Frequency of High-Performance Magnetic Nanoparticles of Mid-Ampicillin, as Antibacterial Agents

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**Abstract**

The project, based on large studies in the context of the application nanoparticles in biological science and medicine. So, firstly the magnetic nanoparticles (MNPs) Fe₃O₄@SiO₂-Ampicillin synthesized by a chemical Co-precipitation method with a cover layer of silica (to prevent excess oxidation and increases the sufficiency of the surface of the nanoparticles) that in the size of 20 nm were prepared. Then the core-shell structure of it detected by SEM, FT-IR. Purpose of this production was for using of the full performance level of nanoparticles in absorption of antibiotics, ampicillin (amp), thus that normal value is 100 µg.ml⁻¹ of amp solved in 20 mg of MNPs on terms of room temperature and normal time 0.25 hr. The resulting sample was tested by the analysis UV-Vis spectrophotometer and the results obtained indicated that amp absorbed is stabilized 85% up on the surface of nanoparticles. The resulting link between those two, the kind of bond-electrostatic which was proved by the analysis of EDX. Eventually this combination to processing bactericidal was used. In this case, MNPs-amp combination in the normal value of 20 µl of a bacteria culture model was added during overnight (In-vitro). More, the results showed that 95% of the bacteria were killed. According to the results obtained, as antibacterial properties of MNPs-amp, became apparent. Lastly, MNPs was separated by magnet which controlled by external magnetic field. So it can be targeted to a system for the transfer between nanoparticles to bacteria for specification of quality antibacterial.

**Keywords:** Magnetic nanoparticles; Antibacterial property; Silica-coated; Electrostatic bonding; EDX analysis

**Abbreviations**
MNPs-Amp: Magnetic Nanoparticles Fe₃O₄@SiO₂-Ampicillin; SEM: Scanning Electron Microscope; FT-IR: Fourier Transform Infrared Spectroscopy; EDX: Energy-Dispersive X-Ray Spectroscopy

**Introduction**

Medical use of magnetic powders returns to ancient Greece and Rome, but as a systematic and research of biological and medical sciences in 1970s and predicted that particles used in the future to meet needs of the salient vital role will have on the health of humanity. Based on nanotechnology, wide range of diagnostic and therapeutic applications in diseases such as cancer, heart disease and nervous system has been facilitated. Magnetic nanoparticles for targeted delivery of therapeutic agents used and the frequency of drug-based spotters between ligand and receptor is the magnet that includes a strong desire or act through specific tissue magnetic attraction due to high performance Intelligent control of therapeutic agents at desired tissue particles are very significant, and therefore the magnetic targeted carrier achieved to them [1].

**Use of magnetic nanoparticles of magnetite has anti-bacterial properties**

Magnetite magnetic nanoparticles are used in important biological applications including bio-magnetic separation and detection (cells, proteins, DNA, nucleic acids, enzymes, microbial and so on). For clinical diagnosis and therapy, such as magnetic photography probes targeted drug delivery and bio-labeling [2]. Almost, half a century of magnetic nanoparticles of magnetite as a strong choice is for as the therapeutic applications (in terms of In-vitro) [3]. Magnetic nanoparticles have large surface area and high chemical activity of an important loss. Size and surface of the nanoparticles have an important role in biological applications. So, to increase microbial resistance to antibiotic organs, healthy, protected by magnetic nanoparticles, it is unusual that by reducing the size of magnetic nanoparticles with specific chemical and physical agents and scientists have raised interest [4] and certain advanced methods for controlling the particle size of magnetic nanoparticles on the basis of performance and design appropriate boomed performance level of them and controlling them with wide application in industry as antibacterial found physics-biology agent achieved. The active antimicrobials of magnetic nanoparticles are dependent on small particle size and large surface area on which to permit the nanoparticles of the membrane viruses, fungi and bacteria in their interactions.

