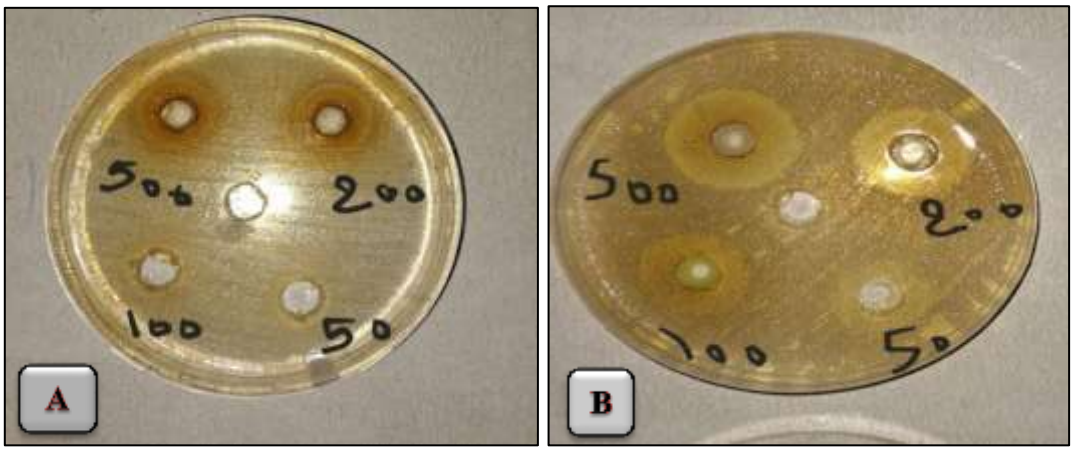

Fig 2: Images (A) and (B) illustrate the effects of extracts from Rosa damascene and Punica granatum on Enterococcus faecalis and Staphylococcus aureus, respectively.

Bacterial samples were isolated from diabetic patients with UTI which were subsequently subjected to diagnosis by the Vitek-2 compact system to confirm the type of bacteria The results showed that the inhibitory activity of aqueous extracts against bacteria increased with increasing concentration. The results obtained included *E.coli* , *S.aureus* , *S.lugdunneusis* , *S.lentus* , *Pseudomonas aeruginosa* , *Enterococcus faecalis* .to investigate the microbiological inhibitory activity of aqueous plant extracts of *Rosa damascene and Punica granatum* using the well diffusion method and four concentrations of each aqueous extract

(50, 100, 200 and 500mg/ml). In addition to making a control pit containing distilled water (figure 2).

The results showed the inhibitory ability of *Punica granatum* extract, as shown in Table 3. The effect of all concentrations on *S.aureus* bacteria were significant, while *E.coli* bacteria were affected by the concentration of 500 and 200, and they were not affected by the concentration of 100 and 50, and the values were significant as for the bacteria *S.lugdunneusis* and *Enterococcus faecalis*. Three concentrations had a substantial impact on it: 500, 200, and 100. The concentration of 50 had no effect, indicating resistance. At concentrations of 500 and 100, the values were not significant across the species of bacteria; but, at 200, they were significant. That aligns with the Mendes *et al* regarding how various bacterial species are affected by *Punica granatum* extract [28]. The fact that Gram-positive bacteria reacted to *Punica granatum* extracts more than Gram-negative bacteria further demonstrated the extracts' and antibacterial effectiveness against all tested species.

Table 3: Effect of *Punica granatum* extract aqueous Bacterial isolates from diabetic patients

Bacterial types	500 µg /ml Mean±SD	200 µg /ml Mean±SD	100 µg /ml Mean±SD	50 µg /ml Mean±SD	P value
Esherishia coli	9.83±6.1	3.4±1.6	0	0	**0.02**
Staphylococcus aureus	17.6±4.6	21.8±3.6	8.2±1.7	4.6±1.3	**0.003**
Staphylococcus lugdunneusis	18.2±2	15.3±0.5	7.3±1.2	0	**0.01**
Enterococcus faecalis	19±5.6	16.5±3.6	6±2.3	0	**0.001**
P value	0.09 nsig	0.05	0.16	N.c	

∗ (n.c) non counted

∗ P< 0.05

Our findings in Table (4) demonstrated that the *Rosa damascene* extract at the three concentrations of 200, 100, and 50 had no effect on the *E.coli* bacteria, but that the concentration of 500 had an impact. At all concentrations, nevertheless, the *S.aureus* bacteria was impacted, and the results were noteworthy. In contrast, the *Staphylococcus lugdunensis* bacteria was unaffected by concentration and was instead influenced by the three concentrations of 500, 200 and 100. At 50, the concentrations of 500 and 200 only had an impact on the *Enterococcus faecalis* bacterium. The numbers had no bearing on anything. We discover that the bacteria *E.coli* were only impacted by the concentration of 500 when comparing the different types of bacteria at the same concentration. The reason for testing the plant was that there was some information regarding its use as an ornamental plant. In addition to its olfactory effects, this plant has been shown to have a number of pharmacological qualities, including anti-HIV, antibacterial, antioxidant, antitussive, hypnotic, antidiabetic, and relaxant effects on tracheal chains [29].

