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RESEARCH ARTICLE

Antibacterial Activity of Synthesized Graphene Oxide Modified Nickel Phthalocyanine

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Abstract

The antimicrobial properties of Graphene Oxide Modified Nickle Phthalocyanine were evaluated against Staphylococcus aureus, Gram-positive bacterium and sydomonus, Gram-negative one.. Bacteriological tests were performed in Muller Hinton solid agar plates with different concentrations of graphene oxide particles. The inhibition zones as a function of added graphene oxide where studied ,the results show that as the concentration of graphene oxide increased the inhibition zone increased also against both types of bacteria. Whene the ratio of added graphene oxide was (15%) maximum inhibitionzone hase been calculated.

Keywords: *Graphene oxide; Nickle Phthalocyanine; Antimicrobial.*

Introduction

Graphene oxide (GO), a two-dimensional carbon material, has attracted a great deal of attention [1] Apart from the layered structure with a large theoretical specific surface area[2] GO nanosheets bear abundant oxygen-containing surface groups, such as hydroxyl, epoxide, carbonyl and carboxyl groups [3]. The presence of such groups not only allows the GO sheets to be well dispersed in water to yield a colloid ally stable suspension, [4] but also offers potential application as nanoscale substrates for the fabrication of flexible GO based composite materials.

For instance, GO has been employed as a support to anchor gold (Au) nanoparticles for catalytic applications [5]. Very recently, it has been reported that GO could inhibit the growth of Escherichia coli (E. coli) [6]. It has also been found that graphene and GO nanowalls could damage the cell membrane by direct contact with the bacteria [7].Moreover; graphene nanosheets can enhance photo-inactivation of graphene/TiO2 composite on E. coli bacteria [8].

Shi et al [9]. Reported that Ag-chemically converted graphene displayed the antibacterial properties of free Ag nanoparticles. In this work, we modified the GO by depositing Nickle Phthalocyanine (NiPc) nanoparticle on the surface of GO nanosheets, which promised two advantages: (a) to keep NiPc nanoparticles well-dispersed in aqueous solution with the support of GO, and (b) to enhance the antibacterial activity by the synergistic effect of NiPc nanoparticles and GO. Experimental results showed that the NiPc-GO nanosheets displayed excellent antibacterial properties towards *Pseudomonas and* staphylococcus.

An antibacterial mechanism was proposed to understand the superior antibacterial activity of the NiPc-GO composite. GO was prepared from natural graphite by using a modified Hummers method [10]. The obtained GO was modified with NiPc nanoparticles with three different weight ratio (10%, 15%20%) wt%.

Required Materials

Graphite flakes (acid treated (99%) Potassium permanganate (99.9%), Phosphoric acid (99.9%), Hydrogen peroxide (98.9%), sulphuric acid (98.%) Hydrochloric acid (35%).Nickle phthaylocinine (NiPc).

Result and Discussion

XRD analysis was used to calculate the average crystalline aspects of the GO sheet. Results are shown in Figure (1).

The prepared sheet of Go showed a very strong peak at 2 θ = 10.1 °, which is deal with the literatures [11]. The tests of XRD initially proved the successful synthesis of GO sheet**.** The FTIR spectrum Figure (2) of shows a broad peak between 3100-3700 cm-1 in the very high frequency area with a sharp peak at 1635 cm-1 refere to the stretching and bending vibration of (OH) groups of water molecules adsorbed on graphene oxide. Therefore, it can be concluded that the samples have strong hydrophilicity. The absorption peaks at 2932 cm-1 and 2855 cm-1 are express the symmetric and anti-symmetric stretching vibrations of CH2, while the presence of 2 absorption peaks happened in the medium frequency area, at 1635 cm-1 and 745 cm-1 can be attached to the stretching vibration of (C=C) and (C=O) of carboxylic acid and carbonyl groups found at the edge of graphene oxide. The presence of these oxygen-containing groups refer to that the graphite has been oxidized. The polar groups, especially the surface hydroxyl group, result in the formation of hydrogen bonds between graphite and water molecules; this further explains the hydrophilic nature of graphene oxide and this deal with [12].

