Activity of Silver Nanoparticle Loaded Sodium Alginate Beats for Removal of Pathogenic Bacteria from Water

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Abstract: ***Silver nanoparticles (AgNPs) show effective antimicrobial activity against wide range of disease demonstrated by Fusarium oxysporum fungus. I investigated the synthesis of silver nanoparticles through biological method. Then silver nanoparticle loaded with sodium alginate beads were tested for removal of pathogenic bacteria from water. Bacteria are naturally found in clinical and industrial settings in association with surfaces. E.coli, most commonly found dominant disease causing bacteria. Biologically synthesized AgNPs shows significantly reduce growth of E.coli. as a time of incubation increases. Sodium alginates beads are ecofriendly nanocomposites film.***

Keywords: sodium alginates beads, silver nanoparticle, bacteria

1. Introduction

Nanotechnology is a interdisciplinary science dealing with smallest particle. (krukemeyer M.G. et al., 2015). Nanotechnology prominently involves use of nanoparticles. Nanoparticles, whose smallest functional organization is on nanometer scale or one billionth of meter (109). Nanotechnology has a massive range of applications. One of the functions of nanoparticles is to show antimicrobial activity against wide range of disease causing microbes. Due to their high specific surface area, AgNPs are more able to interact with membranes of bacterial cells. Several study reported that AgNPs can damage the cell membrane, leading to structural changes that makes bacteria more permeable. In this nanoparticle which is characterized by XRD, FTIR, U.V. Spectroscopy, TEM, Zeta Potential, used to test antimicrobial activity.

2. Materials and Methods

1) Potato Dextrose Agar and Broth
2) *E. coli*
3) *F. oxysporum*
4) 4. Silver Nitrate, Sodium alginate – 1% W/V at 25%, Calcium chloride reagent

Stock solution of silver Nitrate:

- Required: 0.1Mm silver nitrate solution.
- Molecular weight of silver nitrate: 169.87g
- 0.1M silver nitrate solution was prepared by adding 1.69g of silver nitrate in 100ml distilled water.

5) Sterile Distilled Water
6) Glassware's
7) Centrifuge, Incubator

3. Procedure

Part A:

Preparation of beads-
50ml of 10% W/V aqueous solution of sodium alginate was introduce drop wise from a glass syringe with a size 22 needle into 100ml of an aqueous 10% calcium chloride solution being stirred at 400rpm. Calcium alginate beads were harvested by filtration, were washed and stored in (PBS) phosphate buffer saline.

Collection of microorganisms:
The microbes selected for the present study were *Escherichia coli*. The given stock of *E.coli* was used for all experiments.

Preparation of inoculums:
E.coli was recovered for testing by sub-culturing on fresh media. A loopful inoculum of bacterium was suspended in 5 ml of nutrient broth and incubated overnight at 37°C. These overnight culture were used as inoculums in all our experiments.

Preparation of media:
The growth media employed in the present study included LB agar and LB broth. The medium was adjusted to pH 7 and sterilized by autoclaving at 15 lbs pressure (121°C) for 15 minutes for sterilization.

Sub-culturing of microorganism:
The pure culture of was maintained on nutrient agar slant by frequent sub culturing. These cultures was stored at 4˚C for further experiments

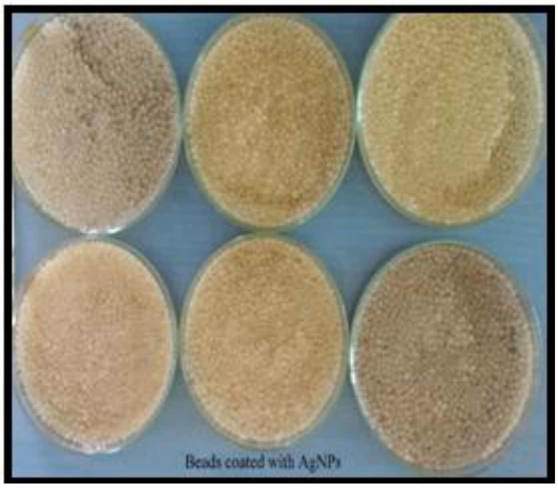
Part B:

Column disinfection experiment:

1) The prepared alginates beads were taken & repeatedly washed with sterile distilled water & were soaked in

silver nanoparticles prepared from *F.oxysporum* into a sterile petriplate.