**Magnetic nanoparticles mid ampicillin, as antibacterial**

Study of the specific interaction between the unique antibiotics and very harmful pathogens, it is extremely important to rational drug design. Liposomes and antibiotics adsorbed on the surface of magnetic nanoparticles to increase drug concentration required at sites without drug toxicity has been set [5]. Intracellular pathogen infection due to losing bacteria by cell death that has several innovative mechanisms, including inhibition of fusion (freeing the spine) Fagosom-lysosome (digestion swallowing action of the striker in the lysosomes by red globules) resistance lysoysoma enzymes, parts oxygen and macrophages (cells that responsible for detecting, destroying pathogens cells) that it occurs in host cell. Therefore, pathogenic
bacteria have created major problems within the cell [6]. The pharmacodynamics and pharmacokinetics properties of antibiotics is indispensable to intracellular activity such as, logging, preservation, distribution and expression of intracellular antibiotic activity in the infected system [7]. Antibiotic release and absorption efficiency of magnetic nanoparticles to the surface, in the free atmosphere and in the presence of carboxyl esterase Esther the top and bottom of the In-vitro has been reported. Colloidal transition (magnetic nanoparticles adsorbed to the surface and antibiotics) into the cells, endosome degradation (wall) cells through phagocytosis process is done with the help of lysosome esterase [8].

Separation of magnetic particles from the environment

Magnetic nanoparticles are widely studied for biomedical reactions would-be, to maintain stability of the catalyst can be easily separated from the reaction by external magnetic field. It should be noted that other techniques, such as conventional filtration, resulting in loss of product are made of nanoparticles in catalysts and pollution. Afterwards, the properties and applications of magnetic nanoparticles significant issues we’re working on a project using magnetic magnetite nanoparticles with silica substrate and then explain treatment-chemical functional group.

The antibiotics cornerstones of healing are modern [9]. The β-lactam antibiotics are one of the largest classes and oldest of chemotherapeutic agents for treatment wide spectrum of antimicrobial clinical trial in which an according to their particular pharmacokinetics properties (compared with other antibiotics), nearly as disrupted bacterial activity [10]. After the discovery of β-lactam prototype, various derivatives it was introduced. Beta-lactam of antimicrobial like ampicillin (6-D-alpha-phenyl-acetamido polyamide (penicillin acid)) is the beta-lactam first identifies a wide range of activities carried antimicrobial clinical ways [11]. The β-lactam antibiotics are beneficial, because it is used clinically to measure antibacterial resistance and motivated researchers to synthesize its derivatives hot. However, the process of discovering new drugs or imitation of antibiotics on up stable them, rising against bacteria (antibacterial agents) is slow. Such concerns recently by the Food and Drug Administration, United States of America, reducing its clinical treatment, have been reported in prior years. Activities to prepare more effective, in the field of synthesis antibacterial factors are increasing [12]. In this project, the magnetic nanoparticles Fe₃O₄@SiO₂ with 20 nm-scale structure and preparation of crystalline structure that was neatly. The surface of the nanoparticles, rated high performance to attract bio-molecules. Therefore, we include sample antibiotics ampicillin (amp) for absorption and fixation on the surface of it. Perfect mechanism, this bio-chemical reaction, was presented in (Figure 1).

Experimental

Materials

Chemicals in this study were representative ideal used as received without purification. All solvents and chemicals are purchased from commercial Suppliers. The structure of materials was provided by Transmission electron microscope (Philips CM-200 and Titan Krios TEM, derivative in the University of the Shahid mortgage Ardabil). Materials such as; ferrous chloride tetrahydrate (FeCl₂·4H₂O), ferric nitride Nona hydrate (Fe (NO₃)₃·9H₂O) and sodium hydroxide (NaOH) were purchased from Merck KGaA (Darmstadt, Germany). And, TEOS (tetaethyl-orthosilicate), Hydrazine (34% by weight aqueous solution, reducer), sodium amp salt (<98% pure; molecular weight 371.4 g/mole), were purchased from Sigma-Aldrich Co. (St Louis, MO, USA). Bacteria’s cultured in lab are models (Maragheh, Iran). Deionized water was used in each experiment.