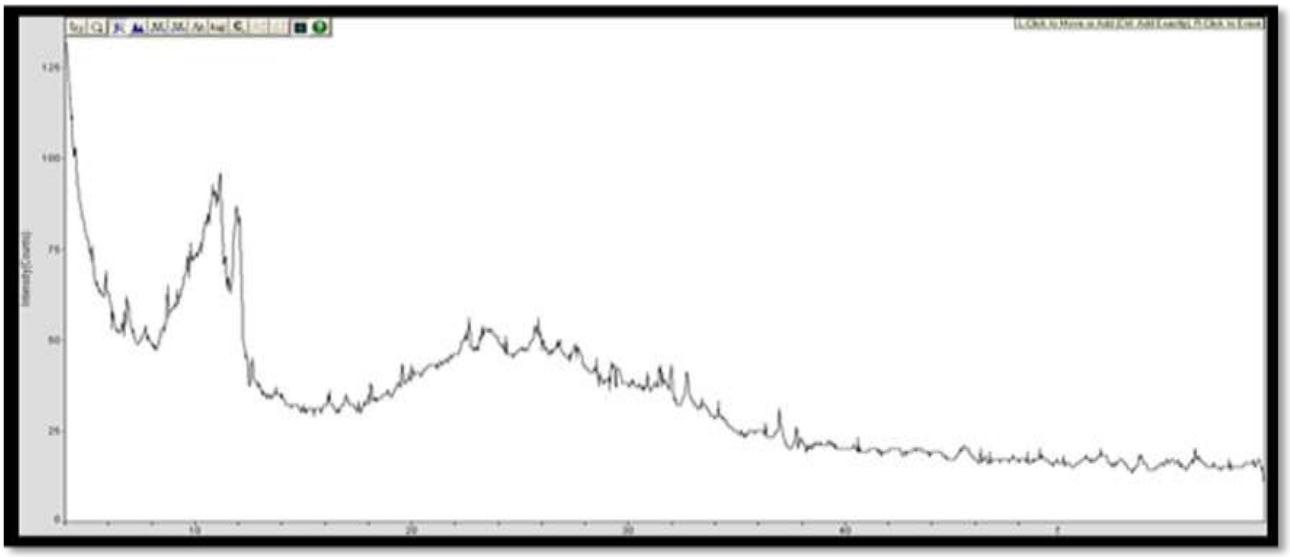

Figure 1: XRD of Prepared graphene oxide

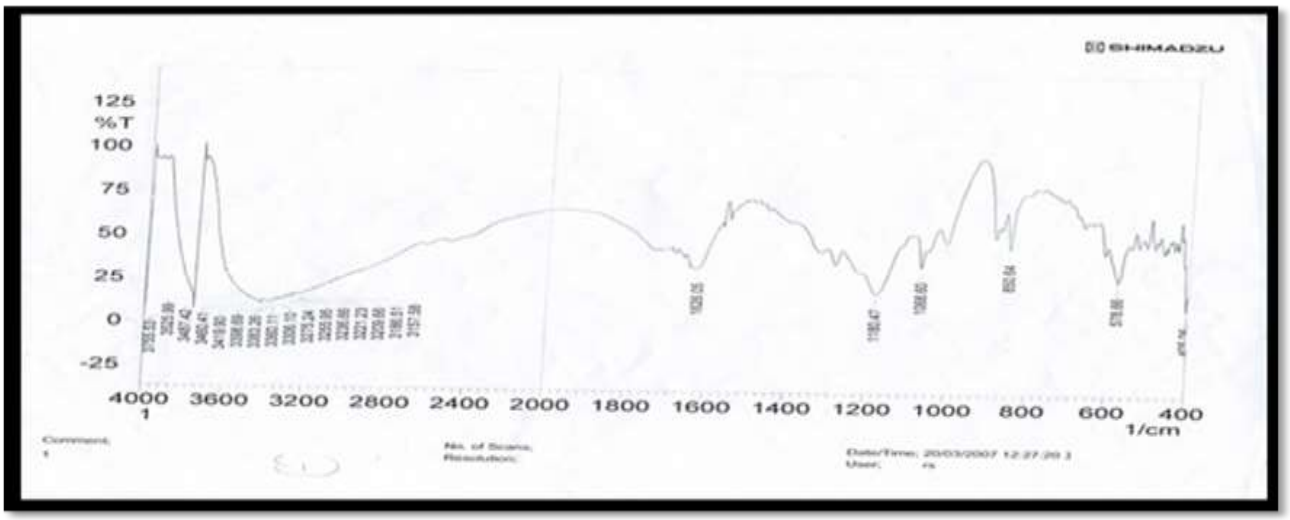

Figure 2: FTIR Spectrum of prepared graphene oxide

Antimicrobial Investigations

The antimicrobial properties were evaluated against Staphylococcus aureus, Gram-positive bacterium and sydomonus, Gram-negative one. The kinetic of bacteria growth rate was determined by a method called Disc count which is in detail On Muller Hinton agar media 0.1 ml of bacterial culture was spread and then leave agar dish in wells at room temperature for 15 min for the purpose of absorbing the vaccine. Four wells were made in the plate using 8 mm diameter, then filled with various 100micro leter Volume of

each weight ratio of GO(10%,15%,20%). In Muller Hinton ager at $37C^0$ for 24 hours, The zone of inhibition measured by mm after 24 hours of incubation.

Two types of bacteria used in this study

Pseudomonas and staphylococcus as show in Fig. (3).

