

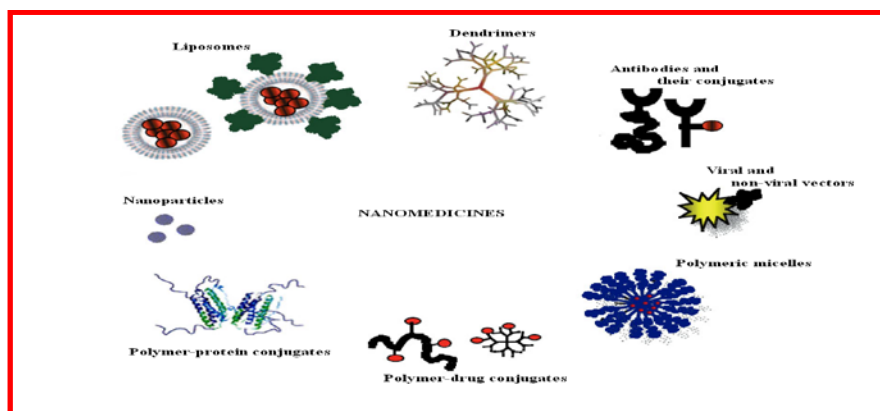
Applications of biosynthesis nanoparticles

-Applications of novel drug delivery system for herbal formulations

Great advances have been made on development of novel drug delivery systems (NDDS) for plant actives and extracts.

Novel herbal formulations like:

Polymeric nanoparticles, nanocapsules, liposomes, phytosomes, nanoemulsions, microsphere, have been reported using bioactive and plant extracts.



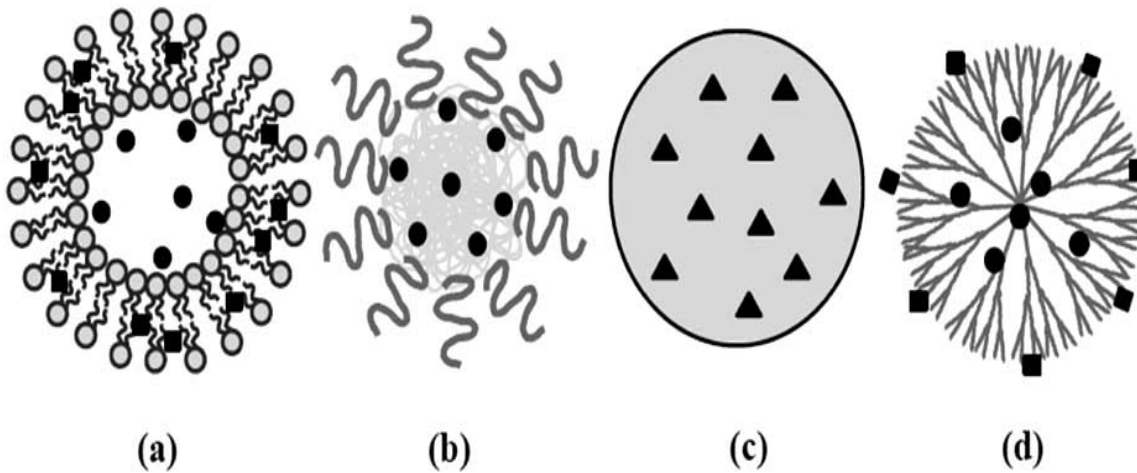
Novel formulations are reported to have remarkable advantages over conventional formulations of plant actives and extracts which include: enhancement of solubility, bioavailability, protection from toxicity, enhancement of pharmacological activity, enhancement of stability, improved tissue macrophages distribution, sustained delivery, and protection from physical and chemical degradation.

LIPOSOMES FOR ANTIMICROBIAL DRUG DELIVERY

Liposomes are spherical lipid vesicles with a bilayered membrane structure consisting of amphiphilic lipid molecules.

After extensive studies on their fundamental properties including lipid polymorphisms, lipidprotein and lipid-drug interactions, and mechanisms of liposome disposition in 1980s, the application potential of liposomes as a drug delivery vehicle was thoroughly recognized and started being transferred to practice.

