International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in

Vol.3., S3, 2015

NCERFM-2015

ISSN: 2321-7758

SYNTHESIS OF BIOMATERIAL FROM LEAF EXTRACT TO REMOVE BACTERIAL SPECIES FROM WATER

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ABSTRACT

Today water pollution is one of the major problems in the world. Assurance of safe drinking water is essential. In the present study, Sliver nanoparticles synthesized from Neem leaves to remove bacterial species from contaminated water samples. Recently, it was found that aqueous silver ions can be reduced by aqueous extract of plant parts to generate extremely stable silver nanoparticles in water. Apart from being environmentally friendly process, use of Neem leaves extract might add synergistic antibacterial effect of Neem leaves to the biosynthesized nanoparticles.

KEYWORDS— Bacterial species, Nano particles, Neem Leaves, Water pollution

INTRODUCTIONS

In recent years the topic of nanoparticles has received particular interest in a wide range of fields. The term “nano” comes from the Greek word “nanos” meaning dwarf and denotes a measurement on the scale of one-billionth (10^9) of a metre in size. A strand of DNA is 2.5 nm in diameter, a typical virus is around 100 nm wide and a typical bacterium is around 1-3 µm wide. Nanoparticles are defined as particulate dispersions of solid particles with at least one dimension at a size range of 10-1000 nm. The most important feature of nanoparticles is their surface area to volume aspect ratio, allowing them to interact with other particles easier (1). Silver nanoparticles exhibit size and shape-dependent properties that are of interest for applications ranging from photonics, food packaging, catalysis, sensing, electronics, optoelectronics, and medicine. Biocide or antimicrobial activity is one of the important properties of silver as it is highly toxic to most of the living cells including bacteria and fungi. These properties can also be influenced by alteration in structure. Biological methods of nanoparticles synthesis using microorganisms, enzyme, and plant or plant extract offer numerous benefits over chemical and physical methods. In this method there is no need to use high pressure, energy, temperature and toxic chemical that may have adverse effect. Recently, it was found that aqueous silver ions can be reduced by aqueous extract of plant parts to generate extremely stable silver nanoparticles in water. Silver nanoparticle containing materials have drawn considerable interest from scientists for water disinfection at the point of use due to their high antibacterial activity and cost effectiveness. Silver nanoparticles have been integrated into various base materials such as polymers, granular activated carbon, ceramic filter, filter membranes and silica composites for the purpose of water disinfection.Nanosilver particles are usually introduced into filter materials by two methods. First, silver ions are reduced in situ to generate silver nanoparticles on a functionalized surface of the filter material second, silver particles are absorbed into the pores of porous materials like porous ceramic filters that are immersed in silver colloidal solution. The former method requires particular techniques to immobilize specific functional groups on the surface of the materials, which play an important role in stabilizing and anchoring silver particles on the filtering materials. The latter method is commonly simplified by submerging or brushing conventional ceramic filters with a silver nanoparticle solution(2).Among the various bioreductants, Neem leaves fig(1) extract was chosen for the present study, since (i) Neem is a quite commonly available plant, (ii) it excludes addition of external stabilizing agent during synthesis and (iii) apart from being environmentally friendly process , Neem leaves extract might

add antimicrobial properties to the synthesized silver nanoparticles (3). Azadirachta indica, also known as Neem. Neem is a member of the mahogany family, Meliaceae Neem tree is found throughout India. It is a popular village tree. Neem leaves has antibacterial properties. The purpose of the present study is to remove bacterial speceies from polluted water using the antimicrobial and antibacterial activity of Neem leaves (4) . Water pollution is a major environmental issue in India. Rivers, lakes and surface water in India are polluted. Drinking water pollution is most important; as such pollution is directly connected with human health. The main source of freshwater pollution can be attributed to the discharge of untreated waste, dumping of industrial effluent, and run-off from agricultural fields. By always increasing pollution it becomes more difficult to guarantee the fundamental right to water. Water has a self-cleaning capacity that ensures the natural break of a number of substances. Water is however too much polluted, and then the self-cleaning capacity is damaged (5)