Table 4: Effect of Rosa damascene extract aqueous Bacterial isolates from diabetic patients

Bacterial types	500 µg /ml Mean±SD	200 µg /ml Mean±SD	100 µg /ml Mean±SD	50 µg /ml Mean±SD	P value
Escherichia coli	2.1±0.5	0	0	0	N.C
Staphylococcus aureus	10.6±1.3	9.2±1.8	5.6±1.2	3.2±0.5	0.05
Staphylococcus lugdunneusis	15.33±0.6	12.3±0.6	7±1.3	0	0.04
Enterococcus faecalis	10±1.4	9±1.7	0	0	0.26
P value	0.03	0.09	0.07	N.c	

∗ (n.c) non counted

∗P< 0.05

Table (5) presents the findings. When comparing the water extract of Rosa damascene and Punica granatum for each bacteria at different concentrations, the bacteria *E.coli* showed a significant difference at the concentration of 500, while the bacteria *S.aureus* showed significant differences at all concentrations. There were significant differences for the microorganisms *Staphylococcus lugdunneusis* and *Enterococcus faecalis* at concentrations of 500 and 200, but not for the concentration of 100.

Table 5: The relationship between punica granatum and Rosa damascene among the bacterial species at concentration of 50 to 500 ug/ml

Bacterial types mm / inhibition zone	Extract type	500 µg /ml Mean±SD	200 µg /ml Mean±SD	100 µg /ml Mean±SD	50 µg /ml Mean±SD
Escherichia coli	Rosa damascene	2.1±0.5	0	0	0
	Punica granatum	9.83±6.1	3.4±1.6	0	0
P valu		0.001	N.c		
Staphylococcus aureus	Rosa damascene	10.6±1.3	9.2±1.8	5.6±1.2	3.2±0.5
	Punica granatum	17.6±4.6	21.8±3.6	8.2±1.7	4.6±1.3
P valu		0.002	0.001	0.05	0.05
Staphylococcus lugdunneusis	Rosa damascene	15.33±0.6	12.3±0.6	7±1.3	0
	Punica granatum	18.2±2	15.3±0.5	7.3±1.2	0
P valu		0.05	0.05	0.9	
Enterococcus faecalis	Rosa damascene	10±1.4	9±1.7	0	0
	Punica granatum	19±5.6	16.5±3.6	6±2.3	0
P value		0.003	0.02	n.c	

∗ (n.c) non counted

∗P< 0.05

Pomegranate peel contains high amounts of polyphenols, such as tannins, ellagic acid, and gallic acid [30]. Pomegranate fruits are abundant in bioactive components, including phenolic compounds—strong antioxidants—as well as acids, sugars, vitamins, and minerals. Pomegranate extracts therefore have a variety of biological qualities, including antioxidant, anti-inflammatory, and anti-cancer effects. Hydrolysable tannins and phenolic chemicals, which are various esters with anti-inflammatory and antioxidant qualities, are abundant in *punica granatum* extract [20]. Numerous such potent substances that regulate microbial activity are found in pomegranate peels. Microorganisms such as *E.coli* and *S.aureus* can be effectively combatted by these [16]. Rich in flavonoids, including anthocyanins, tannins, and phenolic acids, *punica granatum* is a rich source of polyphenols, which are known to have a variety of biological properties, including the ability to effectively combat pathogenic microbes. Research has demonstrated that Punica granatum possesses antibacterial properties against both Gram-positive and Gram-negative bacteria [31]. *R.damascena* flowers have been linked to a number of health benefits, mostly because of their high polyphenolic content, according to pharmacological research. Numerous phytochemicals, including flavonoids, glycosides, terpenes, and anthocyanins, have been isolated from various plant components [16]. Additionally, citric acid, malic acid, pectin, tannins, carotenoids, and vitamins C, A, B1, B2, B3, and K have been found[32]. According to recent studies, roses are a good source of polyphenols and flavonoids, both of which have potent antioxidant qualities.

These days, the main applications for antioxidants include food preservation, nutrition and health care, and the prevention and treatment of numerous diseases. In summary, antioxidants have a wide range of potential applications, particularly in edible plants [33].

Conclusions

UTIs are more common in women with diabetes than in males. The most common form of bacteria that causes UTIs in Iraqi diabetics is E. coli. . The effects of punica granatum extract on S. aureus were significant at all concentration. In line with Staphylococcus. lugdunneusis and Enterococcus. faecalis, Punica granatum E.coli was impacted by concentrations of 500 and 200 but not by concentrations of 100 and 50. The values were quite impressive. 500, 200, and 100 concentrations were the three that significantly affected it. Resistance was shown by a lack of reactivity at 50% concentration. revealed that at a concentration of 500, the Rosa damascene extract had an effect on the E.coli bacteria, but not at the three values of 200, 100, or 50.

References:

Odongo, I., Ssemambo, R., & Kungu, J. M. (2020). Prevalence of *Escherichia coli* and its antimicrobial susceptibility profiles among patients with UTI at Mulago Hospital, Kampala, Uganda. *Interdisciplinary perspectives on infectious diseases*,

Abou Heidar, N. F., Degheili, J. A., Yacoubian, A. A., & Khauli, R. B. (2019). Management of urinary tract infection in women: A practical approach for everyday practice. *Urology annals*, *11*(4), 339-346.