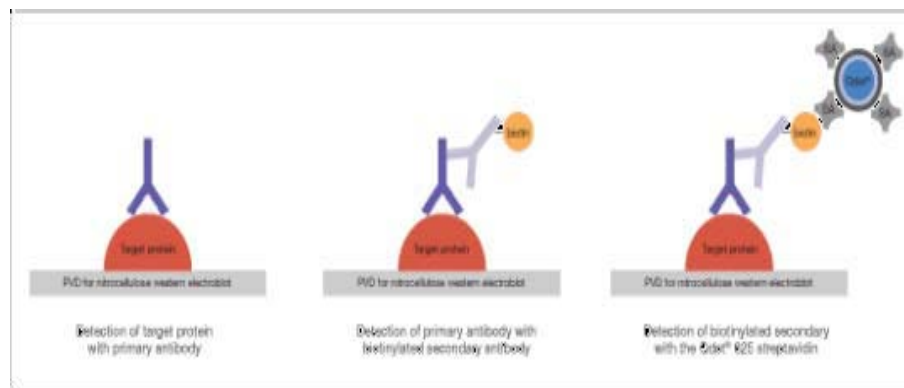
In 1995, Doxil (doxorubicin liposomes) became the first liposomal delivery system approved by the Food and Drug Administration (FDA) to treat AIDS. Liposomal drug delivery system can be made of either natural or synthetic lipids.



-Biosensors

An alternative approach is to develop sensors so tiny that they can be semi permanently implanted inside the body, where they can continuously monitor their surroundings.

New fields of nanotechnology are both components of the biosensor are excellent candidates for the application of nanotechnology.



-Nano robotics

It is the technology of creating machines of robots at or close to the nanometer scale.

Using special bacterium-sized "assembler" devices, nanotechnology would permit on a programmable basis exact control of molecular structures.

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Nanotechnology has the potential to enable cancer research and improve molecular imaging, early detection, prevention, and treatment of cancer.

-Prostheses and implants

Nanotechnology also has applications in tissue engineering to help a person who needs new bones, teeth, or other tissues. That technique based on biological nanostructures is viable.

Biomimetic nanostructures start with a predefined nanochemical or physical structure.

OPPORTUNITY FOR NANOTECHNOLOGY BASED TRADITIONAL MEDICINES

Curcumin

widely accepted as traditional medicine in Southeast Asia. It is commonly used as spice and nutritional supplement, Used as antioxidant, anti-inflammatory, antiviral, antibacterial, antifungal, anticancer activities and potentially acts against various malignant diseases, diabetes, allergies, arthritis and Alzheimer's disease etc.

Major problems associated with its use are its low solubility, bioavailability and stability.

Curcumin is reported to be unstable in the gut, and little amounts of curcumin that pass through the GI tract are rapidly degraded. Nanotechnology has been successfully utilized here and has proven to be very effective in solving these problems.

In vitro therapeutic efficacy of nano formulated curcumin and free curcumin against a panel of human pancreatic cancer cell lines showed comparable results.

Novel polymeric amphiphile conjugates with hydrophilic and hydrophobic segments showed minimal toxicity on HeLa cells. Nanocrystal solid dispersion of curcumin, amorphous solid dispersion, and nanoemulsion exhibited marked improvement in the dissolution behavior when compared with crystalline curcumin with significant improvement in pharmacokinetic behavior.

Sources: Grape seed, hawthorn, milk thistle, green tea, and ginseng. Active Component:

