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Green synthesis of nano binary oxide MgO/SiO_2 antibiotic, cytotoxicity and applied on wound dressing

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Abstract

Green chemistry approach is an environmentally friendly it is preferred over chemical and physical techniques due to the use of natural raw materials instead of chemicals that are more toxic and expensive. The current work concentrated on the green synthesis of nano binary oxide MgO/SiO_2, depending on rice husk ash (RHA)as raw material. The sample prepared with different ratios of MgO/Silica oxide (0.75:0.25,0.9:0.1,0.25:0.75, and 0.5:0.5). The MgO/SiO_2 is characterized using X-ray diffraction,energy dispersive x-ray spectroscopy(EDX), Field emission electron microscopy(FE SEM), and Brunaur-Emmett-Teller surface area (BET) techniques. The effects of magnesium oxide on modifying silica amorphous on structural parameters and surface qualities have been identified. The performance of binary nano oxide MgO/SiO_2 based on the difference in the ratio of MgO/Silica oxide activity and physicochemical properties. According to results the ratio (0.5:0.5) of nano binary oxide MgO/SiO_2 it has high activity with mesoporous having a significant surface area and pore distribution that has more activity against Gram-negative bacteria *Escherichia coli (E. coli*) at a concentration of 625 µg/ml, as well as using binary nano oxide MgO/SiO_2 to make wound dressings that operate as antimicrobial. *In-vitro* cytotoxic effects were studied of nano composites MgO/SiO_2 on Vero cell line 101. Different concentrations were investigated. MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay was used to determine the cytotoxic effects of green synthesized nano powder. This study involved preparations for medical ointments with therapeutic efficacy by studying the effect of these ointments on *Staphylococcus aureus(S. aureas*) bacteria burns and wounds.

Keywords:- Antibiotic; Wound dressing; Rice husk; Skin cancer ; Toxicity

1. Introduction

There is currently the potential for rapid production of metal nanoparticles using conventional chemical and physical methods; nevertheless, these processes result in the presence of some harmful compounds adsorbed on the surface, which may have unintended implications in medical applications [1]. Much interest has been focused on the development and discovery of novel non-toxic, environmentally friendly methods for the synthesis of metal nanoparticles, such as plants and bioactive elements found in plants, because of their superior reducing ability and antimicrobial properties, as well as the physicochemical features of green Nanoparticles synthesis, this technique also has the added benefit of increasing the life span of NPs, which overcomes the limitations of traditional chemical[2].MgO nanoparticles' exact antibacterial mechanism is unknown. Numerous methods have been proposed to explain the antibacterial mechanism of MgO nanoparticles, including the generation of reactive oxygen species (ROS)[3]. Attached to and penetrated within bacteria, nanoparticles create reactive oxygen species nanoparticles (NPs) interact with sulfur-containing proteins in the bacterial membrane and with phosphorus-containing molecules like DNA. Silver NPs target the bacterial membrane and cause cell death by destabilizing the plasma membrane potential and depleting intracellular ATP levels. Recent studies have shown that the production of reactive oxygen species, damage to cellular enzymes (the cellular respiratory chain), disruption of the cellular membrane, and DNA damage all contribute to cell lysis and death. [4]. NPs antibacterial processes include the development of oxidative stress via the generation of reactive oxygen species, which may result in the deterioration of the cell's membrane structure [5]. Ions released from the surface of

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nanoparticles have been shown to cause bacterial mortality via membrane binding [6]. Antimicrobial drug development is undoubtedly the most effective method of chemotherapy in the history of medicine [7] which has saved the lives of millions of people while also relieving their suffering and preventing them from succumbing to chronic infections [8]. Wound dressings have been used to prevent wounds against infection for centuries. However, in recent years, this function has been associated with active wound healing [9]. Modern polymeric dressings can aid in wound healing by maintaining and generating a moist environment around them, but they can also be used directly to deliver bioactive compounds to the wound site and prevent acute and chronic wound infection from reinfection and discomfort. These drug-loaded dressings act as a physical barrier from foreign microorganisms invading, as well as a delivery system for antimicrobials used to treat/ or prevent bioburden [10]. Antibacterial dressings may offer several benefits, including localized, long-lasting antibacterial release, decreased toxicity, adverse effects, and drug administration (reducing antibiotic resistance) [11]. The main aim of the present work is to synthesise, characterize and investigate biological activity of composite nano binary oxide MgO/SiO_2 nanoparticles as a reagent for medical skin treatments.