Abdullah, W. H., Kadhum, A. J., & Baghdadi, G. A. (2022). Diabetic nephropathy in children with type 1 diabetes mellitus with vitamin D deficiency and dyslipidemia as associated risk factors. Medical Journal of Babylon, 19(2), 294-298.

Kareem, A. A. (2020). The Significant Relationship between HbA1c Level and Urinary Tract Infection among Diabetic patients in AL-Diwaniyah Province. *Al-Qadisiyah Medical Journal*, *16*(1).

Kamei, J., & Yamamoto, S. (2021). Complicated urinary tract infections with diabetes mellitus. *Journal of Infection and Chemotherapy*, *27*(8), 1131-1136.

MNA, K. (2020). Incidence of Urinary Tract Infection among Diabetic Patients in Abakaliki Metropolis.

Shalgam, D. O., & Ali Al-Khalidi, R. A. (2021). Bacteriological investigation of the aerobic urinary microbiome in Baghdad women with urinary incontinence (UI). *Biochemical & Cellular Archives*, *21*(2).

Ali, A. J., & Jaafar, N. A. H. (2022). Role of IL-6 in urinary tract infection among diabetic and non-diabetic patients. *Tikrit Journal of Pure Science*, *27*(5), 7-11.

Esther, S-M., Jose, A. G-C and Francisco, M-A. (2020). "Worldwide research trends on medicinal plants." International journal of environmental research and public health 17.10: 3376.

Ghannawi, L. A., & Al-Rubaye, H. F. (2025).Synergism effect of silver nanoparticles and cefotaxime to treat biofilm formation of staphylococcus aureus clinical isolated .Біологічні студії/Studia Biologica, 19(2), 77-90

Vaou, N., Stavropoulou, E., Voidarou, C., Tsigalou, C., & Bezirtzoglou, E. (2021). Towards advances in medicinal plant antimicrobial activity: A review study on challenges and future perspectives. Microorganisms, 9(10), 2041.

Manandhar, S., Luitel, S., & Dahal, R. K. (2019). *In vitro* antimicrobial activity of some medicinal plants against human pathogenic bacteria. Journal of tropical medicine, 2019.

Abubakar, A. R., & Haque, M. (2020). Preparation of medicinal plants: Basic extraction and fractionation procedures for experimental purposes. Journal of pharmacy & bioallied sciences, 12(1), 1.

Dirar, A. I., Alsaadi, D. H. M., Wada, M., Mohamed, M. A., Watanabe, T., & Devkota, H. P. (2019). Effects of extraction solvents on total phenolic and flavonoid contents and biological activities of extracts from Sudanese medicinal plants. South African Journal of Botany, 120, 261-267.

Oguntibeju, O. O. (2018). Medicinal plants with anti-inflammatory activities from selected countries and regions of Africa. *Journal of inflammation research*, 307-317.

Labban, L., & Thalaj, N. (2020). The medicinal and pharmacological properties of Damascene Rose (Rosa damascena): A review. Int. J.Herb. Med , 8 , 33-37.

Akram, M., Riaz, M., Munir, N., Akhter, N., Zafar, S., Jabeen, F., ... & Said Khan, F. (2020). Chemical constituents, experimental and clinical pharmacology of *Rosa damascena*: a literature review. Journal of Pharmacy and Pharmacology, 72(2), 161-174.

Qahir, A., Khan, N., Hakeem, A., & Kamal, R. (2021). The antioxidant, antimicrobial, and clinical effects with elemental contents of pomegranate *(Punica granatum*) peel extracts: A review. *Baghdad Journal of Biochemistry and Applied Biological Sciences*, *2*(01), 21-28.

Soltanzadeh, M., Peighambardoust, S. H., Ghanbarzadeh, B., Mohammadi, M., & Lorenzo, J. M. (2021). Chitosan nanoparticles as a promising nanomaterial for encapsulation of pomegranate (*Punica granatum* L.) peel extract as a natural source of antioxidants. *Nanomaterials*, *11*(6), 1439.

Elshafie, H. S., Caputo, L., De Martino, L., Sakr, S. H., De Feo, V., & Camele, I. (2021). Study of bio-pharmaceutical and antimicrobial properties of pomegranate (*Punica granatum* L.) leathery exocarp extract. *Plants*, *10*(1), 153.

Zaidan, I. Q., & Al-Hadidy, Y. I. (2021). Detection and estimation of active compounds for cumin aqueous extract and essential oil extracted and studying its effect on prolonged minced meat preservation and their effect on pathogenic bacteria isolated from it. *Kirkuk University Journal For Agricultural Sciences*, *12*(4), 64-79.

Khadir, M. K., Hasan, A. Y., & Salman, R. M. (2018). Inhibitory Effect of Myrtus communis L. and Syzygium aromaticum L. Extracts on the Growth of Staphylococcus aureus Isolated from Foot Ulcers of Diabetic Patients.

Zubair, K. U., Shah, A. H., Fawwad, A., Sabir, R., & Butt, A. (2019). Frequency of urinary tract infection and antibiotic sensitivity of uropathogens in patients with diabetes. *Pakistan Journal of Medical Sciences*, *35*(6), 1664.

Najim, H. T., Farhan, A. A., & Athab, A. M. (2018). Bacteriological Study of the Bacteria Cause Urinary Tract Infection of Patients Admitted to Cardiac Care Unite a Baqubah General Teaching Hospital.