Synthesis of silica-coated with Fe₃O₄ magnetic nanoparticles

Different mechanisms have been designed for the synthesis of hollow magnetite microspheres [13-17]. Chemical Co-precipitation also one of the easiest and most convenient method of synthesis of magnetic nanoparticles with core/shell structure. The method is determined by the following formula M the same amount of iron salts (II).

\[
M_{2+} + 8OH^- + 2Fe^{3+} \rightarrow MFe_2O_4 + 4H_2O
\]

So, in this way, sample container iron salts with amounts of 1 to 2 (150 mmoles of FeCl₂·4H₂O and 300 mmoles of Fe (NO₃)₃·9H₂O) were dissolved in distilled water. The reaction temperature was 25 degrees Celsius and high-intensity spinning under inert nitrogen gas. After 3 hours to prevent additional oxidation and increasing the absorption of biomolecules for biological targets of 2 ml tetaethyl-orthosilicate was used. Finally, the yellowish-brown product was obtained in the same magnetic nanoparticles. In the read more, the solution was washed.
magnetic nanoparticles should be made, such as the size of the particle. The dimensions of magnetic nanoparticles that are mixed to iron metal oxide from the oxide, Fe$_3$O$_4$, are 2-100 nm. However, for application as antibacterial, the size should be 20 nm. So, magnetic nanoparticles in chemical reactions and medical procedures are important.

**Preparation of amp-MNPs Nano-composite**

The value of 350 mg of ampicillin was removed in water. Then 100 µl of the prepared solution with 20 mg of magnetic nanoparticles was mixed. This reaction lasted at room temperature and only in the presence of water as a solvent for 0.25 hr. And, magnetic nanoparticles by magnet were separated. Finally, a solution containing ampicillin was collected.

**Results**

**Synthesis and characterization of magnetic nanoparticle coated with silica**

For the preparation of magnetic nanoparticles of magnetite (Fe$_3$O$_4$) to iron metal oxide from the oxide, Fe$^{2+}$, Fe$^{3+}$ were chemical co-precipitation way. After preparation of magnetic nanoparticles, the particles of silica (SiO$_2$) which covers the extra addition to preventing oxidation of magnetite magnetic nanoparticles by oxidizing the vicinity, such as outdoors, as functional surface coating for chemical reactions Medical, accelerating forgiven. In the range of 1-100 nm magnetic nanoparticles should be made, such as the size of the magnetic nanoparticles in chemical reactions and medical procedures are important.

**Figure 3: SEM analysis of the morphology Core/Shell structure of magnetic nanoparticles.**

To investigate and establish the structure of the magnetic nanoparticles is used in a series of analyzes, including; TEM, SEM, XRD, FT-IR, TGA and so on. The project analyzed by SEM was used to stabilize the structure of magnetite magnetic nanoparticles. Analytical SEM, analysis of a series of images of the structure of the magnetic core/shell nanoparticles provides. The structure of magnetic nanoparticles coated with silica by analytical SEM shown in (Figure 3), it regards in picture was dimensions of magnetic nanoparticle that are 100 nm, but for application as antibacterial that it should be 20 nm. So, synthesis of magnetic nanoparticles was reduced to dimensions 20 nm.

Analysis FT-IR, the analysis to show the operating groups and also unexcited) electrons in discrete energy levels or electron shells attached to the core. According to the FT-IR spectra of as-prepared hollow magnetite microspheres (Figures 4a and 4b) SiO$_2$@hollow magnetite microspheres were characterized by a high absorption band at 802 cm$^{-1}$ imputed to the typical band of Fe$_3$O$_4$, equivalent to the stretching vibration modes of Fe-O [18,19]. Afterwards coating by a silica layer, a new band appeared at about 1,122 cm$^{-1}$ (Figure 4b) being determined to stretch of Si-O-Si bands on the surface of the SiO$_2$@hollow magnetite microspheres. By comparing the two images, it can be concluded that the Fe-O bond peak gradually was sharpened that represented the crystallization of the nanoparticles. Thus, the structure of magnetite magnetic nanoparticles coated with silica layer that in addition to preventing additional oxidation and increase the reactivity of nanoparticles, magnetic nanoparticles can also cause regular crystalline structure. Results for identifying the structure of magnetic nanoparticles by functional groups shown in (Figure 4).