2. Experimental

2.1 Material

Local agricultural rice husk, Hydrochloric acid (98.5%, purity), Sodium Hydroxide (97%), triple distilled water, sulphuric acid (99.5% purity) and Magnesium oxide (MgO) (99.8% purity). Miller Hinton agar (HIMEDIA), Nutrient Broth (Himedia) and the solvent Dimethyl Sulfoxide (DMSO) were used. The fresh Vero cell line-101 was procured from the National Institute of Genetic Engineering and Biotechnology in Tehran, Iran, with permission from the Ethical Committee of the Pharmaceutical Sciences Branch of the Islamic Azad University of Tehran.

2.2Preparation of silica oxide from RHA

Rice husks are mechanically cleaned and then rinsed with distilled water to remove contaminants such as soil, dried for three hours at 100 °C. The burning took place in a furnace (Nabertherm type HTCT 08/16/ Germany) at a temperature of 700 °C for two hours to get white ash. 80 ml of (2.5N) sodium hydroxide solution was applied to 10 g of the burning rice husk ash (RHA) sample using a magnetic stirrer under 100 °C for 4 hours to dissolve the silica present in rice husk ash using a 250 mL Erlenmeyer flask. The filtrate is then removed and rinsed with warm distilled water. This stage produces a translucent viscous, colourless solution of sodium silicate, as described in the following chemical equation

$$SiO_2\ (RHA) + NaOH \rightarrow Na_2SiO_3 + H_2O \quad \ldots (1$$

Extraction of pure silicon dioxide by titration with (5N) sulphuric acid solution H_2SO_4 (CAS 7664-93-9) and gradually adding to a sodium silicate solution with a magnetic stirrer at a temperature of 100-90 °C. Complete precipitation of silica and formation of sodium sulphate at this step is shown in the reaction equation below.

$$Na_2SiO_3 + H_2SO_4 \rightarrow SiO_2 + Na_2SO_4 + H_2O \quad \ldots (2$$

To remove sodium sulphate contaminants from the gel product, it is rinsed numerous times with warm distilled water [12].

2.3Preparation of nano binary oxide MgO/SiO_2

nano MgO/SiO_2 was synthesized with a different percentage weight from silica gel that have been prepared from rice husk ash and a different percentage weight from magnesium oxide (0.1:0.9,0.25:0.75,0.75:0.25 and 0.5:0.5). Each different percentage was dissolved in 10 ml of ethanol and 10 ml of de-ionized water was added to a beaker of 100 ml. After that ultrasonic treatment for 15 minutes, the mixture solution was constantly stirred at 50 ˚C until dried, then washed many times with deionized water, and then dried in the oven at 100 °C /24 h [13]. Nanoparticles of nano binary oxide SiO_2/MgO were characterized by X-ray diffraction, FESEM, and BET techniques.

2.4Antibiotic activity determination

The spectrophotometric method was used to determine antibiotic activity. It involves the preparation of a solution of nutrient broth powder by dissolving 13 g in 1000 ml of distilled water and sterilizing in the autoclave at 121 ˚C for 15 min. The stock solution was prepared by weighing 0.05 g of binary oxide dissolved in 20 ml of DMSO. Stock solution with a concentration of 2500 µg/ml was sterilized in an autoclaved and treated with ultrasonic for 24 h. Then, different concentrations of synthesis nano binary oxide (control = 0, 625, 312.5, 156, and 31.25) µg/ml were prepared. 1 ml of l *E. coli* bacteria was added for each concentration and incubated at 37 ˚C for 24 h [14].