Ronald, A., Ludwig, E. (2001) Urinary tract infections in adults with diabetes. *Int. J. Antimicrob. Agents*. *17*, 287–292. [**Google Scholar**] [**CrossRef**] [**PubMed**].

Saliba, W., Nitzan, O., Chazan, B., Elias, M. (2015) Urinary tract infections in patients with type 2 diabetes mellitus: review of prevalence, diagnosis, and management. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy* . 8:129–136. doi: 10.2147/dmso.s51792. [PMC free article] [PubMed] [CrossRef] [Google Scholar].

Oleiwi, S. (2019). Effect of Some Teeth Cleaning Methods on the Microbiological Content of the Oral Cavity. *Tikrit Journal for Agricultural Sciences*, *19*(1), 46-56.

Mendes, P. M., Gomes Fontoura, G. M., Rodrigues, L. D. S., Souza, A. S., Viana, J. P. M., Fernandes Pereira, A. L., ... & Maciel, M. C. G. (2023). Therapeutic Potential of *Punica granatum* and Isolated Compounds: Evidence-Based Advances to Treat Bacterial Infections. *International Journal of Microbiology*, *2023*(1), 4026440.

Boskabady, M. H., Shafei, M. N., Saberi, Z., & Amini, S. (2011). Pharmacological effects of *Rosa damascena*. *Iranian journal of basic medical sciences*, *14*(4), 295.

Palchykov, V. A., Zazharskyi, V. V., Brygadyrenko, V. V., Davydenko, P. O., Kulishenko, O. M., Borovik, I. V., ... & Boyko, O. O. (2019). Bactericidal, protistocidal, nematodicidal properties and chemical composition of ethanol extract of *Punica granatum* peel. *Biosystems Diversity*, *27*(3), 300-306.

Singh, B., Singh, J. P., Kaur, A., & Singh, N. (2019). Antimicrobial potential of pomegranate peel: A review. *International Journal of Food Science & Technology*, *54*(4), 959-965.

Nayebi, N., Khalili, N., Kamalinejad, M., & Emtiazy, M. (2017). A systematic review of the efficacy and safety of *Rosa damascena* Mill. with an overview on its phytopharmacological properties. *Complementary therapies in medicine*, *34*, 129-140.

Liu, W. Y., Chen, L. Y., Huang, Y. Y., Fu, L., Song, L. Y., Wang, Y. Y., & Bi, Y. F. (2020). Antioxidation and active constituents analysis of flower residue of *Rosa damascena*. *Chinese Herbal Medicines*, *12*(3), 336-341.

The Clinical Utility and Limitations of the Thyroglobulin Test in Differentiated Thyroid Cancer: Article Review

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Abstract:

The thyroglobulin (often mentioned as Tg) test is considered a key biomarker in the management of differentiated thyroid cancer (DTC), mainly for detecting residual disease and recurrence after thyroidectomy and radioactive iodine therapy. There have been advances in assay sensitivity, and those advances have strengthened its clinical value, although limitations such as variability across laboratories and interference from anti- thyroglobulin antibodies remain major challenges.

Integrating Tg testing with imaging and molecular techniques offers a more reliable diagnostic approach. Standardization of protocols and broader adoption of high sensitivity methods are essential for accuracy improvements.

To make it clear, Tg testing plays a vital role in thyroid cancer follow-up, though further research is needed to optimize its application and assess its impact on patient outcomes.

Keywords: *Serum thyroglobulin; Thyroid carcinoma; Disease surveillance; Biomarkers; Clinical utility*

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I. Introduction

Developments in endocrinology diagnostics have considerably refined thyroid issue management—a field of growing concern given the prevalence of conditions such as hypothyroidism and thyroid cancer. As healthcare systems globally push for improved, personalized care, the thyroglobulin test has emerged as a vital biomarker, especially in the context of monitoring and handling differentiated thyroid cancers (Bang J-I et al.). This test gauges

Thyroglobulin levels a protein the thyroid gland produces demonstrate potential for both diagnostic clarity and offering prognostic insights following thyroidectomy coupled with radioactive iodine therapy (Maja J Zieba-Domalik et al.). Late research indicates thyroglobulin to be a salient tumor marker, with certain studies showing that elevated levels post-treatment might be indicative of residual disease or even recurrence, which arguably underscores the need for incorporating this biomarker into routine clinical practice (Acharya et al.). However, despite its obvious clinical relevance, the existing literature on the thyroglobulin test highlights several key areas for consideration regarding its application, limitations, and the potential for integrating new technologies to enhance its utility. A multitude of studies emphasize the importance of serum thyroglobulin levels in forecasting outcomes for patients grappling with differentiated thyroid carcinomas (Nosratzehi S et al.). Further investigations underline the necessity for standardized measurement protocols to mitigate variability and enhance the consistency of interpretation across diverse laboratory settings (M Murad et al.). The presence of thyroglobulin antibodies further complicates the picture by potentially compromising the accuracy of thyroglobulin measurements—an issue debated in several reviews (Zhao S et al.) (Wan Q et al.). Furthermore, improvements in molecular and imaging techniques are steering us towards more holistic management strategies, marking a shift away from an over.

