The environmental effects of nano powder against some microbes that isolated from oral cavity

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Abstract

Among the applications that nano powder can use is its ability to inhibit the growth of microbes in certain proportions according to the type of microbe, by changing the environmental characteristics of the culture medium in which the microbes grow, and this is done after isolating and determining the type of microbe by taking a group of isolates taken from swabs of the oral cavity. These microbes were obtained (Streptococcus sp., Staphylococcus aureus sp., Candida sp., Actinomyces sp., Actinobacillus sp., Bacillus sp.) In various proportions 37.6%, 18%, 16.4%, 12.8%, 9.5%, 5.7%, respectively. After the process of producing nano powder, which consists of three crystalline types (sulfur, carbon, and chloride), which have been prepared in a mechanical way and with sequential stages and steps until the particles are obtained through which the desired purpose can be achieved. Its efficiency and ability to inhibit and prevent the growth of microbes in the culture medium are examined after they were identified in the primary isolates and cultivated again, when they were transplanted again with the culture plates, and the areas of inhibition were documented on the plates containing the culture medium in which these microbes were grown.

Keywords: Nano powder, Microbes, Inhibition zone.

Introduction

Modern science has proven the use of nano powder in many fields and different technologies, and among them is the inhibitory ability to prevent the growth of microbes, including bacteria, fungi and other microorganisms that may cause certain diseases in humans. The nano powder particles that are produced in multiple ways and different techniques are effective and effective against both microbes and anaerobes and are suitable to be a treatment for many infections and diseases in general medicine as well as dentistry. Generally, which consists of some minerals also plays a prominent and important role in this aspect, including various compounds of silver as antimicrobial (1, 2, 3). At the present time, and with the continuous and rapid development that has brought nanotechnology in all its categories to address the
problems of the times that humanity suffers from at all levels and fields related to medicine and life. The size of the particles from which the nano powder is composed ranges between 1 and 100 nanometers, and this size is sufficient to penetrate the microbe cell, or destroy the entire nucleus of the cell, leading to its loss of life. The culture media in which microbes in general are incubated, and grow on it can be tested to find out the validity and efficiency of nanoparticles to inhibit the growth of microbes on them, and this is what many experiments have shown by researchers in many times, so it was considered a type of treatment It is used against microbes, as it was affected by it very quickly. It seems that the nano powder particles that are added to a certain area of the surface do not allow the growth of microbes, which makes them form a very clearly visible region on which microbes do not grow and this area is known as the zone of inhibition. This results in a broad spectrum of antimicrobial activities (4, 5, 6). And this area, which was formed as an antimicrobial, differs from one microbe to another according to the species that was isolated and determined.

Materials and Methods

The diagnosis, and general media used reagents, and solutions prepared by (Maste, and Oxeaoid company).

1. Collection of Samples:

The total of (20 swabs) of the smear mouth, are collected from persons, in the manepuolei hospital, in Andhra Pradesh city, Hyderabad State, India.
2. The colonies isolation, and diagnosis:

All samples, were growth in prepared media, and laboratory examinations were completed for diagnoses the microorganisms, uses as a basis on the methods of, (Smith, 2004), and (Coallae, and, et al, 1999), (7), according to the following diagnostics steps:-

1. **Cellular Diagnosis:**

This diagnoses is done by examination of the gram stain, for the shapes, and assembly determination of the microbial cells, and their interactions with dye.

2. **Culture Diagnosis:**

It included the diagnoses of the sizes, and shapes of the microbial colonies, and its growing in culture media.

3. **Biochemical examination:**

This type of the microorganisms diagnosis are based on their ability for producing enzymes, and biochemical effects.
A statistical analysis:

The results of the isolations, and diagnosis, were analyzed statistically by using the key square tests (Daneil, 1987), (8).

Nano-materials Preparation.

Nano materials are nano chemical materials that are used with strong efficiency and very high quality in many industrial and medical applications such as communications and electronics, because they contain many physical and chemical properties, and they can be prepared in different ways, all of them sharing depending on the methods and atomic standards, and whenever they differ the size scale of the mass of a substance differs in effectiveness, meaning the smaller the scale, the more effective the material from which the particles are made.

1- Physical preparation: It is prepared starting from the vapor state of the substance by heating the substance, or thermally dissolving it using laser beams, or by throwing it with a beam of electrons, then after that the vapor is cooled by striking it with a neutral gas to be more saturated, and then it is placed on a cold surface quickly in order not to have a transformation Building a crystal structure for the material, and finally, nanomaterials are prepared using waves or using lasers.

2- Chemical methods:

- Steam state reactions: the vapor of the material to be prepared enters the CVD reactor, then the particles mix on the surface at a certain temperature and interact with other gases to form a solid strip on the surface.

- Reactions in a liquid medium: They are prepared by changing the conditions of the chemical-physical equilibrium by means of double chemical precipitation reactions, or hydrolysis to obtain spherical particles whose dimensions can be controlled.

3- Mechanical methods:

- Mechanical composition: By crushing a material composed of micrometric particles from (1 to 30) into several mixtures and mixing them, this technique is characterized by that it allows the preparation of homogeneous nano materials, as well as allows the production of huge materials from several tons.

- The first monitoring and vitrification process: by converting the atomic material into a huge piece during two stages, the stage of mechanical compaction, and the stage of melting the metal powder to form it after cooling.