E. coli bacteria were isolated from patients wounds and burns, biochemical techniques were used to identify bacteria isolates [13,14]. The minimum bactericidal concentration (MBC) and minimum inhibitory concentration (MIC) tests were used to measure nano binary oxide activity. *E. coli* was grown to achieve 0.5 McFarland ($1.2*10^8$ CFU/ml) in a sterile saline solution. The nano binary oxide MgO/SiO_2 powder was tested at different doses (High dose 625, medium dose, 156, and low dose 31.25) µg/ml. Petri dishes were incubated at 37 °C for 24 h after applying nano binary oxide MgO/SiO_2 on wound dressings.

2.5 Vitro Method to Measure Cytotoxicity of Nano binary oxide SiO_2/MgO nanoparticles agents in Vero cells line101.

Cytotoxicity tests were among the first *in-vitro* bioassay methods used to predict substance toxicity. *In-vitro* cytotoxicity testing is an important tool for assessing safety and screening compounds, as well as ranking them. Specific research objectives may influence the choice of cytotoxicity assay technology. As a result, four major types of essays are used to monitor the response of cultured cells to potential toxicants. Investigating the impact of cell nano binary oxide SiO_2/MgO nanoparticles on Vero cells line-101 was procured from the National Institute of Genetic Engineering and Biotechnology in Tehran, Iran, with permission from the Ethical Committee of the Pharmaceutical Sciences Branch of the Islamic Azad University of Tehran. Vero cells-101 line were seeded and labelled on 96 tissue culture plates and treated with different concentrations of binary oxide SiO_2/MgO nanoparticles preparation with concentrations (2000,1000,500,250,125,62,31, 15.5 and 7.5) µg/ml. Sterile test tubes were prepared, and 1 mL of the complete medium was added to each, except for tube number one, which received 1.8 mL and 200 µg/mL from the Nano binary oxide stock solutions (SiO_2/MgO) with a concentration of 20000µg/ml.

First tube the concentration of it at 2000 µg/ml, then a series of dilutions to prepare the following concentrations (2000,1000,500,250,125,62,31, 15.5 and 7.5) µg/ml . After the preparation of the concentrations is completed, 200 µL from each concentration is taken and added to Vero cell line-101, which was seeded into a 96-well cell culture microtiter plate. Each concentration was replicated four time as a control group. Then the plate was covered with a self-plastic lid and incubated at 37 ˚C for 24 h, at the end of the exposure period. The cell line growth was assessed by a cytotoxicity assay and by an MTT assay. After the incubation period, 200 µL of the MTT labelling reagent was added to each well, and incubated for 4 h in a humidified environment, such as 37°C, 5–6.5% CO_2. 100 µL of the solubilisation buffer was added into each well then the plate was allowed to stand overnight in the incubator in a humidified atmosphere, such as 37°C, with 5 to 6.5% CO_2. The optical density (OD value) of each well was determined using a microplate (ELISA) reader with a wavelength of 570 nm. [15,16].

2.6 Preparation of nano medical ointment

Medical ointment composition from nano binary oxide MgO/SiO_2 (0.5:0.5): the prepared active ingredient and application to the medical gauze method of work includes several steps in the preparation of an ointment base. It consists of two phases: the first is an oil phase including emulsifier materials, and the second is an aqueous phase. The oil phase includes the weight of 12.5 g of beeswax white and 70 mL of paraffin oil, and it is placed in a ceramic jar inside a water bath at 60˚C. Then the mineral oil (paraffin) is added and mixed well.

An aqueous phase is prepared by adding 1g of borax to water to dissolve the borax in a water bath at 60 ˚C (both liquid phase and oil phase at the same temperature). After completing the melting process for the oil phase, the water phase is gradually added to the oil phase with continuous stirring. Benzoic acid (0.1%), a preservative is added to its antibacterial [17]. Benzoic acid itself has low toxicity [18]. After preparation, the ointment base 1g from emulsions was taken and was mixed with different weights of (0.04, 0.06, 0. 08 and 0.1) grams of nano active powder (SiO_2/MgO). Each weight of nano-active powder was mixed well to ensure the homogeneity of the active substance with the emulsion (ointment base) to obtain an effective medicinal ointment.