**Figure 4: FT-IR analysis of magnetite nanoparticles in Figures 4a and 4b with coated silica.**

**Adsorption studies**

As the project title suggests, I have tried that to stable antibiotics such as ampicillin on magnetic nanoparticles Fe$_3$O$_4$@SiO$_2$. So, I just have to expand other researches in this area, that I have achieved a basic conclusion. As you know, the magnetic nanoparticles and their magnetic properties are able to be controlled remotely by an external magnetic field. Before must, biomolecules of interest (amp) in response to MNPs that, to be a link between the two. The most important thing is the phenomenon of absorption of ampicillin on MNPs. It was bonding, an electrostatic bond which taken of the EDX analysis. The device we all separate elements in the sample indicates the pilot. Energy-dispersive X-ray spectroscopy (EDS, EDX or XEDS), energy dispersive X sometimes checks X (EDXA) energy dispersive X-ray Microanalysis is called or (EDXMA), an analytical technique used to assess the element or review chemical properties of a sample. It stimulates the interaction of some of the X-ray sources and the sample is based on. To stimulate the release of X-rays characteristic of a sample of a high-energy beam of charged particles such as electrons or protons (PIXE see), or the X-ray beam that is focused on the sample being studied. At rest, the ground state of an atom in the sample (or unexcited) electrons in discrete energy levels or electron shells attached to the core. The light may excite an electron in an inner shell, ejecting it from the skin while creating a cavity in which electrons are electrons.
An electron through an external circuit, higher energy then fills the cavity, and the difference in energy between a higher energy shell and the shell may be in the form of lower energy X-rays released. The number and energy of X-rays emitted from the sample can be calculated by a spectrometer to disperse energy. As the X-ray energy characteristics of the difference in energy between the two shells, and the atomic structure of the element from which they were emitted, this allows the elemental composition of the sample to measure [20].

Discussion

Results of ampicillin loaded onto magnetic nanoparticles Fe₃O₄@SiO₂ by spectrophotometry

The absorption evaluation ampicillin on magnetic nanoparticles, the amount of 1 µg.ml⁻¹ ampicillin is standard was developed by Bradford formula (A=2, C=1 µg.ml⁻¹). Which is defined as follows:

1) C=50, A/100

In formula, 50 and 100 is constant number and A (absorption rate). A (amount of absorption as well as by the law beer-lambert) can be calculated and measured by the spectrophotometer analysis. The relationship between the intensity of the emitted light and the light output was achieved in 1760 by Lambert and in 1762 Pierre properly examine it about the solutions and concluded that this is also the case for the solution. Lambert absorption law directly to a sample thickness (along the way) is adequate. In according to law, the absorption rate is depending on the concentration of the sample. The combination of the two, Beer-Lambert law is obtained indicating that it takes up the sample thickness and concentration. Beer-Lambert law is true that;

2) Log (Iₒ/I) = A

1) With single-color light emitted by the material, 2) Concentration of the solution should be located in the linear range.

Where Iₒ (initial light intensity), I (intensity of the transmitted light) and the A uptake [21] Article. Which is defined as follows:

3) A= abc

Where a material absorption coefficient (ε May also be shown.) [21], b length of the sample (sample container) and c is the concentration.

Beer-Lambert law states that part of the light after being colored with glass solution, absorption and other passes. Continue to work with the device was conducted by spectrophotometer, that 20 mg of magnetic nanoparticles added to a solution of 100 µg. ml⁻¹ ampicillin and eventually resulting in cell light absorption rate testing machine and in the interval 0 to 15 min on magnetic nanoparticles increased absorption of ampicillin. For this purpose, to check the results of the absorption of ampicillin on MNPs-coated with silica, in the amount of 100 µl ampicillin (100 µg.ml⁻¹) 20 mg of magnetic nanoparticles in the presence of 2 ml of distilled water to MNPs and in the first place, 400 µl samples of the supernatant removed after a time of 0.25 hr away is another example, some examples were different in the two samples and the samples for analysis were prepared to stabilize the absorption of ampicillin on MNPs. At the beginning of the reaction, patterns were to study the magnetic nanoparticles containing silica-ampicillin absorption studies conducted showed that the uptake ampicillin the concentration (100 µg/ml), in The wavelength of 268 nm for 15 min (absorption wavelength ampicillin) is 85%, and after 0.25 hr absorption decreases over time because it can be to break the aromatic ring of ampicillin and realizing it from the surface of magnetic nanoparticles containing silica noted. The results are shown in (Figures 5 and 6).