MATERIALS AND METHODS

The plant Neem (Azadirachta indica) was selected. Neem leaves were thoroughly washed with distilled water, dried, cut into fine pieces and were boiled in a Erlenmeyer flask with sterile distilled water and were filtered. The extract of Neem leaves was mixed with silver nitrate ($AgNO_3$) solution in a conical flask under aseptic condition. The flask was kept in shaking water bath in dark. A change in the color was observed indicating the formation of silver nanoparticles. This indicates the preliminary confirmation for the formation of plant silver nanoparticles. UV visible spectrophotometer is the main technique to examine the silver nanoparticles in the aqueous suspension (6).Water filter in a pot shape made from the sintering of the mixture of clay and a combustible material. They are usually coated with colloidal silver from Neem leaf extract which acts as a disinfectant and prevents the formation of biofilm on the surface of the filter

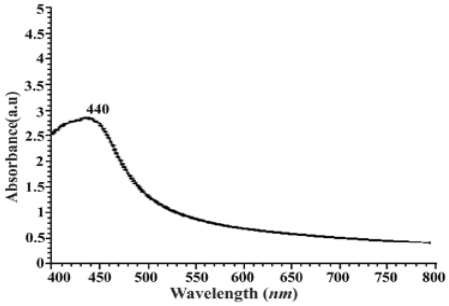
Fig(1) Neem Leaves

CHARACTERIZATION OF SILVER NANOPARTICLES:

UV-V is Analysis: The optical property of Ag_NPs was determined by UV-V spectrophotometer. After the addition of $AgNO_3$ to the plant extract.

RESULTS AND DISCUSSION

It is well known that silver nanoparticles exhibit yellowish colour in aqueous solution due to excitation of surface plasmon vibrations in silver nanoparticles. The appearances of yellowish colour in the reaction tubes suggest the formation of silver nanoparticles. Silver nitrate was used as reducing agent as silver has distinctive properties such as good conductivity catalytic and chemical stability. The aqueous silver ions when exposed to herbal, leading to the formation of silver hydrosol. The green synthesized silver nanoparticles had been confirmed by UV-Vis spectrum of the reaction media (7). The UV-Vis spectrum of green synthesized silver from Azadirachta indica has maximum absorbance peaks at 440 as shown in Fig (2)



Fig(2) UV-Vis spectrum of green synthesized silver from Azadirachta indica

GERMICIDAL EFFECT OF SILVER

Silver nanoparticles can effectively kill bacteria when applied to filter membranes, but it should noted that the silver wouldn't leach out into the water during use. The gel was tested using it to sop up water laced with two troublesome bacterial species, Escherichia coli and Bacillus subtilis. After 15 seconds in the gel, the amount of bacteria in the water squeezed out was 0.1% that of the original levels. When the exposure time was increased to five minutes, the amount of bacteria in the treated water was about one-millionth that of the tainted water. With such treatment times can turn unsafe water into drinkable water (8).

Table (1) - Effect of filtering raw water with a pot filter

Parameter	Water sample		Standard
	Raw	Filtered	
Turbidity(NTU)	10.10	1.29	<1
Residual Turbidity	---	-8.81	1-5*
pH	6.64	6.96	6.5-8.5
Electrical conductivity (µS/cm)	292	411	700.0
Staphylococcus aureus (Gram positive bacterium	6.0×10^6 CFU /ml	nil	--
Pseudmonas aeruginosa (Gram negative bacterium)	1.0×10^7 CFU / m	nil	--
Escherichia coli (Gram negative bacterium)	3.0×10^6 CFU / m	nil	--

The results presented in Table (1) show that the water filtration system was an efficient water purification technique. When the concentration of silver nanoparticles was 1.0 mM, the turbidity decreased more than 80% from 10.1 NTU to 1.29 NTU.

CONCLUSION

As the chemistry involved in the preparation of nanoparticle-coated pots is very simple, it can be scaled up to industrial application without the involvement of high pressure or temperature. Besides effectively removing bacteria from water, it is also capable of reducing the turbidity of the water. It is also very sustainable and has the potential to generate wealth these qualities make this technology adaptable to underdeveloped nations where bacterial contamination is the principal issue in drinking water. The method employed here is a biomimetic approach and the chemicals involved in the synthesis of nanoparticles are non-toxic, commonly available and cost effective.

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