3. Results and discussion

3.1 Charctrazition of nano binary oxide

The crystalline phases of the samples were detected by X-ray powder diffractions (XRD) with Cu-K radiation 1.54056 A˚ at room temperature using a diffraction meter (2700 AB HAO YUAN). X-ray diffraction techniques can be used to understand crystaline. Fig.1shows the diffraction peak of nano binary oxide MgO/SiO_2 (0.5:0.5) appearing at 2^o values as shown in table1, the structure is orthorhombic. Fig.1b of nano binary oxide MgO/SiO_2 is observed at 2 theta 20-30 broad peak indexes for amorphous silica oxide present in the crystal structure

of nano binary oxide MgO/SiO_2. Also, observe shift peak at 2 º 42.689 and 62.096 that indicates an overlap between silica geal and magnesium oxide to produce nano binary oxide with new physicochemical properties as shown in table 1. The Leshan Usgodaarachchi et al XRD pattern of amorphous silica NPs that were synthesised from raw material rice husk is similar to the XRD pattern of our study [19].

Average crystal size can measure from x-ray diffraction technology data by the Scherrer equation [20].

L =kλ/β cos º … (3

L= thickness of crystallite (mean crystal size), K= Scherrer s constant depends on crystal shape (0.94 is spherical, 0.90 tube or rode and 0.89 or 0.85 wire or other shapes), λ= is the wavelength (0.1540 nm), β= FWHM * Π/180 and º = is Bragg angle.

Table1. The average crystal size of nano binary oxide SiO_2/MgO powder and magnesium oxide.

No	2 Theta	Average crystal size(nm) SiO_2/MgO	2Theta	Average crystal size(nm) MgO
1	29.235	62.855	22.581	42.832
2	42.689	16.997	30.462	42.934
3	62.096	16.138	38.178	33.291
4	78.326	21.484	55.413	38.542

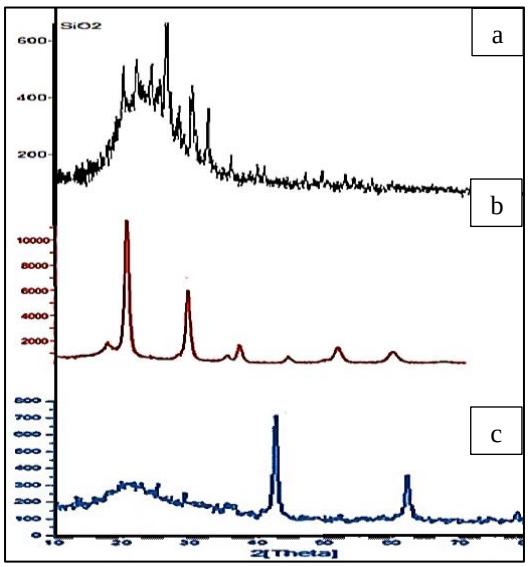


Fig1. X-ray diffraction of patterns a. nano-silica oxide b. magnesium oxide MgO, and c. Nano binary oxide SiO_2/MgO).

At -196 ˚C, nitrogen adsorption-desorption isotherms on the desorption branches were evaluated using the Emmett-Teller (BET) and Barrett-Joyner-Halenda (BJH) models (RESOLUTION795.00e-3) the results conducted that 0.5/0.5 percentage is more activity with the highest surface area BET (m^2/g).

