Silver Nano Perfume Ejector to Destroy Bacteria for Clothes

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Abstract-- In modern era, silver nano technology is based on the concept of destroying the bacteria by the use of ionized silver particles. Samsung launched its washing machine which claims of releasing several silver ions during the wash cycle that inhibit the bacterial cell growth and destroy the bacterial cells thus making the clothes germ free and bacteria free. The clothes also get coated with thin layer of the silver ions so that the clothes remain bacteria free for the next thirty days after the wash. Silver Nano Perfume Ejector (Model: SKC-SE 500II) mixes 99.99% pure nano silver particles with lavender or lemon fragrance launched by Seo-Kwang Co.,Ltd.

Keywords--nano silver; silver ion; germ and bacteria

1. INTRODUCTION

Nanotechnology is raising in the modern area because its can solve many problems for human life. In this modern era, nanotechnology is developing for comfortable, safe, and hygienic textile. Germ and bacteria are dangerous things in human life and they usually live in our clothes. They can develop more than thousands only in one hour.

And, why we have to use silver nano? Silver nanoparticles are being used in numerous technologies and incorporated into a wide array of consumer products that take advantage of their desirable optical, conductive, and antibacterial properties.

- Diagnostic applications: Silver nanoparticles are used in biosensors and numerous assays where the silver nanoparticle materials can be used as biological tags for quantitative detection.
- Antibacterial applications: Silver nanoparticles are incorporated in apparel, footwear, paints, wound dressings, appliances, cosmetics, and plastics for their antibacterial properties.
- Conductive applications: Silver nanoparticles are used in conductive inks and integrated into composites to enhance thermal and electrical conductivity.
- Optical applications: Silver nanoparticles are used to efficiently harvest light and for enhanced optical spectroscopies including metal-enhanced fluorescence (MEF) and surface-enhanced Raman scattering (SERS).

So, in the second point, silver nano can be produced to destroy germ and bacteria in our clothes.

Silver nanoparticles (NPs) are toxic to bacteria, and are currently used in everything from medical devices to sport socks and washing machines to deter microbial growth [1]. Toxicity of silver ion and its compounds towards microbes is well established and this property was used in wound dressings, silver loaded zeolites etc. because of its higher stability, stronger antibacterial activity and broad antibacterial spectrum [2]. Since silver displays multiple modes of inhibitory action to microorganisms, it may be used for controlling various plant pathogens in a relatively safer way compared to synthetic fungicides [3]. Since that, many researchers in material major are developing silver in nano scale.

Bacteria have different membrane structures which allow a general classification of them as Gram-negative or Gram-positive. The structural differences lie in the organization of a key component of the membrane, peptidoglycan. Gram-negative bacteria exhibit only a thin peptidoglycan layer (~2–3 nm) between the cytoplasmic membrane and the outer membrane [4] such as E. coli, V. cholera, P. aeruginosa and S. typhus; in contrast, Gram-positive bacteria lack the outer membrane but have a peptidoglycan layer of about 30 nm thick [5]. By silver in nano scale, silver nano can destroy not only Gram-positive bacteria with 30 nm thick but also Gram-negative bacteria with thinner layer than Gram-positive bacteria.

The silver nanoparticles have been electron spin resonance spectroscopy studies that suggested that there is formation of free radicals by the silver nanoparticles when in contact with the bacteria, and these free radicals have the ability to damage the cell membrane and make it porous which can ultimately lead to cell death [6,7]. It has also been proposed that there can be release of silver ions by the nanoparticles [8], and these ions can interact with the thiol groups of many vital enzymes and inactivate them [9]. Silver is a soft acid, and there is a natural tendency of an acid to react with a base, in this case, a soft acid to react with a soft base [10]. So that, the bacteria can destroyed by nanosilver that is a soft acid. By this interaction, bacteria and also germ can leave from our cotton.
II. MATERIALS AND METHOD

Silver nanoparticles have different shape in atomic scale. The material shown in Figure 1.

Fig. 1. Silver nanoparticles. (a) TEM image of the silver nanoparticles that have been released from the carbon matrix; the inset illustrates the agglomerated particles in the carbon matrix. (b)-(d) Most common morphologies of the particles used. The \{111\} facets are labelled and their respective models are shown as insets: (b) icosahedral particle, (c) twinned particle and (d) decahedral particle seen in the [100] direction.

The atomic structure of silver is characterized by TEM (Transmission Electron Microscopy) and its has four results of atomic characterization. And then, after we know about its characterization, we need synthesized by biological synthesis method of silver nanoparticles. In fact, there are three methods to synthesis silver nanoparticles: chemical, physical, and biological synthesis. But, chemical and physical synthesis method have extremely expensive and also involve the use of toxic, hazardous chemicals, which may pose potential environmental and biological risks. So, we use biological synthesis method to be handled by humans and must be available at cheaper rates for their effective utilization; thus, there is a need for an environmentally and economically feasible way to synthesize these nanoparticles. The growing need to develop environmentally friendly and economically feasible technologies for material synthesis led to the search for biomimetic methods of synthesis [11].