Table 1: Amounts of absorption data.

| Time (min) | 0   | 5   | 10  | 15  | 30  |
|-----------|-----|-----|-----|-----|-----|
| 1. ABS. % (10 µg/ml) | 0   | 10  | 15  | 30  | 65  |
| 2. ABS. % (50 µg/ml)  | 0   | 25  | 40  | 65  | 85  |
| 3. ABS. % (100 µg/ml) | 0   | 35  | 50  | 85  | 100 |

Figure 5: Adsorption rate of ampicillin (100 µg/ml) in surface MNPs which it, s for concentration.

Realizing by amp on base time

Reaction time for absorption, 0.25 hr in this test as the standard time for this research is very important. At the beginning of the reaction, patterns were to study the magnetic nanoparticles containing silica-ampicillin absorption studies conducted showed that the uptake ampicillin the concentration (100 µg/ml), in The wavelength of 268 nm for 15 min (absorption wavelength ampicillin) is 85%, and after 0.25 hr absorption decreases over time because it can be to break the aromatic ring of ampicillin and realizing it from the surface of magnetic nanoparticles containing silica noted. The results are shown in (Figures 5 and 6).
Figure 6: Absorption of ampicillin in surface MNPs since time of 0.25 hr and after it.

**Figure 6:** Absorption of ampicillin in surface MNPs since time of 0.25 hr and after it.

**Link of between magnetic nanoparticles and biotechnology how to affection in the body**

Extensive knowledge of the Nano is under way in all areas. One of the most important aspects of its application, in the context of making Nano-catalyst hybrid (two different phase responses) which is more on the topics of chemistry. Nowadays, relying upon this knowledge magnetic Nano-catalyst has high power to move the drug into the body of the organism. So the magnetic nanoparticles (without causing toxicity) as the carrier of the magnetic field of the body disposed of.

The system that we have in this project, we raised was just covered with silica and link it with ampicillin is a type of electrostatic bonding. Lastly, we can say that if a drug, with the same type of link to be easily connected when the nanoparticles reach the target cell (the creation of a disease) has been released to suppress disease. This is the objective that we were looking for that this system got introduced to the world.

**Release of results and inhibition of bacterial growth by magnetic nanoparticles Fe₃O₄@SiO₂**

Because the antibiotics used in this project as a model biological molecule are therefore only a sample of the bacteria can be an inhibitory effect of using magnetic nanoparticles Fe₃O₄@SiO₂-ampicillin, on the growth of bacteria studied (Bacteria cultured in the lab, the bacteria are models). The bacteria were grown in the presence of kanamycin, prepared for the reaction are a few examples; Example 1 (bacteria cultivated *In-vitro* (20 µl of bacteria in medium LB (200 ml) which (by 20 ml kanamycin fed) and incubated overnight at a temperature of 370°C treated), Sample 2 (Fe₃O₄@SiO₂ nanoparticles in water distribution without ampicillin), Sample 3 (sample surface of magnetic nanoparticles Fe₃O₄@SiO₂ reaction to ampicillin at time zero), Example 4 (sample surface of magnetic nanoparticles Fe₃O₄@SiO₂ reaction to ampicillin at time zero), Example 5 (a mass of magnetic nanoparticles Fe₃O₄@SiO₂ no reaction ampicillin solvent) at concentrations (70, 140 and 210 μg/ml) are the producers. After preparation of samples, bacteria separately injected them in containers and then at night time the magnetic nanoparticles Fe₃O₄@SiO₂ ampicillin attracted to bacteria by spectrophotometric analysis assessment was. Results of absorption, the highest absorption in the sample 5 (highlighted by green color) with a concentration (210 μg/ml) 95% is shown. By comparing the results of spectrophotometry in the uptake and inhibit the growth of bacteria at a wavelength of 600 nm (absorption wavelength bacteria), was 95% and almost no trace of bacteria *In-vitro* did not exist. The results of the observations indicated in (Figures 7, 8 and 9) and Table 2. In Figure 10, the absorption for antibacterial established by UV-Vis spectrophotometry analysis. In the first analysis, the devices by means of distilled water in the number zero was set up and then it was calibrated, with solution contain of bacteria in 600 nm wavelengths. Reduce rate benchmark line growth of bacteria (in the frequency of capture) shows. Then, the solution samples were number 5 that 3 examples of them are contained mixed of MNPs-amp at the times of 0-15 min. The other two samples each contain only one the two, i.e. amp or MNPs. The importing thing being to get the amount of absorption, samples in glass cell (preferably in the 350-700 nm wavelength was used) in a data transfer device. Finally, the results showed that the absorption in concentration 210 μg/ml (15 min) is highest.