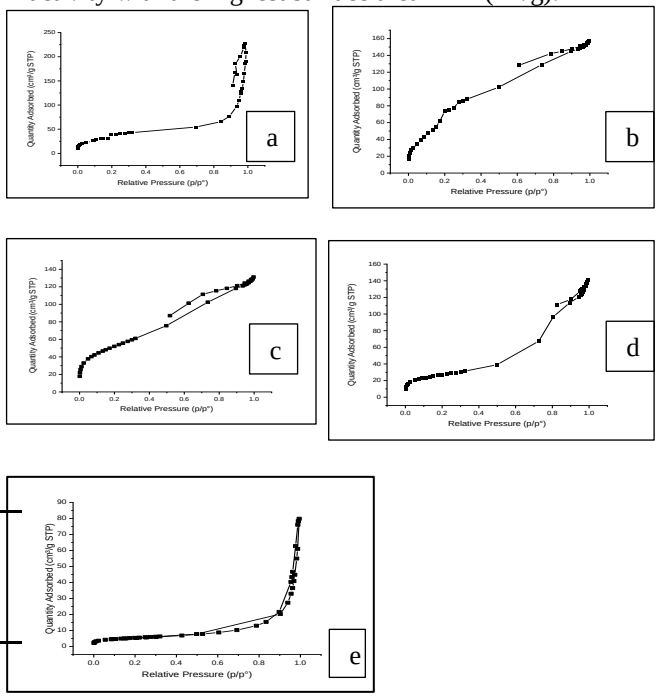


Fig2. Nitrogen adsorption isotherms and pore size distribution for MgO/SiO_2 a. 0.25:0.75, b.0.75:0.25 , c.0.9:0.1 ,d. 0.5:0.5,and e. pure SiO_2.

Table 2. Surface area BET(m^2/g) of nano binary oxide MgO /SiO_2 at a different percentage.

Antibiotic Mg-Si	BET (m^2/g)	Average Volume (cm^3/g)	Average Particle Diam. (nm)	Average Size crystal (nm)
0.25/0.75	183.142	0.265	4.977	35.813
0.75/0.25	100.967	0.185	6.072	49.518
0.9/0.1	97.527	0.129	6.421	58.100
0.5/0.5	200.147	0.288	4.403	29.032
SiO_2	91.134	0.111	9.183	47.832

The adsorption isotherms for the binary mixed oxide synthesized by the wet method with different percentages. Table 2 summarizes the Brunauer-Emmett-Teller (BET) for MgO /SiO_2 with a different percentage from the adsorption isotherms. The specific pore volume Vp was determined using the molar volumes of gaseous and liquid nitrogen and the adsorbed amount of nitrogen. While the nano binary oxide MgO /SiO_2 (0.75:0.25, 0.25:0.75, 0.9:0.1 and 0.5:0.5) are comparable, the specific surface area

(SBET) and pore volume (Vp) of mixed oxides are highly dependent on the MgO and silica oxide content.

So nano binary oxide MgO/SiO_2 gives the greatest value for surface areas (BET) of 0.5:0.5 equal to 200.147 m^2/g. Surprisingly, the mixed oxides with a large proportion of magnesium oxide have much larger surface areas than pure silica oxide. But at the same time noted with a high weight percentage of magnesium oxide contents 0.9:0.1 the surface area is smaller as shown in table 2. The International Union of Pure and Applied Chemistry classifies them as Type IV isotherms as shown in Fig.2. The BJH pores have an average diameter of between (4 and 6) nm, indicating that they are mesoporous [21].

The morphology of the antibiotic MgO/SiO_2 was examined using FESEM results of scanning electron microscopy images for binary oxide MgO/SiO_2(0.5:0.5). Which consists of a spherical particle structure with a diameter within a nanoscale that agglomerates together. The morphology of nano binary oxide MgO/SiO_2 nanoparticles derived from rice husk was studied using field-emission scanning electron microscopy (FESEM). This microscope captures three-dimensional images of the crystallographic process in high resolution. The morphology of MgO/SiO_2 generated with this approach was investigated using three-dimensional pictures on the 200nm scale. The crystal grain size and crystal grain size distribution amount was (27.715) nm as shown in Fig.3.

