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BIOPOLYASH : EXPLORES POLYMERS IN ORDER TO BE FURTHER IMPLEMENTED AS BIOCIDE ANTIMICROBIAL AND ANTI-DEPOSIT SURFACES ALSO USED IN FABRICATION OF FOOD PACKAGING MATERIALS USING MICROBIAL SYNTHESIZED SILVER NANOPARTICLES

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ABSTRACT

Nanotechnology is a rapidly growing science for producing and utilizing nano sized particles that measure in nanometers.In recent months concerns have been mounting that silver nanoparticles. pose an unacceptable toxicity risk to human health and the environment.An important aspect of nanotechnology is to synthesis of nanomaterials of controlled size, polydispersity, chemical composition, and shape.As a powerful bactericide, silver nanoparticles threaten bacteria-dependent processes that underpin ecosystem function use of silver nanoparticles ("nanosilver") will lead to the development of antibiotic resistance among harmful bacteria (Kriegel,2008).An important area of research in nanotechnology is the biosynthesis of nanoparticles such as nanosilver. The application of silver nanoparticles are in antibacterial or in antifungal agents in biotechnology and bioengineering, textile engineering and water treatment.The same principles can be applied to food industries coating of silver nanoparticles in food packaging materials. The use of microbially synthesized nanoparticles in food packaging have several advantages. The potential for nanosilver to result in increased antibiotic resistance among harmful bacteria is a serious concern. Only may certain harmful bacteria become resistant against nanosilver, but because of the type of resistance mechanism developed they may also potentially develop resistance to 50% of currently used antibiotics (beta-lactams). Benzoic acid (diluent: 50% methanol :50% water) analyzed in 50% methanol: 50% water eluent shows significant peak distortion (Lo Brutto and Kazakevich,2000).The main focus of the present work is to tap the bacteria as a candidate for rapid synthesis of sliver nanoparticles (Torres,2008). And thereby coating of microbially synthesized silver nanoparticles in food packaging which prevents packed food from contamination.

KEYWORDS:Nanoparticles,packaging,Nutrient,Bionanocomposite, Biopolymer, Smart Packaging,Active Packaging.

1.INTRODUCTION

Food packaging and distribution for the purpose of this report is defined as materials used to package fresh and processed foods (barrier packaging), materials that interact with food or packaging internal environment (food contact materials and active packaging), mechanisms of indicating the quality of Fabrication Of Food Packaging Materials Using Microbial Synthesized Silver Nanoparticles (Robertson,2006).This report covers usage of the food packaging, segmented by the major applications which include dairy, meat and deli containers made up mostly of liquid foods, prepared foods , food service packaging. Coverage is specific in terms of analyzing pre-packaged foods in rigid packaging and excludes non-prepackaged rigid packaging in addition to food service uses such as trays for holding meals and cups (Kriegel, 2008). For example, the free base and phosphate-salt hydrate of codeine have aqueous solubilities of 8.3 and 435mg/mL, respectively (Higgins and Rocco,2003). The market data represents consumption of plastics in rigid food packaging. Clearly, there has been a trend to source plastics offshore, especially from Asia.This trend of offshore sourcing has been most prominent with plastic films, although more recently, commodity plastic and other products have been imported in greater amounts. At this point in time it is not feasible to quantitatively assess the impact of offshore products in plastic rigid food packaging, and it is important to keep in mind that consumption for the market tables in this report.In addition to evaluations of the many technologies involved, this report quantitatively assesses individual plastics usage in the key markets. provides rationales for the trends within each market sector; describes the roles of the many companies involved such as molders and discusses the structure of the industry, the impact of recycling, and other critical issues.The principal roles of food packaging are to protect food products from outside influences and damage, to contain the food, and to provide consumers with ingredient and nutritional information . Traceability, convenience, and tamper indication are secondary functions of increasing importance. The goal of food packaging is to contain food in a cost-effective way that satisfies industry requirements and consumer desires, maintains food safety, and minimizes environmental impact.

2.EXPERIMENTAL

Active packaging (internal environment control including interacting with food contained within).Smart packaging (including functionalities such as trace & track and indication of authenticity). Biodegradable packaging materials Nanotechnologies offer promising innovations for these broad functional requirements. In particular, nanocomposites promise enormous potential in the near-term for a number of these, and we are seeing the first products on the market

(De Azeredo,2009). For many plastics recycling is made difficult as a result of the different components involved, which means that the item cannot be processed in a single step, but needs to be dismantled and component plastics separated. One way to avoid this, but to still achieve sustainability, is to use biodegradable polymers from renewable sources. These are generally proteins or carbohydrates and can be derived from animal or plant origin. Lipid films can be created also, but these tend to be used to directly coat and protect foodstuffs (and are described in the report 'Food Processing and Functional Food'). When biopolymers (such as cellulose) are mixed with nanoclay particles, the resultant nanocomposites exhibit improved barrier properties compared with the pure polymer, and after their useful life can be composted and returned to the soil.Other nanomaterials can be used including metal oxide nanoparticles, and carbon nanofibres and nanotubes (Collister,2002). In addition to melt extrusion, many biopolymers such as cellulose, collagen and zein (derived from corn) have been synthesised as nanofibres using electrospinning equipment. In some cases these have superior properties to the traditionally cast polymer, including increased heat resistance, and in addition, mats of such nanofibres possess a highly nanoporous structure and can be used as support matrixes for additional functionality.Such biodegradable nanocomposites could be of great use in other agrifood application areas, such as the plastics used in agriculture plasticisers (some biopolymers, such as starch, are not thermoplastic) and melt conditions (Rhim and Ng,2007). The addition of biobased nanomaterials as reinforcements in biopolymers have also been shown to improve moisture barrier.