On sole thyroglobulin testing (I Ignatko et al.). Even considering these advancements, there remain gaps in comprehensive understanding the clinical utility of the thyroglobulin test. For instance, although numerous studies have meticulously explored the link between thyroglobulin levels and the likelihood of disease recurrence (Chen L et al.), fewer have given thought to how sociocultural and economic factors may influence testing practices and, subsequently, patient outcomes across diverse population segments (Anthony P Weetman). There's also a notable requirement for longitudinal studies that can accurately assess how the thyroglobulin test impacts patient quality of life, coupled with treatment satisfaction—areas that are perhaps neglected in current research initiatives (Caio G et al.) (Douglas S Ross et al.). Furthermore, while cutting-edge technologies such as high- sensitivity assays may well refine thyroglobulin testing practices, the full integration of these innovative approaches into routine clinical workflows has yet to be fully realized (Carling T et al.). The synthesis of conventional diagnostic techniques alongside these emerging technologies offers a promising avenue for exploration, and researchers continue to strive to meld both traditional and novel methods. This review, building on earlier findings, is set to critically dissect thyroglobulin testing; clarifying its role in present clinical practice while also highlighting areas for focused

future research that might potentially optimize diagnostic and therapeutic strategies (Deandreis et al.) (BIONDI et al.) (Carvalho et al.).

Ultimately, by methodically addressing these recognized gaps, the aim here is to contribute to a more comprehensive understanding of thyroglobulin testing's overall role in thyroid disease management, its consequent impact on patient outcomes, and thus, hopefully, set the stage for further studies down the line.

II. Review of Literature

At first, the thyroglobulin test's importance was mainly about diagnosing and keeping track of thyroid problems, especially differentiated thyroid cancer. Initial studies really showed it worked well as a tumor marker, and it seemed promising for taking care of thyroid cancer patients after surgery. It was considered a reliable sign that the disease might come back (Abacı et al.). As we learned more about how the thyroid works, the test was studied more, and it turned out that different things, like thyroid hormone amounts and autoimmune problems, could change the results, which made things a bit more confusing (Chiu et al.). Around the late 1990s and early 2000s, improvements in immunoassay techniques led to more sensitive and specific thyroglobulin measurements, resulting in better patient management outcomes (Bellavia S et al.). That time was a real turning point, with new methods, like liquid chromatography-mass spectrometry, being created. These allowed for more exact measurements when watching for thyroid cancer [cite4, cite5]. By the 2010s, it was clearer that thyroglobulin testing should be part of clinical guidelines, which showed how important it was to check high-risk groups regularly (Capiau et al.). Even now, modern research still has ongoing discussions about what the best cut-off points for thyroglobulin levels should be and what it means if the results jump around. This has led to calls for standard procedures to make sure the test is interpreted the same way everywhere [cite7, cite8]. Also, studies have started looking at how test results affect patients emotionally, understanding that emotional reactions to thyroglobulin levels need more attention and care [cite9, cite10]. On the whole, the thyroglobulin test's development shows significant considerable improvements in how we diagnose things and a growing understanding of how crucial it is to manage thyroid disease thoroughly. Research and standard clinical practices are still needed, specifically for how the thyroglobulin test is used to monitor and manage thyroid cancer. In the beginning, its diagnostic value has become vital for distinguishing between dangerous and harmless thyroid lumps. Research suggests that higher thyroglobulin levels can suggest follicular and papillary thyroid cancer, which further emphasizes how helpful it is for early detection [cite1, cite2]. Furthermore, it's important in postoperative monitoring, where a drop in thyroglobulin levels is a key signal for the risk of thyroid cancer coming back [cite3, cite4]. Moreover, its changes in thyroglobulin levels across different groups, along with its relation to thyroid conditions and autoimmune conditions, have been well documented. For example, research shows that anti-thyroglobulin antibodies can mess with test results, thus complicating the interpretation [cite5, cite6]. This highlights the necessity for tailored methods in doing the thyroglobulin test, as noted in recent clinical advice (Bouga et al.). Moreover, including thyroglobulin testing in broader strategies for handling

thyroid carcinoma is getting more attention. Research has started suggesting its use with imaging methods, such as ultrasound, to help get a better understanding of the disease [cite8, cite9]. Therefore, the increasing understanding of the thyroglobulin test shows its potential as more than just a marker by itself; it's a key part of a multifaceted way to handle thyroid cancer that considers clinical background and personal patient aspects.