- Strong deformation techniques: By strongly deforming a crystalline material such as metal or porcelain in order to improve the hardness and ductility properties of the materials.
- **Scrubbing method:** By placing very thin silicon strips in chemicals such as HF, rubbing the silicone strips to obtain silicone particles on the surface of the slides, and placing these strips in a solution such as isopropanol and then in an ultrasound device to drop the particles into the solution.

- **Grinding method:** It is used to produce nano-materials in the form of powder, where the basic material is exposed to a very high energy, and then grinded using balls made of steel that move in a vibratory, planetary or vertical manner, and the size of the nano materials that are manufactured ranges between 3 to 25 nanometers. Crystals are taken from sulfur, carbonate, and chloride sands at rates of (20 gm) each, then grinded with ball mills and tube mills. The mixture turns into a powder of increased precision as precipitation and rotation continue.

**Results and Discussion**

Results showed that, nano powder exhibited inhibition zone (mm) of about (18, 19, 15, 14, 24, and 24.) mm in diameter for (Streptococcus sp., Staphylococcus aureus sp., Candida sp., Actinomyces sp., Actinobacillus sp., Bacillus sp.), respectively. The lack of resistance of microbes to the nanopowder proves that it is suitable to be a successful antibacterial because it does not allow its growth on the culture medium with a specific area for each of the mentioned types of microbes, which have been isolated and identified during the work. As shown in the **table (no. 1)**. The interaction between nanoparticles, biomolecules and microorganisms is an important and expanding area for many researches, many investigations have focused on its effect as a bactericide and its various applications in plastics and health (9).

| Microbes                  | Inhibition Zone (mm) |
|---------------------------|----------------------|
| *Streptococcus sp.*       | 18                   |
| *Staphylococcus aureus sp.* | 19                  |
| *Candida sp.*             | 15                   |
| *Actinomyces sp.*         | 14                   |
| *Actinobacillus sp.*      | 24                   |
| *Bacillus sp.*            | 24                   |

**Table (no. 1):** to show the microbes that isolate and determined.

The results and statistical analyzes that were obtained through knowing the area of the area of inhibition were recorded and documented according to the statistical **table no. 2**, shown below. In addition, the nature of the distribution has been documented to find out the relationship between these results obtained during the work, according to **table no. 3**, which shows the type of relationship and the link between these results that we are about to discuss.
Table (no. 1): to show descriptives of the results.

| Inhibition | Statistic | Std. Error |
|------------|-----------|------------|
| Mean       | 19.000    | 1.7511     |
| 95% Confidence Interval for Mean | | |
| Lower Bound | 14.498 | 4 |
| Upper Bound | 23.501 | 6 |
| 5% Trimmed Mean | 19.000 | 0 |
| Median     | 18.500    | 0          |
| Variance   | 18.400    |            |
| Std. Deviation | 4.2895 | 2 |
| Minimum    | 14.000    |            |
| Maximum    | 24.000    |            |
| Range      | 10.000    |            |
| Interquartile Range | 9.25 | |
| Skewness   | - .228    | .845       |
| Kurtosis   | -1.842    | 1.741      |

Tests of Normality

| Inhibition | Kolmogorov-Smirnova | Shapiro-Wilk |
|------------|---------------------|--------------|
| Statistic  | df | Sig. | Statistic | df | Sig. |
| Inhibition | .211 | 6 | .200 | .889 | 6 | .314 |

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table (no. 2): to show the normality of the results.

As for the repetition of the obtained measurements results, it is illustrated in figure no. 2, which shows the relationship between the inhibition area measured by the measuring unit of the millimeter on the culture medium on which the bacteria to be tested grow.
Figure no. 1: to show frequency toward zone inhibition.

A number of strains of microorganisms cannot resist nanoparticles in their culture media. In many tests that rely on the use of nanoparticles to prevent the growth of microbes, bacteria, viruses and fungi were killed within minutes of contact (10). The size of nanoparticles in general, which occupied a large surface area, along with colonies of bacteria and other microbes in the culture medium. This large contact surface is expected to enhance the extent to which the isolated microbes are eliminated, however, microbial in and of itself is not the goal. The manufacture and characterization of nano materials in terms of a set of physical and chemical properties is a major and important factor in the formation of an antibacterial material (11). The inhibitory ability that was reached by the nano powder is not in all the existing materials, but rather in a specific class only through which the property of the product being antimicrobial can be achieved. The antimicrobial property of the nano powder particles is related to the type of material, not its quantity. The material produced from it, which inhibits the growth of microbes in their normal state, is inert, but it is active when it is transformed into very small particles that may penetrate the body of the microbe and kill it or reduce its activity, so that it binds to it, or the DNA they contain, which leads to the mutilation and death of cells (12). Therefore, many materials with maximum effectiveness have been produced, such as tooth whiteners that kill the microbes that cause caries, as well
as in the field of treating wounds and burns and other medical fields that are useful in a certain aspect in solving a problem related to medicine in general and life as well.

**Conclusion**

Nano powder appeared as one of the most anti-microbial agents, and this was demonstrated by the effectiveness that has been shown in the formation of a surface area on the plate that contains the culture medium of the microbe, and this area is the area of inhibition. They can be used as effective growth inhibitors for many microorganisms. In addition, the nano powder can be modified to achieve better efficiency and facilitate its applications in many different fields such as biological materials and medicine as well. The long-term antimicrobial effects of the produced nano powder on dentistry and biomedical materials should be investigated in several studies in the near future.

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