Synthesis of silver nanoparticles by *Bacillus species:* *Bacillus* strain isolated from soil was studied and inoculated bacteria were prepared in petridishes at room temperature using nutrient agar.They were grown aerobically in liquid media containing 0.005% NaCl and peptone and 0.003% of yeast and beef extracts. The bacterial biomass were centrifuged consequtively until the pellet was separated completely. Inorder to test whether the *Bacillus species* produce metal nanoparticles extracellularly or intracellularly both supernatant and suspended pellet was used for further studies.1mM, 2mM and 3mM concentrations of $AgNO_3$ solution was prepared and then that is transferred to supernatant and pellet containing test tubes.Control was also run along with the experimental tubes and these cultures were incubated at 42 to 45°C for 5 to 6 days. The characteristic colour change was reported and recorded for every 24 hours.

Package design and construction in determining the shelf life of a food product (Rhim and Ng,2007). The packaging materials and technologies maintains product quality and freshness during distribution and storage. Materials that have traditionally been used in food packaging include glass, metals (aluminum, foils and laminates, tinplate, and tin-free steel), paper and paperboards, and plastics. Moreover, a wider variety of plastics have been introduced in both rigid and flexible forms. Today's food packages often combine several materials to exploit each material's functional or aesthetic properties. As research to improve food packaging continues, advances in the field may affect the environmental impact of packaging.

Aluminum foil: Aluminum foil is made by rolling pure aluminum metal into very thin sheets, followed by annealing to achieve dead-folding properties (a crease or fold made in the film will stay in place), which allows it to be folded tightly. It is inert to acidic foods and does not require lacquer or other protection. Although aluminum is easily recyclable, foils cannot be made from recycled aluminum without pinhole formation in the thin sheets.

Laminates and metallized films: Lamination of packaging involves the binding of aluminum foil to paper or plastic film to improve barrier properties. Thin gauges facilitate application. Although lamination to plastic enables heat sealability, the seal does not completely bar moisture and air. Because laminated aluminum is relatively expensive, it is typically used to package high value foods such as dried soups, herbs, and spices. These films have improved barrier properties to moisture, oils, air, and odors, and the highly reflective surface of the aluminum is attractive to consumers. More flexible than laminated films, metallized films are mainly used to package snacks.

Tinplate: Produced from low-carbon steel, tinplate is the result of coating both sides of blackplate with thin layers of tin. The coating is achieved by dipping sheets of steel in molten tin or by the electro-deposition of tin on the steel sheetAlthough tin provides steel with some corrosion resistance, tinplate containers are often lacquered to provide an inert barrier between the metal and the food product. Commonly used lacquers are materials in the epoxy phenolic and oleoresinous groups and vinyl resins.

Plastics: Plastics are made by condensation polymerization (polycondensation) or addition polymerization (polyaddition) of monomer units. In polycondensation, the polymer chain grows by condensation reactions between molecules and is accompanied by formation of low molecular weight byproducts such as water and methanol. In fact, many plastics are heat sealable, easy to print, and can be integrated into production processes where the package is formed, filled, and sealed in the same production line. The major disadvantage of plastics is their variable permeability to light, gases, vapors, and low molecular weight molecules (Ray,2006).

Polyolefins: Polyolefin is a collective term for polyethylene and polypropylene, the 2 most widely used plastics in food packaging, and other less popular olefin polymers. Polyethylene and polypropylene both possess a successful combination of properties, including flexibility, strength, lightness, stability, moisture and chemical resistance, and easy processability, and are well suited for recycling and reuse.

Polyethylene terephthalate: Formed when terephthalic acid reacts with ethylene glycol, PETE provides a good barrier to gases (oxygen and carbon dioxide) and moisture. It also has good resistance to heat, mineral oils, solvents, and acids, but not to bases. Consequently, PETE is becoming the packaging material of choice for many food products, particularly beverages and mineral waters.

Polycarbonate:. Polycarbonate is formed by polymerization of a sodium salt of bisphenol acid with carbonyl dichloride (phosgene). Clear, heat resistant, and durable, it is mainly used as a replacement for glass in items such as large returnable/refillable water bottles and sterilizable baby bottles. Care must be taken when cleaning polycarbonate because using harsh detergents such as sodium hypochlorite is not recommended because they catalyze the release of bisphenol A, a potential health hazard.