Thyroglobulin Testing in Thyroid Cancer Diagnostics Developments in how we handle thyroid cancer showcase a push towards tailored medicine, with customized plans becoming more common. Also, numerous studies have examined the importance of ensuring our tests adhere to the same standards. You see, if the testing methods aren't the same, it can throw off thyroglobulin levels, and that messes with the decisions doctors make (Chiu et al.). Research comparing different types of tests reveals a significant difference between them, so we urgently need to get everyone on the same page so we can count on the results being consistent and trustworthy (Bellavia S et al.). Furthermore, recent overviews have pointed out that measuring thyroglobulin alongside other markers, using methods that check lots of things at once, looks like it could really boost our ability to diagnose correctly (Chiu et al., Bellavia et al.). This approach gives us a more complete understanding of Understanding what the thyroglobulin test is telling us is crucial for improving thyroid cancer diagnostics and management. The existing research highlights a real need for careful methods and consistency. That way, we can make the most of thyroglobulin testing in thyroid cancer care. It is generally said that biochemical theories tend to consider the test's role as a tumor marker valuable, with higher thyroglobulin levels typically linked to the recurrence of a disease. Many different ideas come together when we talk about the thyroglobulin test, particularly when it comes to keeping an eye on thyroid cancer and seeing how well treatments are working. In particular, high levels found after treatment might mean that the surgery didn't get everything, or that the cancer has spread elsewhere (Chiu et al.)(Bellavia S et al.). Though, some experts wonder if we can really rely on the thyroglobulin test, mentioning things like autoimmune thyroiditis, which can give us misleading results because of anti-thyroglobulin antibodies (Bellavia S et al.). Because of all these different viewpoints, we have to remember that interpreting these results can be tricky, and doctors have to consider them alongside the overall health of the person. Recent meta-analyses further show that combining thyroglobulin measurements with imaging techniques can improve how well patients do, shifting to a more holistic method of handling thyroid cancer (Chiu et al.)(Bellavia S et al.). The socio- economic results of tests have gained attention, with analysts advocating for a standardized application of the thyroglobulin test to even out disparities in cancer care (Bellavia S et al.). Therefore, the text provides an investigation of the thyroglobulin test, integrating views on its biochemical importance, clinical utility, and socio-economic implications. All together, these different frameworks really add to the discussion about how reliable and effective the thyroglobulin test actually is in the clinical setting.

Conclusion

Thyroglobulin has become quite the key player in navigating thyroid issues, particularly when we're talking about differentiated thyroid cancer. This review? It's a gathering of different researchers, showing the biomarker importance of thyroglobulin when thyroid diseases and their management become a thing, supported by recent work pointing out how crucial it is in clinics (Deandreis et al.). We're covering a lot, from the tests first created to the newest testing methods we've got. Some studies really bring out how well this test functions for surveillance of the disease, and its diagnostic value, plus how it can help tell us how treatments like surgery and radioactive iodine do, solidifying its role as a core management instrument (Bang J-I et al., 2023; Maja J Zieba-Domalik et al., 2024). Most clinicians would probably agree that rising thyroglobulin post-treatment is often a pretty significant clue that there may still be lingering disease, or recurrence; guidelines often suggest monitoring, too (Nosratzehi S et al., 2024). However, thyroglobulin stories? They sometimes have twists. Some documented limitations do exist; for example, test results can sometimes, variations are observed due to autoimmune factors or methodological inconsistencies, which can lead to interpretational variability (M Murad et al., 2023; Zhao S et al., 2025).

Thyroglobulin Testing Challenges and Opportunities

Thyroglobulin antibodies, as noted in Wan Q et al.,2024, can really throw a wrench into test results, making it more challenging to get a clear picture of someone's thyroid disease. Healthcare access disparities? They can also mess with how often people get the thyroglobulin test and how well it works for different folks (I Ignatko et al., 2022; Chen L et al., 2016). So, tackling these issues is a must if we want to get the most out of this test. This review sheds light on some bigger systemic problems, too, by the way. For starters, Anthony P. Weetman (2020) and Caio G et al. (2019) suggest that standardizing the testing process and using super-sensitive assays more often could really boost diagnostic accuracy and lead to more personalized treatments in endocrinology. Integrating thyroglobulin testing with imaging? That's another smart move. A complete assessment, according to Douglas S Ross et al. (2016) and Carling T et al. (2013), should look at not just molecular markers but also imaging and the patient's unique situation. Making these changes should improve patient care and lead to better results for those with thyroid disease. Even with all the progress, we still have gaps in our knowledge.

Studies have been conducted on how thyroglobulin testing affects patients' quality of life and their satisfaction with treatment. It seems most studies focus on clinical outcomes (Deandreis et al., 2016; BIONDI et al., 2005). As Carvalho et al. (2013) would likely agree, as new technologies emerge, we need to see how they integrate with existing tests to create solid guidelines that work for everyone. To wrap it up, while the thyroglobulin test is key in managing thyroid cancer, more research is clearly needed to sort out the challenges and limitations we've talked about. By staying curious and digging deeper, doctors can make sure thyroid disorder management keeps up with the latest science and best practices, ultimately making things better for patients. The points made here offer a strong base for future study

and conversations in this ever-changing area.