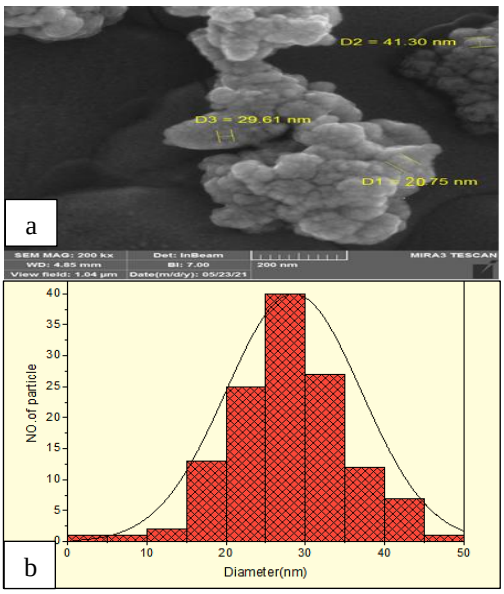
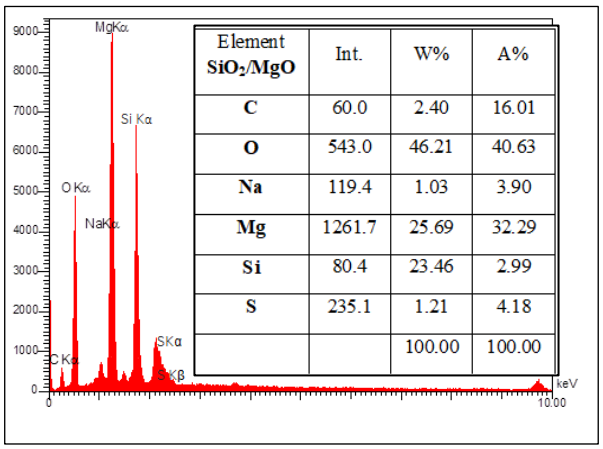


Fig.3.FE-SEM image of MgO/SiO_2(0.5:0.5),b. The average particle diameter of composition particles grains sizes.

To assess the chemical composition of nano binary oxide MgO/SiO_2 (0.5:0.5), elemental analysis was performed as depicted in Fig.4. As demonstrated by the observed result, the nano binary oxide (0.5:0.5) contained significant amounts of major components such as magnesium, oxygen, carbon, and silica with different weight percentages as shown in the table attached to Fig.4. It is self-evident from the elemental analysis that carbon percentage was 2.40%, magnesium 25.69% and silica 23.46%.



Element SiO_2/MgO	Int.	W%	A%
C	60.0	2.40	16.01
O	543.0	46.21	40.63
Na	119.4	1.03	3.90
Mg	1261.7	25.69	32.29
Si	80.4	23.46	2.99
S	235.1	1.21	4.18
		100.00	100.00

Fig.4 EDX of nano binary oxide MgO/SiO_2 (0.5:0.5) with percentage weight of element content in a sample.

3.2Antibiotic activity

Numerous analytical techniques have been employed to determine the antibacterial activity of nano binary oxide MgO/SiO_2, The measure of zone inhibition by using Muller Henton agar is the most often used method, followed by colony counting, which includes bacteria and MgO/SiO_2 nanoparticles in optimal circumstances, the mechanisms include the release of ions oxygen species, which interact with the cell membrane of bacteria and causes degradation of membrane structure and causes death cells. The results of the antibiotic test at a high dose with a concentration of 625µg/ml showed no growth at medium dose and low dose growth inhibition (97% and 95%) respectively is shown in table3.

The antibiotic activity of MgO/SiO_2 nanoparticles increased with antibiotic 0.5:0.5 more than in another antibiotic (0.25:0.75,0.9:0.1, and 0.75:0.25) this is due to antibacterial activity depending on particle size. When the particle size of MgO/SiO_2 increased, the activity decreased. The results show particle size of antibiotic 0.5:0.5 equal to 29.0323 nm smaller than another antibiotic as shown in table 3. Makhluf *et. al*., revealed that magnesium oxide nanoparticles with particle size (45-70) nm were effective against *E. coli* and *S. aureus* [22]. Also, the results show the

antibiotic activity of 0.25:0.75 against *E. coli* more than 0.9:0.1 and 0.75:0.25 as shown in table 3. This is due to the effect of partial size that increases with increased magnesium oxide. Therefore we noted antibiotic activity decreases. The results demonstrated a distinct size effect with the number of bacteria destroyed being highly dependent on particle size. Krishnamoorthy *et. al*. examined the effect of the size of magnesium oxide nanoparticles and their antibacterial activity. They found MgO NPS has antibiotic activity with MIC 1000 µg/mL and 500 µg/ml against *Pseudomon*as and *E. coli* reversely [23,24]. The results of our study indicated that nano binary oxide MgO/SiO_2 nanoparticles (0.5:0.5) with a smaller size exhibited superior antibacterial activity against gram-negative *E. coli* bacteria as shown in table 3 designation of the minimum inhibition concentration (MIC) and minimum bacterial concentration (MBC) values of MgO/SiO_2 0.5:0.5 antibiotics are equal to (156 and 625) µg/mL respectively.

