INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 6.078
(Volume 6, Issue 4)
Available online at: www.ijariit.com

Biosynthesis of silver nanoparticle from pasteurized milk and their effects on raw milk to control spoilage

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ABSTRACT

Controlling bacterial growth in fluid milk is of economic interest, and supplemental methods to stop or reduce bacterial growth before and during the cooling chain may be valuable. Silver is effective in controlling growth of single-celled organisms, but has no effect on tissue cells. Smaller diameter (6-8 nm) silver nanoparticles were produced, with purity (no chemical reaction used in the process), It's purely biosynthesis. Using pasteurized toned milk with added concentration of silver nitrate and kept for incubation overnight. The color of milk has been changed from white to dark red indicate that the nanoparticles has been synthesized. The first trial investigated effects of time, and temperature, on total aerobic bacteria count in control milk and milk treated with silver nanoparticles. The AgNP particles were effective at all treatment temperatures and durations except for 10h, which indicated that the treated milk could be used after 10h for other dairy products such as yogurt, which require microbial activity. Small-diameter, silver nanoparticle can stop or reduce bacterial growth in fluid milk. Silver nanoparticles inhibited microbial growth and may be useful in complementing the cooling chain and the thermal processes. These results warrant more research on the sensory properties and long-term safety of the use of silver nanoparticles in dairy products. Recent rodent studies have shown that nanoparticles are distributed to breast milk, Here, used mice to investigate the safety of nanoparticle use during lactation. When Ag and Au nanoparticles were intravenously administered to lactating mice, the nanoparticles were distributed to breast milk without producing apparent damage to the mammary gland, and the amount of Ag nanoparticles distributed to breast milk increased with decreasing particle size. Orally administered Ag nanoparticles were also distributed to breast milk and subsequently to the brains of breast-fed pups. Ten-nanometer Ag nanoparticles were retained longer in the pups' brains than in their livers and lungs. Nevertheless, no significant behavioral changes were observed in offspring breast-fed by dams that had received orally administered 10 nm Ag nanoparticles. These data provide basic information for evaluating the safety of nanoparticle use during lactation.

***Keywords*:** *Breast Milk, Distribution, Gold Nanoparticle, Infant, Lactation, Silver Nanoparticle, Toxicity*

1. INTRODUCTION

Silver nanoparticles are one of the most commonly utilized nanomaterials due to their anti-microbial properties, high electrical conductivity, and optical properties

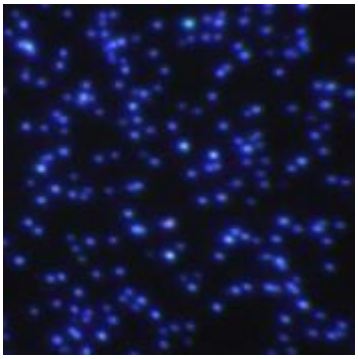
2. MEDICAL APPLICATIONS

Silver nanopaticles are widely incorporated into wound dressings, and are used as an antiseptic and disinfectant in medical applications and in consumer goods. Silver nanoparticles have a high surface area per unit mass and release a continuous level of silver ions into their environment. The silver ions are bioactive and have broad spectrum antimicrobial properties against a wide range of bacteria. By controlling the size, shape, surface and agglomeration state of the nanoparticles, specific silver ion release profiles can be developed for a given application.

3. CONDUCTIVE COMPOSITES

Incorporation of silver particles into plastics, composites, and adhesives increases the electrical conductivity of the material. Silver pastes and epoxies are widely utilized in the electronics industries. Silver nanoparticle based inks are used to print flexible electronics and have the advantage that the melting point of the small silver nanoparticles in the ink is reduced by hundreds of degrees compared to bulk silver. When scintered, these silver nanoparticle based inks have excellent conductivity.

4. PLASMONICS



Silver nanoparticles have unique optical properties because they support surface plasmons. At specific wavelengths of light the surface plasmons are driven into resonance and strongly absorb or scatter incident light. This effect is so strong that it allows for individual nanoparticles as small as 20 nm in diameter to be imaged using a conventional dark field microscope. This strong coupling of metal nanostructures with light is the basis for the new field of plasmonics. Applications of plasmonic silver nanoparticles include biomedical labels, sensors, and detectors. It is also the basis for analysis techniques such as Surface Enhanced Raman Spectroscopy (SERS) and Surface Enhanced Fluorescent Spectroscopy.

5. PHOTOVOLTAICS

There is increasing interest in utilizing the large scattering and absorption cross sections of plasmonic silver nanoparticles for solar applications. Since the nanoparticles act as efficient optical antennas, very high efficiencies can be obtained when the nanoparticles are incorporated into collectors. https://nanocomposix.com/pages/introduction-to-silver-nanoparticle

6. MATERIAL AND METHOD

6.1 Material

All chemical reagents including silver nitrate (AgNO3) (Fisher Scientific) were obtained and used as received.All the chemicals used were of the highest purity available. Ultrapure water was used for every experiments (Milli–Q System; Millipore Corp.).

6.2 Sample collection

Tonned milk sample was collected from Aasma Foods & Beverages (Bihar Hajipur Unit) (Table 1).

6.3 Synthesis of silver nanoparticle

Firstly we were collect Tonned Milk milk then make serial dilution 10-1 and 10-2 with distilled water. 1 ml of 10-2 dilution was added to the 9 ml of silver nitrate solution. This solution mixture was exposed to direct sunlight for 30 minutes and change in the color was observed.

