



## Biomedical applications of biodegradable polymers doped with nanoparticles (Co, Ni, Au, Ag, Cu and Ag-Pd)

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### Abstract

This work describes the synthesis of metal colloids using nanoparticles of gold (Au), silver (Ag), copper (Cu) and silverpalladium alloy (Ag-Pd) which was supported in hyaluronic acid (HA) and chitosan (CS). Also, cobalt (Co) and nickel (Ni) were supported in Chitosan. The Solvated Metal Atom Dispersed (SMAD) method using a non-aqueous solvent 2-propanol and hyaluronic acid and chitosan were performed. The characterization techniques, such as Atomic Force Microscopy (AFM) and High-Resolution Transmission Electron Microscopy (HRTEM) were used. The development of microbiological assays to determine the Minimum Inhibitory Concentration (MIC) on solutions and films with nanoparticles under study, ATCC bacterial strains of *Escherichia coli*, *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Pseudomonas aeruginosa*. The toxicological tests were performed by conducting bioassays in Wistar rats of 100 g weight; which were injected intraperitoneal with different solutions of metallic nanoparticles (four samples prepared). With the results, toxicity was evaluated according to the minimum and maximum values of concentration for cobalt, nickel, gold, copper, silver and silver-palladium. No toxicity was observed, since the levels of alkaline phosphatase, ALT (alanine aminotransferase) and GGT (gamma-glutamyl transpeptidase) were in the normal range.

Biodegradable polymers are a special category of polymer that breaks down once it's supposed purpose by microorganism decomposition method to lead to natural byproducts like gases (CO<sub>2</sub>, N<sub>2</sub>), water, biomass, and inorganic salts. These polymers are found each naturally and synthetically created, and for the most part comprises organic compound, amide, and ether useful teams. Their properties and breakdown mechanism are determined by their precise structure. These polymers are usually synthesized by condensation reactions,

ring gap polymerisation, and metal catalysts. There are large examples and applications of perishable polymers.

Bio-based packaging materials are introduced as an inexperienced various within the past decades, among that, edible films have gained a lot of attention because of their environmentally-friendly characteristics, large selection and accessibility, non-toxicity, and low price. Perishable polymers have an extended history, and since several are natural product, the precise timeline of their discovery and use can't be accurately derived. One in every of the primary medicative uses of a perishable compound was the catgut suture, that dates back to a minimum of one hundred AD. The primary catgut sutures were made of the intestines of sheep, however trendy catgut sutures are made of sublimate scleroprotein extracted from the tiny intestines of cows, sheep, or goats.

Biomedical engineering (BME) or medical engineering is that the application of engineering principles and style ideas to drugs and biology for aid functions (e.g., diagnostic or therapeutic). BME is additionally historically called "bioengineering", however this term has come back to additionally check with biological engineering. This field seeks to shut the gap between engineering and drugs, combining the planning and problem-solving skills of engineering with medical biological sciences to advance health care treatment, together with identification, monitoring, and medical aid. Additionally enclosed underneath the scope of a medicine engineer is that the management of current medical instrumentality in hospitals whereas adhering to relevant business standards. This involves creating instrumentality recommendations, procural, routine testing, and preventive maintenance, a task additionally called a medicine instrumentality Technician (BMET) or as clinical engineering.

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Biomedical engineering has recently emerged as its own study, as compared to several different engineering fields. Such associate evolution is common as a brand new field transitions from being associate knowledge base specialization among already-established fields to being thought-about a field in itself. A lot of the add medicine engineering consists of analysis and development, spanning a broad array of subfields (see below). distinguished medicine engineering applications embody the event of biocompatible prostheses, varied diagnostic and therapeutic medical devices starting from clinical instrumentality to micro-implants, common imaging instrumentality like MRIs and EKG/ECGs, regenerative tissue growth, pharmaceutical medicine and therapeutic biologicals. A nanoparticle or ultrafine particle is sometimes outlined as a particle of matter that's between 1 and 100 nanometres (nm) in diameter. The term is usually used for larger particles, up to 500 nm, or fibers and tubes that are but 100 nm in barely 2 directions. At rock bottom vary, metal particles smaller than one nm are sometimes known as atom clusters instead. Nanoparticles are sometimes distinguished from microparticles (1-1000  $\mu\text{m}$ ), "fine particles" (sized between one hundred and 2500 nm), and "coarse particles" (ranging from 2500 to 10,000 nm), as a result of their smaller size drives terribly totally different physical or chemical properties, like mixture properties and optical or electrical properties. Being a lot of subject to the Brownian movement, they typically don't sediment, like mixture particles that conversely are sometimes understood to vary from one to one thousand nm. Nanoparticles occur wide in nature and are objects of study in several sciences like chemistry, physics, earth science and biology.

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