Table 3. Antibiotic activity of nano binary oxide MgO/SiO_2 at different percentage ratio against G-negative (E.coli).

0.25/0.75	0.75/0.25	0.9/0.1	0.5/0.5	Percentage Ratio
Percentage growth inhibition				Concentration µg/mL
0	0	0	0	Control
97.647	93.168	88.751	100	625
94.932	86.51	84.319	100	312.5
90.819	78.628	76.612	97.974	156
80.591	73.548	69.810	95.634	31.25

3.3 Vitro Method to Measure Cytotoxicity of Nano binary oxide SiO_2/MgO nanoparticles agents Vero cells line101.

Nano binary oxide SiO_2/MgO shows viability of Vero cells line101at different range concentrations (2000,1000,500, 250,125,62,31,15.5, and 7.5)µg/ml. Nano binary oxide SiO_2/MgO was characterized by showing a decrease in effective toxicity against Vero cell line-101 at low concentrations of 7.5 µg/mL compared to the control groups shown in figure 5 and table 4

Elham Behzadi *et. al.* showed that MgO NPs can exhibit specific cytotoxicity against the K562 cell line and can be considered a new anticancer agent. It has also been shown that ROS production in cancer cells initiates apoptosis mediated MgO NPs. More research on other cancer types and normal cells is needed to determine whether MgO NPs' anticancer activity is equally applicable and productive against other cancer cell lines [25, 26]

The current study demonstrates that nano binary oxide SiO_2/MgO exhibited low cytotoxicity against Vero cells-101. The results confirmed that nano binary oxide SiO_2/MgO has high cytotoxicity with increased concentration. Inhibition of nano binary oxide SiO_2/MgO (0.5:0.5) is 14.285 % on Vero cells-101 with a concentration of 250 µg/ml. Results exhibited that nano binary oxide can be considered a novel antimicrobial agent because it is efficient in killing microbes at low concentration and at the same time shows low toxicity at low concentration. It was recently found that nano-MgO outperforms copper, silver, TiO_2, other bactericides, anti-cancer, sporicidal, and antiviral activity [27].

The concentration required for a 50% inhibition of viability (IC50) was determined by using an-excel sheet and fitted by blotting graphically the relative cell inhibition percentage on the Y-axis versus the concentration of each compound used on the X-axis. calculation of cell viability was done by dividing the absorbance measured for each concentration by the absorbance of the control multiplied by 100 according to [28].

The concentration of nano binary oxide required for a 50% inhibition of viability (IC50) was 975µgl/ml for Vero cells-101 line as shown in fig6.

Table 4. Cytotoxicity effect of nano binary oxide SiO_2/MgO (0.5:0.5) on Vero cells-101line cells data is presented as mean ± SD of four independent experiments.

Inhibition	Stander Deviation %SD	Viability Average	Concentration µg/ml
80.413	10.780	19.587	2000
71.282	7.449	28.718	1000
49.411	7.148	50.589	500
24.286	9.898	75.714	250
19.283	9.299	80.717	125
13.042	6.404	86.958	62
2.359	8.712	97.641	31
1.169	7.925	98.831	15.5
0.188	7.542	99.812	7.5
-	8.913	100	Control

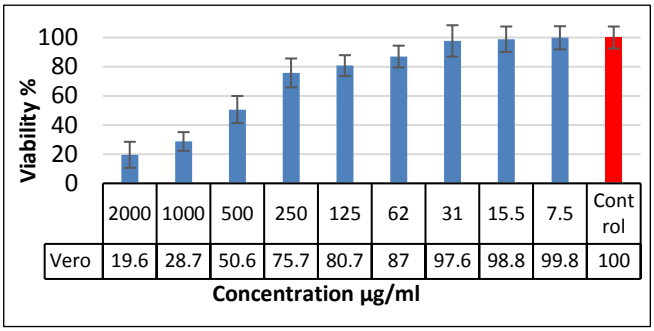


Fig5. Effects of nano binary oxide SiO_2/MgO (0.5:0.5) on the viability of Vero cells-101using MTT assay.