TABLE 1. THIS SHOWN THAT SILVER NANOPARTICLES CAN BE SYNTHESIZED BY PLANT

<table>
<thead>
<tr>
<th>No.</th>
<th>Organism</th>
<th>Particle size (nm)</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Medicago sativa</td>
<td>2 to 20</td>
<td>[12]</td>
</tr>
<tr>
<td>2.</td>
<td>Azadirachta indica</td>
<td>50</td>
<td>[13]</td>
</tr>
<tr>
<td>3.</td>
<td>Aloe vera</td>
<td>15 to 20</td>
<td>[14]</td>
</tr>
<tr>
<td>5.</td>
<td>Carica papaya fruit</td>
<td>15</td>
<td>[16]</td>
</tr>
</tbody>
</table>

6. Cinnamomum zeylanicum bark 50 to 100 [17]
7. Jatropha curcas 10 to 20 [18]
8. Desmodium triflorum 5to20 [19]
9. Coriandrum sativum leaf 26 [20]
10. Piper betle leaf 3 to 37 [21]

The major advantage of using plant extracts for silver nanoparticle synthesis is that they are easily available, safe, and nontoxic in most cases, have a broad variety of metabolites that can aid in the reduction of silver ions, and are quicker than microbes in the synthesis [22]. This method is the best way to synthesis silver.

III. RESULTS AND DISCUSSION

Silver kills bacteria by strangling them in a warm and moist environment [23, 24]. Highly bioactive silver ions bind with proteins inside and outside bacterial cell membranes, thus inhibiting cell respiration and reproduction. Silver is 3–4 times more active at pH 8 than at pH 6. Silver products are effective against bacteria but not as effective against other organisms like fungi, mould, and mildew; they can be used with polyester where many other products cannot. Alginate and chitosan have also been used to make novel antimicrobial materials in combination with silver [25]. And then, silver nanoparticles can combined by a parfume ejector to destroy bacteria or germ into our clothes. Some of microorganism that cause diseases shown by Table 2.

TABLE 2. THIS SHOWN SOME OF MICROORGANISM THAT CAUSE DISEASES

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Disease or conditions caused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram-positive bacteria</td>
<td></td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>Pyrogenic infections</td>
</tr>
<tr>
<td>Staphylococcus epidemis</td>
<td>Body odour</td>
</tr>
<tr>
<td>Corynebacterium dithyroides</td>
<td>Body odour</td>
</tr>
<tr>
<td>Brevibacterium ammonigenes</td>
<td>Diaper rash</td>
</tr>
<tr>
<td>Streptococcus pneumonia</td>
<td>Bacterial pneumonia</td>
</tr>
<tr>
<td>Gram-negative bacteria</td>
<td></td>
</tr>
<tr>
<td>Escherichia Coli</td>
<td>Infections of ungenital tract</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>Infection of wounds and burns</td>
</tr>
<tr>
<td>Proteus mirabilis</td>
<td>Urinary infections</td>
</tr>
</tbody>
</table>

Some proposed mechanisms for microbial degradation of cotton are as follows [26]:
- The secondary wall of cellulosic fabric may be directly damaged by fungal hypha (a thread like element of fungus), and then fungus starts growing inside the lumen.
- In some fibres, hypha penetrates the lumen without breaking the outside surface. Fungal hypha is coarser (5 μm) than the cotton pore (16 Å) or even NaOH swollen pores (40–50 Å).
• Bacterial decomposition of cellulose takes place from outside to inside, but they cannot digest cellulose directly. Cellulolytic microorganisms secrete enzymes which make cellulose soluble; this is followed by the diffusion of microbes inside the cell.

• Carbon heterotopy types of bacteria degrade polysaccharide chains into shorter ones which are eventually hydrolysed to shorter oligomers and then finally to cellobiose and D-glucose.

By this mechanism, silver nano perfume possesses to destroy bacteria and germ in our clothes. And then, not only destroy both of them but also silver nano perfume can inhibit the bacterial cell growth. The clothes also get coated with thin layer of the silver ions so that the clothes remain bacteria free.

A product from Seo-Kwang Co.,Ltd. with series SKC-SE 500II mixes 99.99% pure nano silver particles with lavender or lemon fragrance. Figure 2. shown the product from the company.

This product has been launched with some specification:
• Fresh floral scent in the air and bad odors.
• Vegetable floral fragrance types are hazelnut, lemon, lavender, peach, morning lane, breeze, spring garden, ocean blue, white musk, acacia is more than 10 kinds.
• Injector shaped by the needs of the buyers will be replaced from time to time.
• The two kinds of kinds of fragrance with three kinds of two models.
• In general, hazelnut coffee aroma and flavor is lemon.
• The applications are a lot of people at school, hospital, airport, market, restaurant, academy, toilets, place of business, ward, etc.

Based on these products, we believe it can also be developed as a perfume that can be sprayed directly into the human body. The need for further research into direct contact between nano silver perfume with human skin of various races. Basically, the mechanism of action of nano perfume ejector is same with body perfume, its only that the price for this body perfume is still expensive at public market.

IV. CONCLUSION

Silver nanoparticles have been developed in many things for human life such as toothpaste, toothbrush, facial cleanser, comb, refrigerator, air-conditioner, and socks. Bacteria in Gram-positive and Gram-negative as its general classification can be destroyed by nano silver which has size 1 – 10 nm. Some of bacteria are Staphylococcus aureus which causes pyrogenic infections, Corynbacterium ditheroïdes which causes body odour, Escherichia coli which causes infections of urogenital tract, and Pseudomonas aeruginosa which causes infections of wounds and burns. The synthesis of nano silver can be done by biological synthesis because this method is nontoxic effect and low budget in research. Nano silver synthesis uses Medicago sativa which has 2 – 20 nm, Desmodium triflorum which has 5 – 20 nm, and Piper betle leaf which has 3 – 37 nm in shape. This is because smaller size makes more effective to destroy bacteria which has shape <20 nm. Therefore, nano silver perfume can be made by sustainable research not only from nanomaterial science but also medicine have to research about the effect after using nano silver perfume in human body.

REFERENCES