Literature review summrry

Author	Year	Title	Main Focus	Findings
Ji-In Bang, Sohyun Park, Keunyoung Kim, Youngduk Seo, A. Chong, C.	2023	The Diagnostic Value of F-18 FDG PET/CT in Differentiated Thyroid Cancer Patients with Elevated Thyroglobulin/Thyrogl obulin Antibody	Evaluate the diagnostic accuracy of FDG PET/CT in detecting recurrence in	Moderate quality evidence demonstrates high diagnostic accuracy of
Hong, Miyoung Choi, Sang- Woo Lee, S. Oh		Levels and Negative Iodine Scintigraphy: A Systematic Review and Meta-analysis.	differentiated thyroid cancer patients with elevated thyroglobulin levels and negative whole-body scans.	FDG PET/CT with pooled sensitivity of 0.87 and specificity of 0.84.
Shahin Nosratzehi, Seyed-Mehdi Hashemi, Abolfazl Payandeh, Ahmad Bolouri, Fahimeh Okati	2024	The relationship between breast cancer and thyroid autoimmune disorders in southeast Iran: A case-control study	Investigate the relationship between breast cancer and thyroid autoimmune disorders in southeast Iranian women.	Subclinical hyperthyroidi sm risk was significantly higher in breast cancer patients (OR=8.27), but no difference in autoimmune thyroid disease incidence was observed.
M. Murad, S. Eassa	2023	Potential role of latent toxoplasmosis in inducing thyroid disorders with relevance to autoimmune thyroid disease and interleukin-33 level during pregnancy	Investigate the association between Toxoplasma gondii seropositivity and thyroid dysfunction in pregnant women.	Significant association between Toxoplasma infection and autoimmune thyroid disease prevalence, with high IL-33 levels linked to abnormal thyroid function.
Shiyi Zhao, Yue Xiang, Wei Yan, Dejie Chen	2025	Exploration of the clinical significance of rapid intraoperative measurement of lymph node thyroglobulin concentration in determining lymph node metastasis of papillary thyroid carcinoma	Evaluate the diagnostic accuracy of intraoperative thyroglobulin detection for lymph node metastasis in papillary thyroid carcinoma.	The optimal cutoff value for thyroglobulin was 77 ng/mL, with a sensitivity of 94% and specificity of 96% in identifying lymph node metastasis.
Qin Wan, Liling Tan, Xinlan Tang, Wenjun Wang, Yuting Su, Zhen	2024	The clinical value of iodine-125 seed implantation in the treatment of iodine-	Explore clinical benefits of iodine-125 seed implantation for iodine-	125I seed implantation significantly reduced tumor size and improved pain

Wu, M. Ke, Zhijun Chen		refractory differentiated thyroid carcinoma.	refractory differentiated thyroid cancer.	symptoms; effective in managing iodine-refractory differentiated thyroid carcinoma.
I. Ignatko, D. Yakubova, A. D. Megrabyan, E. Timokhina	2022	Clinical significance of autoantibody levels in diagnosis of early and late forms of fetal growth retardation	Analyze the potential of autoantibodies for diagnosing fetal growth retardation forms.	Certain autoantibodies levels significantly increased in women with different forms of fetal growth retardation.
Li Chen, Kai Chang, Xiaoyun Pu, Shifu Luo, Zhuyun Peng, Ming Chen	2016	Gestation-specific reference intervals for thyroid function tests and the clinical significance for thyroid function monitoring through different periods of pregnancy	Investigate gestation-specific reference intervals and thyroid function dynamic changes in pregnancy.	Establishment of gestation-specific reference intervals helped reduce the risk of overdiagnosis of thyroid dysfunction.
Anthony P. Weetman	2020	An update on the pathogenesis of Hashimoto's thyroiditis	Update on the understanding of the pathogenesis of Hashimoto's thyroiditis with recent findings.	Emphasizes the complexity of genetic factors and cytokine networks in Hashimoto's thyroiditis pathogenesis.
Giacomo Caio, Umberto Volta, Anna Sapone, Daniel A. Leffler, Roberto De Giorgio, Carlo Catassi, Alessio Fasano	2019	Celiac disease: a comprehensive current review	Comprehensive review of celiac disease pathophysiology, diagnosis, and management.	Highlights the autoimmune nature of celiac disease and the predominance of a strict gluten-free diet as therapy.
Douglas S. Ross, Henry B. Burch, David S. Cooper, M. Carol Greenlee, Peter Laurberg, Ana Luiza Maia, Scott A. Rivkees, Mary H. Samuels, Julie Ann Sosa, Marius N. Stan, Martin A. Walter	2016	2016 American Thyroid Association Guidelines for Diagnosis and Management of Hyperthyroidism and Other Causes of Thyrotoxicosis	Provide updated evidence-based clinical guidelines for diagnosing and managing thyrotoxicosis.	Developed 124 evidence-based recommendations for managing thyrotoxicosis considering new literature.
Tobias Carling, Robert Udelsman	2013	Thyroid Cancer	Discuss the increasing incidence and treatment controversies of thyroid cancer.	Emphasizes the need for personalized treatment plans due to varied treatment responses and outcomes.

Deandreis, Désirée, Durante, Cosimo, Filetti, Sebastiano, Lamartina, Livia	2016	ENDOCRINE TUMOURS: Imaging in the follow-up of differentiated thyroid cancer: current evidence and future perspectives for a risk-adapted approach	Evaluate the use of imaging technology for follow-up care in differentiated thyroid cancer.	Advocates for a dynamic, risk-adjusted follow-up strategy utilizing advancements in imaging technology.
BIONDI, BERNADET TE, Filetti S, Schlumberge r M.	2005	Thyroid-hormone therapy and thyroid cancer: a reassessment.	Reassess the role of thyroid-hormone therapy and TSH suppression in thyroid cancer treatment.	Indicates TSH Suppression benefits high-risk patients but may not be advantageous for low-risk cases.
Carvalho, Gisah A., Graf, Hans, Maciel, Léa Maria Z., Maciel, Rui Monteiro de Barros, Maia, Ana Luiza, Rosário, Pedro Weslley, Vaisman, Mário, Ward, Laura S.	2013	Nódulo tireoidiano e câncer diferenciado de tireoide: atualização do consenso brasileiro	Update the Brazilian Consensus on thyroid nodules and differentiated thyroid cancer.	Emphasizes the importance of identifying patients for aggressive management while minimizing unnecessary treatments.