6.4 Characterization of synthesized nanoparticles

The silver and gold nanoparticles obtained from camel milk were characterized by recording UV-Vis absorption spectra using Double Beam UV-visible spectrophotometer 2203 through a quartz cell with 10 mm optical path that demonstrated peak value respectively. The samples were packed in a quartz cuvette of 1 cm light- path length, and the light absorption spectra were given in reference to deionized water. The morphology of the colloidal sample was examined using Scanning electron microscopy (SEM-Zeiss) and Transmission electron microscopy (TEM-FEI Tecnai G2 STwin), with ultrahigh resolution (UHR) pole piece operating at an accelerating voltage of 300 kV that revealed size and shape.

Table 1: Composition of tonned milk

Parameter	Nutrional Value	Units
Protein	60	kcal
Carbohydrate	4.8	gm
Fat	3.1	g
Vitamine	37.50	Micro gram

Fig. 1: Stock solution before incubation

Before synthesis of Ag nanoparticles: Color of stock before incubation.

Fig. 2: Stock Solution After Ag Nano synthesis

After synthesis of Ag nanoparticles: Color of solution has been changed after 30 min. Incubation in room temperature

7. RESULTS AND DISCUSSION

7.1 Methylene Blue Dye Reduction Test

Methylene Blue Dye Reduction Test, commonly known as MBRT test is used as a quick method to assess the microbiological quality of raw and pasteurized milk. This test is based on the fact that the blue colour of the dye solution added to the milk get decolourized when the oxygen present in the milk get exhausted due to microbial activity. The sooner the decolourization, more inferior is the bacteriological quality of milk assumed to be. This test is widely used at the dairy reception dock, processing units and milk chilling centres where it is followed as acceptance/rejection criteria for the raw and processed milk.

7.1.1 Method: Tanker milk was collected and keep for MBRT test. Two sterile test tube were collected and one is control(without Ag nanoparticle added).And 2nd test tube was added with Ag nanoparticles.Test was kept for watch at 1.00 PM and after 45 min control was discoloured.

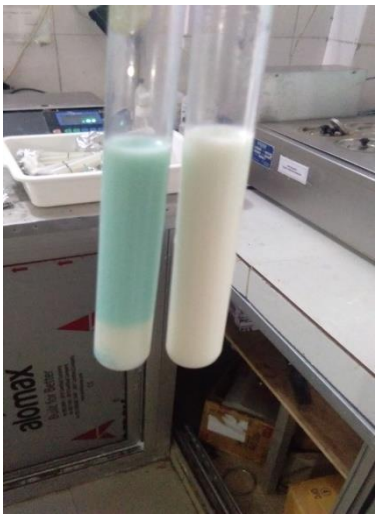


Fig. 3: MBRT test

- Blue color test tube is added with Ag nanoparticles after eight hours still MBRT is running
- White color test tube was stand only for 45 min. in MBRT test.

7.2 Nitrate Test

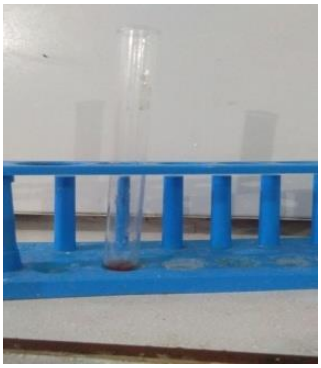


Fig. 4: Nitrate Test

A **nitrate test** is a chemical **test** used to determine the presence of nitrate ion in milk.Testing for the presence of nitrate**.** Figure 3-Nitrate test is negative.There is no formation of blue color band on the surface of test tube.

8. KEEPING QUALITY TEST FOLLOWED WITH COB, ALCOHAL & ACIDITY

Fig. 5: Keeping quality test (COB,alcohol,acidity)

5. Here we kept 10 liter milk in cane for 6 hrs and continuously check the acidity, alcohol and COB at regular interval at 26^0C temp. Mention in table 2.

Time interval	Acidity	Alcohal	COB	Sensory	Remarks
11.00 am	0.117	NEG	NEG	OK	OK
12.00 PM	0.117	NEG	NEG	OK	OK
13.00 PM	0.117	NEG	NEG	OK	OK
14.00 PM	0.117	NEG	NEG	OK	OK
15.00 PM	0.117	NEG	NEG	OK	OK
16.00 PM	0.126	NEG	NEG	OK	OK
17.00 PM	0.126	NEG	NEG	OK	OK
18.00 PM	0.126	NEG	NEG	OK	0K
19.00 PM	0.135	NEG	NEG	OK	OK
20.00 PM	0.135	NEG	NEG	OK	OK
21.00 PM	0.144	POSITIVE	NEG	OK	OK

9. CONCLUSION

Silver Nanoparticle synthesized from pasteurized milk have potential to stop spoilage in milk for longer time.It can reduce the cost of cold chain and labour.In future need the study of their effect on human.For preservation and cleaning by nanoparticle will assure their is less chance of contamination.

10. REFERENCES

[1] Article (PDF Available) *in* Journal of Dairy Science 95(3):1119-27 · March 2012 *with* 497 Reads DOI: 10.3168/jds.2011-4817 · Source: PubMed https://nanocomposix.com/pages/**introduction**-to-**silver**-**nanoparticle**