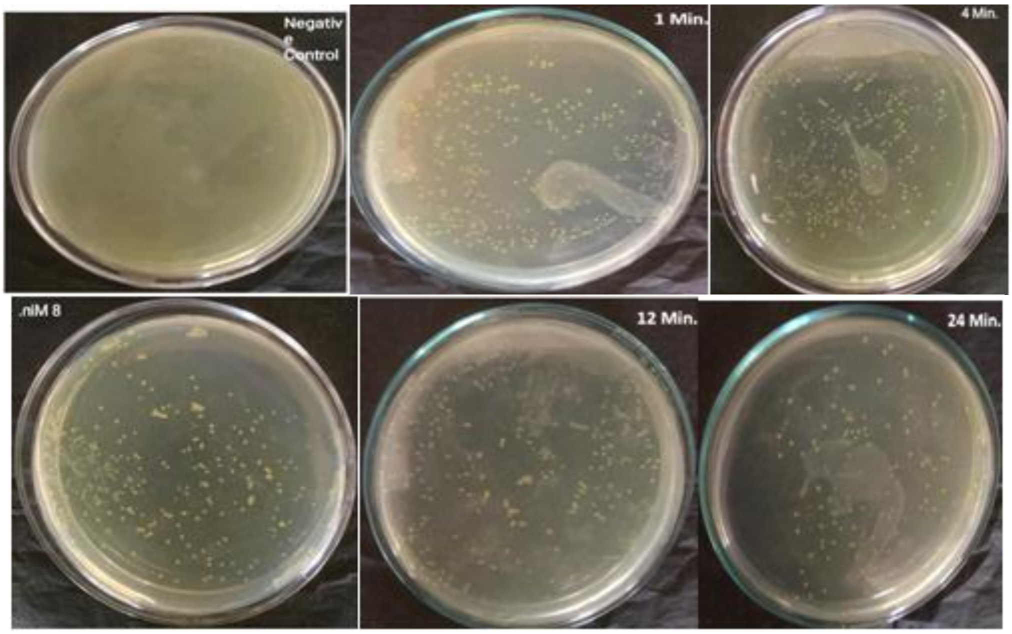
2) Soaked beads after an hour were packed in sterile chromatographic column.
3) The packed column was then placed U.V for an hour.
4) The sterile distilled water was passed through the column to remove any adsorbed nanoparticles on surface.
5) 0.1ml of sterile distilled water was passed though it and immediately collected in a sterile beaker, which was then immediately spread evenly on LB agar plate and kept for incubation at 37°C.
6) Dilutions of activated culture of *E.Coli* were prepared in sterile saline upto 10^{-4} dilution.
7) 10^{-4} dilution sample was then passed thorough nanoparticles coated column and collected at T = 1, 4, 8, 12 & 24 min
8) For each run three samples of effluent collected at T= 0min,
9) Immediately after being collected, *E.Coli* samples were homogenously spread on LB agar plates & placed into incubator at 37°C overnight to allow the growth of visible colony.
10) Also plated were the influent sample which was, *E.Coli* suspension without passing through any column.



4. Result

Number of colonies observed after exposure of E. coli to AgNPs loaded Sodium alginate

Sr. No.	Exposure time (Minutes)	No. of colony observed		
		Set 1	Set 2	Set 3
1.	Control	00	00	00
2	1	286	281	290
3	4	231	240	228
4	8	190	196	194
5	12	180	184	177
6	24	94	99	91



Antibacterial activity results

5. Discussion

- Mycosynthesied AgNPs showed highest antibacterial activity at T= 24min.
- Thus AgNPs sodium alginate beads has remarkable potential for antibacterial water filter

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