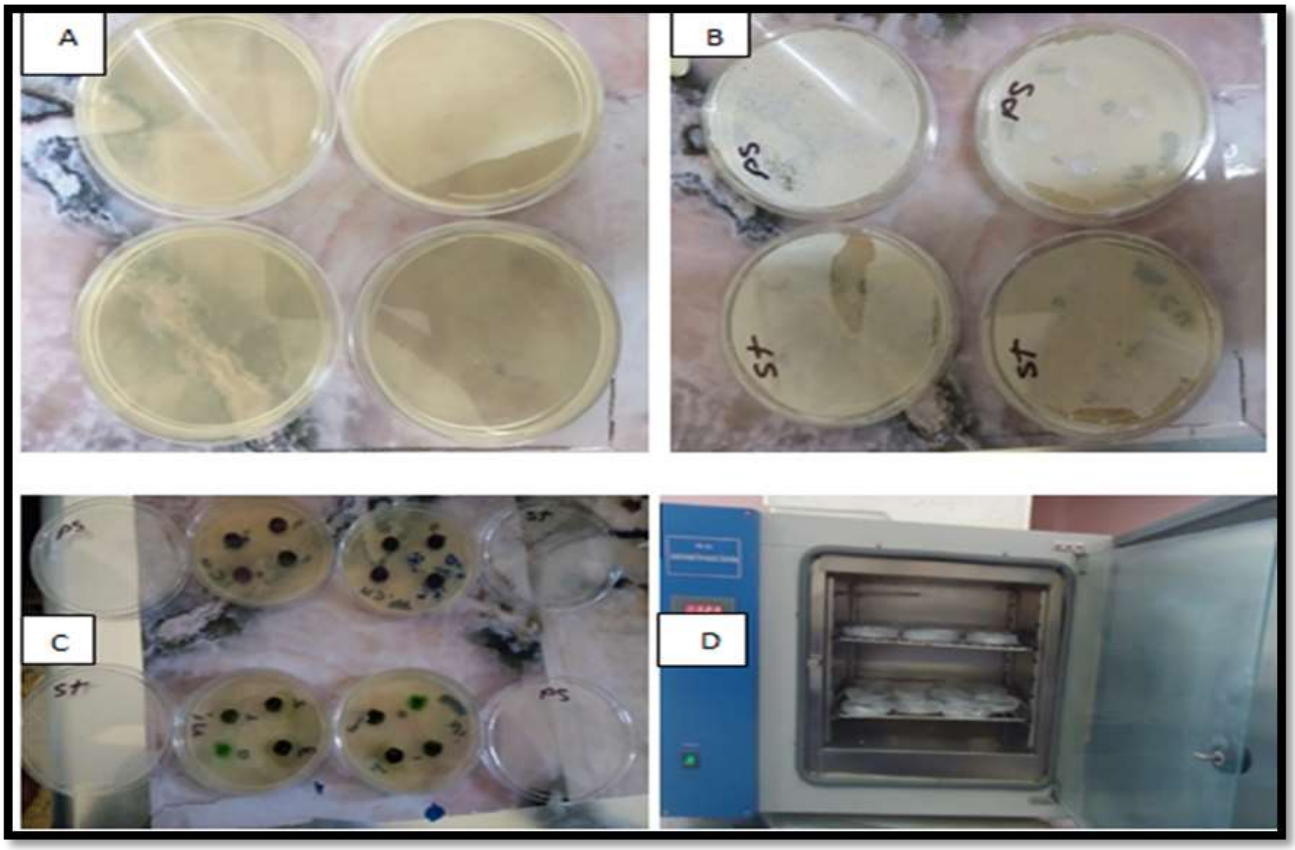

Figure 3: (A,B) Culturing bacteria on the surface called agger, (C)10,15,20% of GO added to nickle phthalocyanine (D)Bacteria culture instrument and specimens

The effect of graphene oxide on the inhibition zone against staphylococcus aureus illustrated as follow:

- When the ratio of GO was zero there was no inhibition that mean the inhibition zone is zero.
- At 10% wt of GO, (GO/NiPc) The inhibition zone was (9.50±1.32) against staphylococcus aureus.
- At 15% wt of GO (GO/NiPc), the inhibition zone was (18.50±0.95) against staphylococcus aureus.
- At 20% wt of GO, (GO/NiPc), the inhibition zone was (10.50±1.57) against staphylococcus aureus [13].

The result above illustrated in Table (1).

Table 1: Inhibition zone Values with the ratio of (GO) against staphylococcus aureus bacteria

Sample	Inhibition Zone
Pure NiPc	0 mm
NiPc:10% GO	9.50±1.32 mm
NiPc:15% GO	18.50±0.95 mm
NiPc:20% GO	10.50±1.57 mm

The effect of graphene oxide on the inhibition zone against Pseudomonas aureus illustrated as follow:

- When the ratio of GO was zero there was no inhibition that mean the inhibition zone is zero.
- At 10% wt of GO (GO/NiPc) the inhibition zone was (6.50±1.3) against Pseudomonas bacteria.
- At 15% wt of GO (GO/NiPc), the inhibition zone was (13.50±0.75) against Pseudomonas bacteria.

- At 20% wt of GO (GO/NiPc), the inhibition zone was (7.5±1.5) against Pseudomonas bacteria [14].

The results above illustrated in Table (2).

Table 2: Inhibition zone (mm) Value with the ratio of (GO) against staphylococcus aureus bacteria

Sample	Inhibition Zone
Pure NiPc	0 mm
NiPc:10% GO	6.50±1.3mm
NiPc:15% GO	13.5±0.75mm
NiPc:20% GO	7.5±1.5mm

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