**Figure 7:** Reflects the strength of inhibition of growth of bacteria in the presence of magnetic nanoparticles containing ampicillin (including samples 3, 4 and 5 at concentrations (A) 70, B) 140 and C) 210 μg/ml) shows 95%.

**Figure 8:** Reflects the strength of inhibition of growth of bacteria in the presence of magnetic nanoparticles-ampicillin (including 5 in the figure above, compared with 2 samples (powder, MNPs-amp) which absorb 55%, (the concentration (210 μg/ml, 95% stopped the growth of bacteria) to double the growth of bacteria are prevented.

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levels of inhibition of growth of bacteria on the surface of magnetic nanoparticles in the presence of ampicillin. The concentration (210 μg/ml) showed that 95% of the bacterial growth stops and a high share of 5 in this interaction (nanoparticles with absorption ampicillin on the surface of bacteria).

Table 2: Evaluation of measured values (70, 140 and 210 μg/ml) at concentrations (210 μg/ml) is the inhibition of bacterial growth, for example 5 to 95% of the samples more ampicillin indicates the bactericidal properties of MNPs respectively.

Recovery of the retained ampicillin from the MNPs

With the results of the effect of magnetic nanoparticles with a bed of silica to absorb ampicillin, the resistance MNPs-amp review, the results of the process of absorption (absorption ampicillin in magnetic nanoparticles with silica bed) and release phase (delivery ampicillin in bacteria), and that can be higher than the standard 24 hr after absorption, sustained on the surface of magnetic nanoparticles (Methods ampicillin the interaction between the surface of magnetic nanoparticles with optimized amount that was to be repeated The parts listed before the concentration (100 μg/ml) and 20 mg of magnetic nanoparticles for 15 min in the time period of 12-108 hr of initial consolidation and stability on the surface of magnetic nanoparticles ampicillin only 10% and 95% showing stable of high stability and high performance magnetic nanoparticles in the stabilization and consolidation ampicillin biological molecule after its initial consolidation (ampicillin) showed and can be in the future for transfer in living organisms like mice and eventually people tested the magnetic targeted delivery is the same. The result is shown in (Figure 11).

To do this, the research needed to reach the right solution for absorption ampicillin taken to the surface of the nanoparticles. Same you know, the magnetic properties of magnetic nanoparticles to size made them to be controlled by an external magnetic field. First of all, the most important problem has been communication between biological molecules ampicillin and magnetic nanoparticles Fe₃O₄@SiO₂, ampicillin, ampicillin absorption of the nanoparticles respectively. Now the debate has already been mentioned, stabilizing electrostatic bond (between ampicillin and magnetic nanoparticles) that (detailed proof of the topics of this project was to link external electrostatic) is based on a proven by EDX. All elements in the sample area to show the device separately. Spectroscopic analysis; X-ray diffraction EDS, (EDX or XEDS) is an analytical method for evaluating the elements or chemical properties of a sample. In this discussion, by W% of elements perceived whichever were dependent to reactants of ampicillin and magnetic nanoparticles Fe₃O₄@SiO₂ and EDX analysis showed that both of the reactants bonded together been in the product. Also, elements of Fek-α and Fek-β with elements Si (with strong peak) and O are shown in Fe₃O₄@SiO₂ product. This analysis may be a demonstrative bond of between magnetic nanoparticles Fe₃O₄@SiO₂ and ampicillin. The results of the EDX analysis show that binding of agent N in 750 keV and agent of O 1100 keV because they are in a line, so it may be stated this approaching is electrostatic bonding same. Element O is in the agent group O2 of coated silica (SiO₂) and element N of the agent NH₂ of ampicillin. Evidence of EDX analyses is a Spectrophotometer seconder for this tissue. The result of absorption and the link between magnetic nanoparticles and ampicillin by EDX analysis, shown in (Figure 12).
Antibacterial properties of magnetic nanoparticles