Polystyrene: Polystyrene, an addition polymer of styrene, is clear, hard, and brittle with a relatively low melting point. It can be mono-extruded, co-extruded with other plastics, injection molded, or foamed to produce a range of products. Foaming produces an opaque, rigid, lightweight material with impact protection and thermal insulation properties. Typical applications include protective packaging such as egg cartons, containers, disposable plastic silverware, lids, cups, plates, bottles, and food trays. In expanded form, polystyrene is used for nonfood packaging and cushioning, and it can be recycled or incinerated.

Polyamide: Commonly known as nylon, polyamides were originally used in textiles. Formed by a condensation reaction between diamine and diacid, polyamides are polymers in which the repeating units are held together by amide links. Different types of polyamides are characterized by a number that relates to the number of carbons in the originating monomer. For example, nylon-6 has 6 carbons and is typically used in packaging. It has mechanical and thermal properties similar to PETE, so it has similar usefulness, such as boil-in bag packaging. Nylon also offers good chemical resistance, toughness, and low gas permeability.

3.RESULTS AND DISCUSSION

In the present study, As the silver is naturally inflected with strong microbicidal activity, the above microbially synthesized silver nanoparticles can be used for coating of food packing material results were cultured nuterients in Fig 1and Fig 2. This will help the consumers to retain the shell life of food for few more days without getting contamination. The inoculation of bacterial with silver partials shows Fig 3,Fig 4 and Fig5. These nanoparticles can be coated before packing dairy products as silver is having less activity towards lactic acid. These have the following advantages in food packaging. It is less cost effective than chemically or physically synthesized nanoparticles.

The UV Spectro analysis is given. The use of silver coating in food packaging makes the product more efficient and safer.The coating acts as a barrier which makes it difficult for gasses like O2,to pass through the packaging. The nanopartical synthesized and measurement results is showed.

Fig1: Culture in nutrient broth at 16hrs

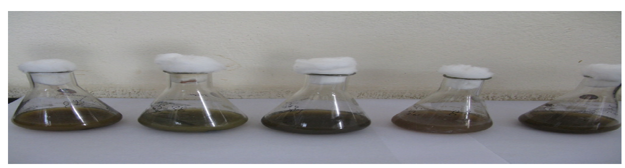


Fig2: Culture in nutrient broth at 24hrs

Fig 4: Bacterial Supernatant Before inoculation with Silver Nitrate

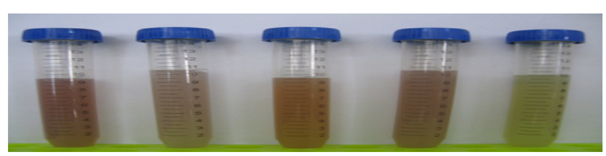
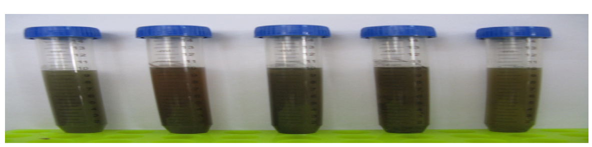


Fig 5: Bacterial pellet after inoculation with Silver Nitrate



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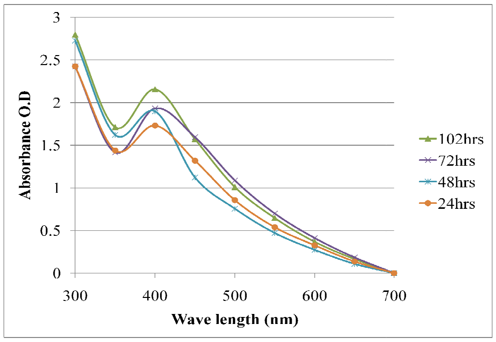
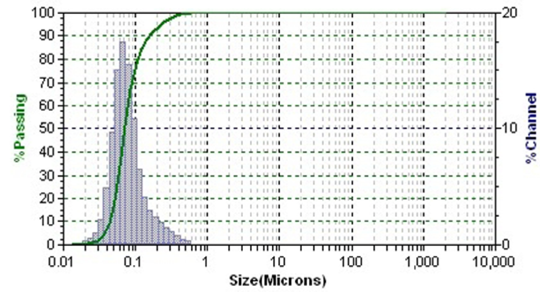
UV SPECTROMETER ANALYSIS:



PARTICLE SIZE MEASUREMENTS:



Particle size distribution of nanoparticles produced by *Bacillus sp.*

SCANNING ELECTRON MICROSCOPE ANALYSIS

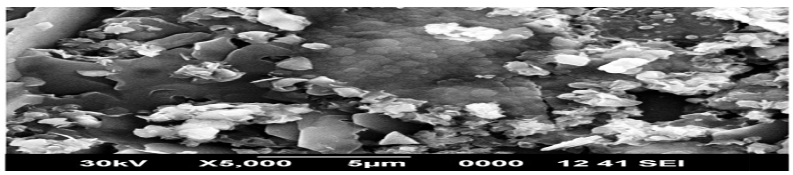


Fig: SEM analysis of the freeze dried sample of silver nanoparticle synthesized by *Bacillus sp*

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