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Research Article

Antifungal Effect of Silver Nanoparticles (AgNPs) Against *Aspergillus flavus*

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Abstract

Silver nanoparticle is a nontoxic, safe inorganic antimicrobial agent and is capable of killing about 650 type of microorganisms. In this study, the results showed that the effectiveness of silver nanoparticles (AgNPs) inhibition the fungus *Aspergillus flavus*. The maximum inhibition of the fungus growth on the PDA 100% for concentration of 200 ppm, 175 ppm while 95% inhibition of 150 ppm. Silver nanoparticles also prevented the production of AFB1 in stored maize grain using HPLC showed 100% inhibition ratio the growth of fungus in maize sample contaminated with the fungus.

Keywords: *Silver Nanoparticle; Aspergillus flavus*

Introduction

Nanotechnology is a new technology playing a vital role in different fields of science like medicine, engineering, electronic, pharmaceuticals, agriculture and food industry [1]. Previous studies pointed the effectiveness of silver nanoparticles as an anti-microbial [2-4]. Silver is a nontoxic, safe inorganic antimicrobial agent and is capable of killing about 650 type of microorganisms [5]. Silver has been described as being 'oligodynamic' because of its ability to exert a bactericidal effect at low concentrations [6]. Silver nanoparticles as an alternative to chemically manufactured pesticides without toxicity problems [7].

Objectives

Test the efficiency of nanomaterials (Silver Ag NPs) to destroy the toxin and the possibility of interpreting mechanism reductase toxin using these materials.

Materials and Methods

Test the efficiency of silver nanoparticles in the inhibition the fungus *Aspergillus flavus* in the PDA media laboratory

The silver nanoparticles that were obtained from the American company MTI with the following specifications.

Silver Ag	Nano powder
Purity	99.9+ %
APS	50 - 40nm (TEM)
SSA	10 – 5 m^2/g
Morphology	Spherical
Bulk density	1.3 - 1.2 g/cm^3
True density	10.5 g/cm^3

Three concentrations of silver (150 ppm, 175 ppm, 200 ppm) were used and three replicates for each concentration added these concentrations to 50 ml PDA media and set to the Sonication for 5 minutes then poured in Petri dishes and inoculated with fungus by using insight cork diameter 0.5 cm and monitored for five days to measure fungal growth rate and determine the percentage of inhibition to choose the best concentration gave the highest percentage of inhibition.

Test the efficiency of silver nanoparticles in the inhibition the fungus *Aspergillus flavus* and prevent the production of AFB1 in yellow corn

Corn grain soak with water for two hours and filterate the water then sterilized in autoclave at a temperature of 121^{0}C and pressure 1.5 kg / cm^2 for 20 minutes, and distributed in glass containers capacity of 1 kg by 500g of the container with three replicates of the treatment, added 175 ppm of silver nanoparticles for each container after exposing to Sonication and left three containers without addition for comparison. Contaminated containers with the fungus *Aspergillus flavus* and stored in degree lab temperature for a month.

Test silver efficient in breaking AFB1 in yellow corn

Yellow corn was prepared in the same manner described in paragraph 3.5.1 and contaminate with the fungus *Aspergillus flavus* and incubated at a temperature 2 ± 25 for 21 days, After the yellow corn become ready (contaminated by toxin), sterilized by the Autoclave at a temperature of 121^{0}C and pressure of 1.5 kg/cm^2 for 20 minutes and then treated with silver nanoparticles per container and left three containers a comparison (without the addition) Samples were shacked well and storage in Lab temperature degree for a month for the purpose of extract AFB1 and estimate its concentration in the samples and calculate reduction ration.

Results and Discussion

Test the efficiency of silver nanoparticles in inhibition the fungus *Aspergillus flavus* laboratory in PDA media

The results showed the effectiveness of silver nanoparticles AgNPs inhibition the fungus *Aspergillus flavus* in three concentrations (150 ppm, 175 ppm, 200 ppm) as the inhibition ratio of the fungus growth on the PDA 100% for concentration of 175 ppm , 200 ppm and 95% inhibition ratio of 150 ppm this is consistent with referred Al-othman., *et al*. [8] that the addition of silver nanoparticles reduced the production of mycotoxins by 95.5 - 81.1% also silver nanoparticles can change the metabolism and toxicity of molds in the case of high concentrations of silver nanoparticles used.

Test silver nanoparticles efficient in inhibiting the fungus *Aspergillus flavus* and prevent the production of AFB1 in yellow corn

The results of quantitative estimation to test the efficiency of silver nanoparticles in inhibition the fungus *Aspergillus flavus* and prevent the production of AFB1 in stored maize grain using HPLC showed 100% inhibition ratio the growth of fungus in maize sample contaminated with the fungus. This is consistent with Clement and Jarrett [9], in the use of silver nanoparticles in management of the plant diseases as they found it inhibit microorganisms in several ways. So it can be used with relative safety factor for control of various pathogens, compared with fungicide manufacturers [10]. The previous studies have demonstrated that bulk silver in an oxygen-charged aqueous media will catalyze complete destructive oxidation of micro-organisms [11]. In most cases, inhibition increased as the concentration of AgNPs increased. This could be due to the high density at which the solution was able to saturate and cohere to fungal hyphae and to deactivate plant pathogenic fungi. Reports on the mechanism of inhibitory action of silver ions on microorganisms have shown that upon treatment with Ag^+, DNA loses its ability to replicate [12]. Resulting in inactivated expression of ribosomal subunit proteins, as well as certain other cellular proteins and enzymes essential to ATP [13]. It has also been hypothesized that Ag^+ primarily affects the function of membrane-bound enzymes, such as those in the respiratory chain [14,15]. Alothman., *et al*. [8] was suggested morphological changes on treated fungi could occur, SEM examination of fungal hyphae treatment with silver nanoparticles shown damage such as: deformations in mycelial growth and the shape of hyphal walls, unusual bulges and ruptures. Savi., *et al*. [16] confirm changes and rupture occur of the fungal cell membrane in *A. flavus, F. verticillioides* and *P. citrinum* due to gold NPs. Sharon., *et al*. [17] noted Physical, chemical pressure and antifungal compounds, have been reported to trigger necrosis or apoptosis-like cell death in fungi.

Conclusion

The Study proved the efficiency of silver nanoparticles inhibit the fungus *A. flavus* of 100% in concentration of 175 ppm.

Silver nanoparticles in the experiment proved efficiency in the inhibition fungus of 100% and the reduction of the concentration of toxin from 0.6 to 0.1 µgm/gm.

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