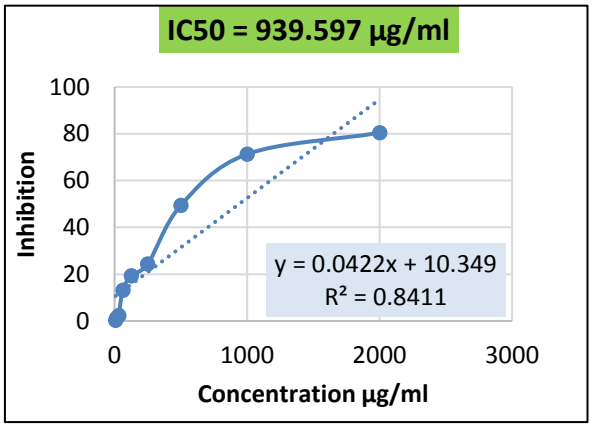


Fig.6 IC50 measurements of nano binary oxide MgO/SiO_2 (0.5:0.5) on Vero cells-101line.

All data were collected and analyzed by Microsoft Office Excel 2016 and Origin Pro 2021version 9.85 software. ANOVA one way test was used to assess significant differences among the means of data.

The results toxicity of nano binary oxide MgO/SiO_2 on Vero cell line 101, showed a statistically significant ($p < 0.05$) increase in cells viability at a concentration of 7.5 µg/ml and a significant ($p < 0.05$) decrease in cells viability at the concentrations of 2000 µg/ml compared to control group.

3.5 Study activity of medical ointment on *S.aureas*

The antibacterial activity of nano binary oxide SiO_2/MgO (0.5:0.5) NPs as medical ointment was evaluated. This study was against gram-positive bacteria *S. aureas*. The results of the assay show the diameter of the inhibition zones increased with increasing nano ointment dose. The percentage weight ranges from (4 to 10) % as shown in table 5. As a result of Nano binary oxide SiO_2/MgO (0.5:0.5) NPs small size and applicability, nanoparticles have prompted a lot of interest. It plays a role in providing a healthy environment, and assists in wound healing by inhibiting microbial growth [29,30]. The results of medical ointment for nano binary NPs show 10% give high zone inhibition as shown in fig 7. Therefore, the nano-ointment can be used for antimicrobial and wound healing. Especially since the nano binary oxide NPs showed a low toxicity assay.

Fig.7. Medical ointment cream preparation from nano binary oxide SiO_2/MgO (0.5:0.5) (left) and inhibiting microbial growth of ointment cream on S.aureas microbial (Right).

Table 5.The activity of nano binary oxide SiO_2/MgO (0.5:0.5) ointment with different percentage weights

Wight%	Zone inhibition mm
10%	22
8%	17
6%	12
4%	7.5

4. Conclusions

Presented work investigates the antibacterial activity for nano binary oxide SiO_2–MgO has antimicrobial activity and low toxicity , this makes it aproduct that can applying it to wound dressing. Nano binary oxide SiO_2/MgO is a promising product agent that can be used as an external topical treatment antibiotic. The mechanical properties of nanoparticles are not clear. Nano binary oxide MgO/SiO_2 nanoparticles have antibacterial activity that is dependent on average particle size and the concentration of solution. The percentage of 0.5:0.5 has more surface area with a small particle size with more antibiotic activity. There was no bacterial growth after a high dose of nano binary oxide MgO/SiO_2 at a concentration of 625 µg/ml. The result of nano composites MgO/SiO_2 identification by X-ray diffraction shows the average crystal size (62,16 and 21) nm in nanoscale depended on Bragg's equation . It also showed a high efficiency and a promising effect for the production of topical medical preparations with therapeutic efficacy by studying the effect of these ointments on *S. aureas* bacteria on burns and wounds. The toxicity test did not show

high toxicity towards Vero cell line 101(normal cells) at low concentration as indicated by the results.

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