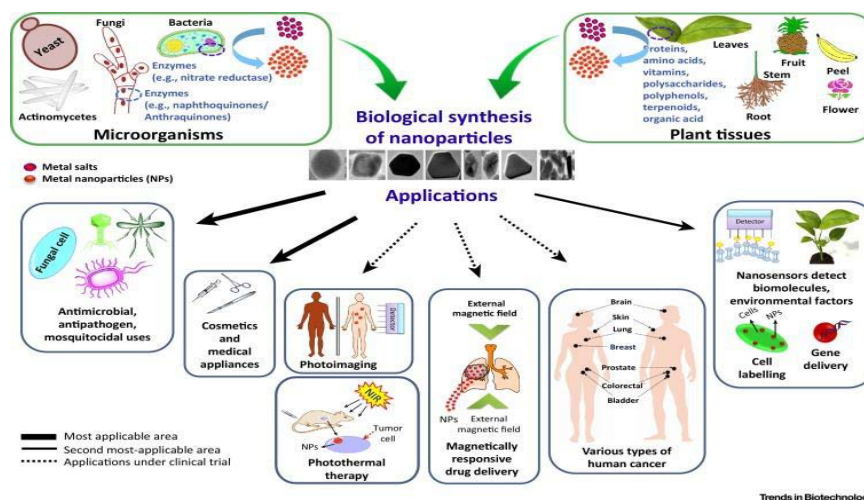
Nanotechnology and Cancer

Drugs can be embedded or dissolved in nanoparticles and can also be adsorbed or coupled on the surface. Encapsulating drugs within NPs can improve the solubility and pharmacokinetics of drugs. The leaf extract of *Ginkgo biloba* L. has been widely used for brain cell activation properties. The nano sized *G. biloba* extract is expected to activate the brain cell and work on the treatment of Alzheimer's dementia (like loss of memory, thinking, language, judgement and behaviour) better than pure extract.

The pharmacokinetic behavior and physicochemical factors related with delivery systems are considered to be primarily responsible for the improved targeting and therapeutic effectiveness; therefore, dealing with these factors during development of nano-herbal formulation can lead to more promising treatments for acute and chronic diseases.

Therefore, the nanoformulation can overcome the disadvantages of:

Poor aqueous solubility, physical instability, low drug absorption, lower bioavailability, slow pharmacological action, drug targeting, faster elimination, toxicity of many herbal drugs.



Nanotechnology in Agriculture and Food Technology

Areas of Nanoscience Research in Agriculture and Food Science

Gi Pathogen and contaminant detection.

Imagine using nanotechnology to create self-healing materials or coatings that can modify agricultural materials or packaging to prevent microbial contamination;

Or sensors which can slow decomposition and detect pathogens before your nose does.

2. Tracking crops and products.

Products Traceable nanotags and food quality sensors could Improve food quality, taste and nutritional value. Preserve foods and extend nutritional stability.

3. Nanodevices for molecular and cell biology.

Nanotechnology is making revolutionary changes within cells which will improve agriculture and the food industry in amazing ways.

Develop better soil additives, fertilizers, pesticides, and soil conditioners. Develop surfaces that select, reject or bond to molecules based on nanotechnology. Nanoscience can reduce oil use in all types of restaurants, including all fast food establishments, by half.

As a result of the large surface area at the nanoscale, it can extend the useful life span of the oil and it heats up more quickly which reduces the energy required for cooking.

4. Nanoscale materials science and engineering.

Engineering and materials science at the nanoscale is also improving agriculture and the food industry: Conducting research to better understand the mechanics of nanomaterials such as self-assembly, like the self-assembled capsule on the right.

Developing nanomaterials using DNA as a building block, like DNA nanowires, DNA-microelectronic hybrids, bioseparation and biofilms.

5. Environmental issues and agricultural waste.

Agriculture is utilizing nanotechnology as it works toward the following solutions:

Understanding the role of nanoparticles (inorganic and organic) in the movement and uptake of nutrients and pollutants; and the movement and toxicity of nanoparticles in agricultural pollution (dust, feedlot runoff);

-Reducing or converting animal or plant waste into useful products.

- Understanding the role of nanoparticles in the global carbon cycle.
- Designing and developing reusable nanomaterials, such as nanocatalysts, that help reduce waste materials.
- Create ammonia needed in fertilizer.
- Create artificial iron in water.
- Clean soils using nanoparticles in water that clean the soil as they pass through it.

6.Educating the public and future workforce

Healthy Nanotechnology can provide foods that look and taste better, are more nutritious and safer than what we eat today. Nanoscience is also working to :

- Educate the public,
- Develop regulations to manage and monitor nanotechnology developments in the food industry.

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