According to the results of the analysis of the spectrophotometer, the results observed from destroying bacteria, the results of magnetic nanoparticles without the presence of ampicillin, the data showed that the magnetic nanoparticles alone has antibacterial effect (antibacterial rate equivalent to percent of) and it can even completely, preventing the growth of bacteria. This is antibacterial properties of magnetic nanoparticles MNPs same (Figure 13).

Figure 12: The results analysis EDX showed the absorption percentage and the link between magnetic nanoparticles and ampicillin.

Figure 13: Full of reaction stabilization and realize results of ampicillin antibiotic on magnetic nanoparticles Fe3O4@SiO2 and affection upon growth of bacteria.

Conclusion

The overall conclusion of this project, to follow a few conclusions are important, which are as follows: First, should the nanoparticles prepared in terms of crystallography in good standing that has a particle size appropriate, and also has coverage in order to prevent the oxidation of additional and the level of performance are suitable for carrying out chemical reactions and biomedical. Then try using a functional magnetic nanoparticles level of absorption of biomolecules biological level, which this project is to discuss the antibiotic ampicillin. In addition to working on concentration suitable ampicillin to attract on the surface of the nanoparticles, the concentration of ampicillin to attract (100 μg.ml⁻¹), tried using the technique of innovative bonding electrostatic, MNPs and ampicillin in addition to increased absorption of ampicillin on the surface of the nanoparticles (IE attracting top 85%) as well as a stabilization time (108 hr) showed and we were able to have a real fixation on the surface of MNPs achieve ampicillin. These products can help us to deliver targeted (ampicillin adsorbed to the surface of MNPs) in future research In-vivo mouse from genetically has a structure close to humans is injected as drug carriers targeted by controlling the external magnetic field. Finally, experiments on bacteria were able to achieve satisfactory results achieved shown that magnetic nanoparticles with the presence of ampicillin powerful antibacterial lot (which amount to about 95%, up nearly 100) as well as MNPs alone has antibacterial properties (the top 70%), respectively. The antibacterial properties of MNPs, can be dangerous in the future to eliminate pathogenic bacteria in organisms ranging from humans that control with an external magnetic (dispose of a living organism without causing damage to the body) to be undertaken. Research is still ongoing, it is hoped that in the future, the magnetic nanoparticles in the treatment of incurable diseases such as cancer and certain, without any side effects, but also with high therapeutic effect, will be used. Non-specific words are such as; Fagosoum-lysosome, Ester, Medical, Microanalysis, Antimicrobial, Intracellular pathogenic, Phagocytosis process, pharmacodynamics and pharmacokinetics, Liposomes, macrophages, endosome.

Supplementary Materials

The Supporting Information contains UV-Vis spectrophotometry absorption, Absorption time, Concentration absorption, EDX analysis, table of amounts adsorbed by bacteria and an SEM image of the magnetic nanoparticles and FT-IR analysis of agents group the silica layer and pictures of the influence of magnetic nanoparticles on bacterial growth and recovery graph nanoparticles.

Supplementary Materials file. Pdf; Additional figures.

Author statements

Ethical issues not applicable for this paper.

Conflicts of interests

"No conflict exists." The authors declare that they have no conflict of interest.

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All subjects received from various magazines in the field of nanotechnology with biology and chemistry. In furthermore of the goal of attracting the magnetic nanoparticles were Biomolecular antibiotics. I hope it been a day one of best research paper.

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