References:

Ji-In Bang, Sohyun Park, Keunyoung Kim, Youngduk Seo, A. Chong, C. Hong, Miyoung Choi, et al. (2023) The Diagnostic Value of F-18 FDG PET/CT in Differentiated Thyroid Cancer Patients with Elevated Thyroglobulin/Thyroglobulin Antibody Levels and Negative Iodine Scintigraphy: A Systematic Review and Meta-analysis.. Thyroid : official journal of the American Thyroid Association. doi: https://www.semanticscholar.org/paper/e3d83eb5d355cf76ff717b80a73ad972a62351cc

Maja J Zieba-Domalik, Dominika Orszulak, Kacper Niziński, Katarzyna Wilk, M. Janik, Rafał Stojko, Agnieszka Drosdzol- Cop (2024) Associations vulvar lichen sclerosus with autoimmune thyroid diseases.. Ginekologia polska. doi: https://www.semanticscholar.org/paper/948f026ff3c694830e7ccd5440dcc1b454023830

Shahin Nosratzehi, Seyed-Mehdi Hashemi, Abolfazl Payandeh, Ahmad Bolouri, Fahimeh Okati (2024) The relationship between breast cancer and thyroid autoimmune disorders in southeast Iran: A case-control study. Volume(58). Endocrine Regulations. doi: https://www.semanticscholar.org/paper/95e9744d2dcd4cd24358d6a1a9ef182efe0e077b

M. Murad, S. Eassa (2023) Potential role of latent toxoplasmosis in inducing thyroid disorders with relevance to autoimmune thyroid disease and interleukin-33 level during pregnancy. International Journal of One Health. doi: https://www.semanticscholar.org/paper/d3394be85edef2463042f6a92881845894fc62ee

Shiyi Zhao, Yue Xiang, Wei Yan, Dejie Chen (2025) Exploration of the clinical significance of rapid intraoperative measurement of lymph node thyroglobulin concentration in determining lymph node metastasis of papillary thyroid carcinoma. Molecular & Cellular Biomechanics. doi: https://www.semanticscholar.org/paper/4c8b7e683ae713891006d48791131f431e0844a0

Qin Wan, Liling Tan, Xinlan Tang, Wenjun Wang, Yuting Su, Zhen Wu, M. Ke, et al. (2024) The clinical value of iodine-125 seed implantation in the treatment of iodine-refractory differentiated thyroid carcinoma.. Volume(15), 1327766 . Frontiers in endocrinology. doi: https://www.semanticscholar.org/paper/9654cc532991db7dedd2aab2802e984047d43274

I. Ignatko, D. Yakubova, A. D. Megrabyan, E. Timokhina (2022) Clinical significance of autoantibodies level in diagnosis of early and late forms of fetal growth retardation. Obstetrics, Gynecology and Reproduction. doi: https://www.semanticscholar.org/paper/703f66fd71a1ec41bf8bd

029c58372b2fc8e0de3

Li Chen, Kai Chang, Xiaoyun Pu, Shifu Luo, Zhuyun Peng, Ming Chen (2016) Gestation-specific reference intervals for thyroid function tests and the clinical significance for thyroid function monitoring through different periods of pregnancy. Volume(39), 511-515. Chinese Journal of Laboratory Medicine. doi: https://www.semanticscholar.org/paper/fbd802bb918488b00af2dfd4f5c35702017e626b

Anthony P. Weetman (2020) An update on the pathogenesis of Hashimoto's thyroiditis. Volume(44), 883-890. Journal of Endocrinological Investigation. doi: https://doi.org/10.1007/s40618-020-01477-1

Giacomo Caio, Umberto Volta, Anna Sapone, Daniel A. Leffler, Roberto De Giorgio, Carlo Catassi, Alessio Fasano (2019) Celiac disease: a comprehensive current review. Volume(17). BMC Medicine. doi: https://doi.org/10.1186/s12916-019-1380-z

Douglas S. Ross, Henry B. Burch, David S. Cooper, M. Carol Greenlee, Peter Laurberg, Ana Luiza Maia, Scott A. Rivkees, et al. (2016) 2016 American Thyroid Association Guidelines for Diagnosis and Management of Hyperthyroidism and Other Causes of Thyrotoxicosis. Volume(26), 1343-1421. Thyroid. doi: https://doi.org/10.1089/thy.2016.0229

Tobias Carling, Robert Udelsman (2013) Thyroid Cancer. Volume(65), 125-137. Annual Review of Medicine. doi: https://doi.org/10.1146/annurev-med-061512-105739

Deandreis, Désirée, Durante, Cosimo, Filetti, Sebastiano, Lamartina, et al. (2016) ENDOCRINE TUMOURS: Imaging in the follow up of differentiated thyroid cancer: current evidence and future perspectives for a risk-adapted approach. doi: https://core.ac.uk/download/74318453.pdf

BIONDI, BERNADETTE, Filetti S, Schlumberger M. (2005) Thyroid-hormone therapy and thyroid cancer: a reassessment.. doi: https://core.ac.uk/download/55012111.pdf

Carvalho, Gisah A., Graf, Hans, Maciel, Léa Maria Z., Maciel, et al. (2013) Nódulo tireoidiano e câncer diferenciado de tireoide: atualização do consenso brasileiro. doi: https://core.ac.uk/download/37711168.pdf

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