



Damietta University
Faculty of science
Zoology Department



The effect of nano particles on the environment and
copper NPs as example

By

Yusuf Adel Yusuf Marof

Supervisor

Dr. Shima M. kteeba

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Introduction

Definition of nanoparticles:

Nanoparticles are defined as a set of substances where at least one dimension is less than approximately 100 nanometers.

Importance and uses of nanoparticle:

the nanotechnology consumer products inventory has grown from 212 products in 2006 to 1,317 products in 2011, nearly a 521% increase in 5 years.

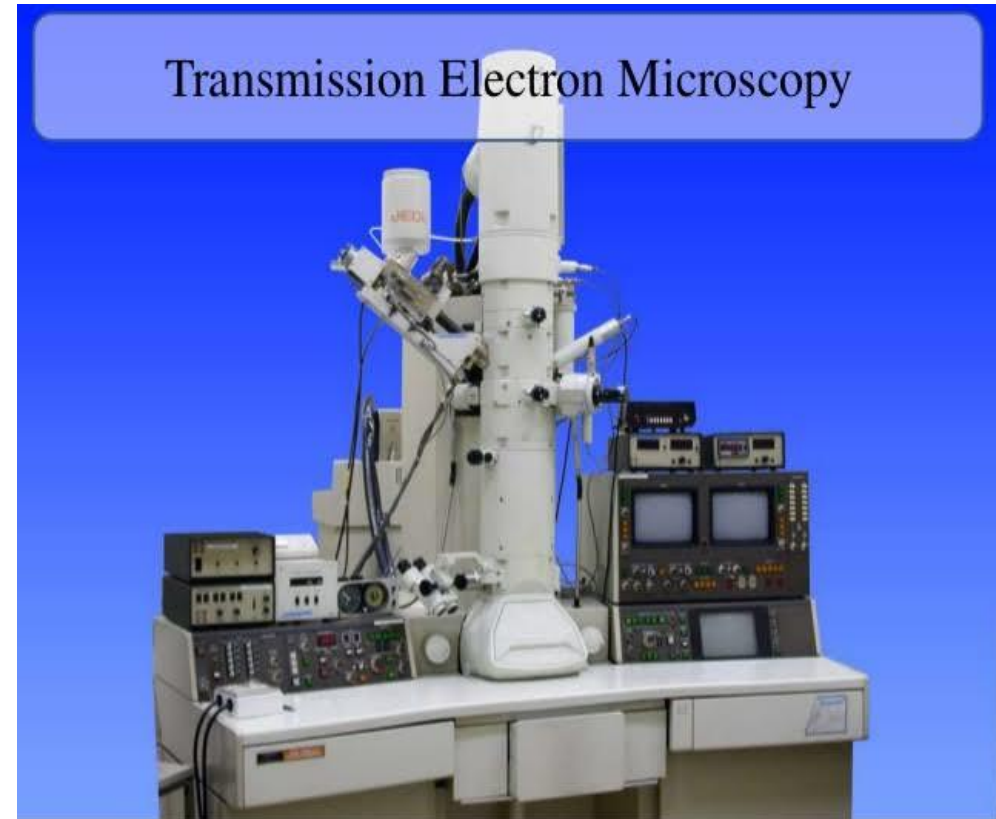
The U.S. National Science Foundation is estimating that nanotechnology will have a \$1 trillion effect on the global market and will employ over 7 million workers by 2015

- In the pharmaceutical field include improving drugs, proteins, genes, and vaccine delivery systems.
- In manufacturing and industrial the nanoparticles uses, and applications have been growing at a very rapid rate
- In Agricultural and food industries offers many innovations to enhance the quality of the plants

Characterization of nanoparticles

Transmission electron microscopy:

- Manual or automatic techniques are used for particle size analysis.
- usually based on the use of a marking moved along the particle.



X-ray diffraction:

- As it is a primary method for characterization of the crystal structure, crystallite, size, and strain, and have been widely used in NPs research



Exposure and mechanism of nanoparticles to human body , terrestrial ecologies, aquatic life

On human body:

- 1. Penetration through skin nodes**
- 2. Intake by respiratory system via inhalation**
- 3. Intake by digestive system via ingestion**

On Terrestrial Ecologies:

NPs are taken up and adsorbed to plant surfaces through a plant's nano or micrometer-scale openings.

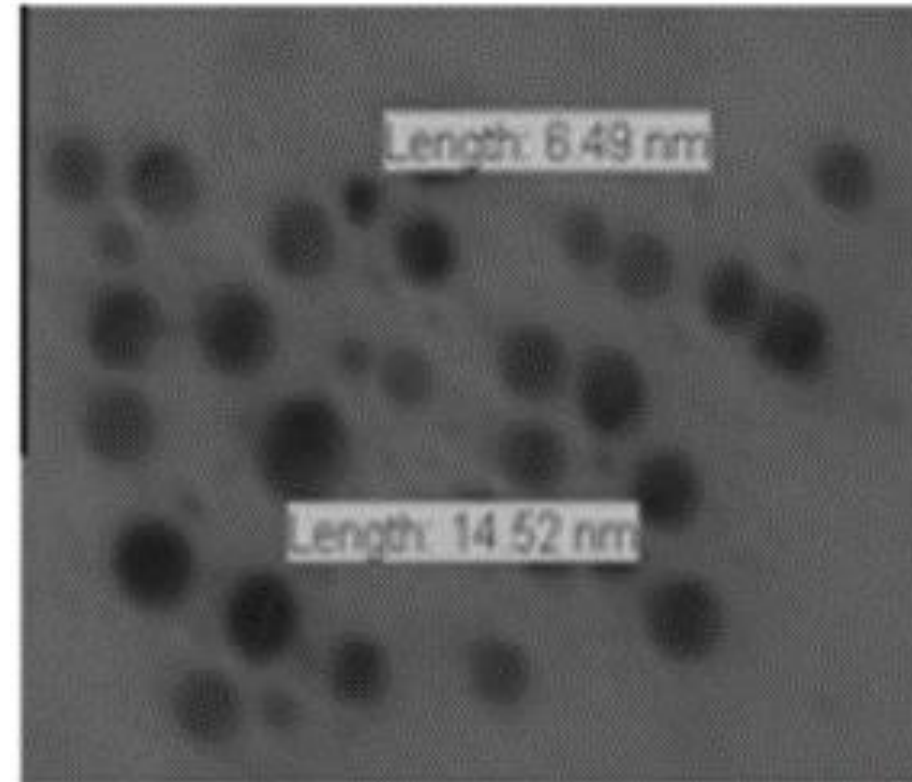
On Aquatic Life:

Possible mechanisms through which NPs are toxic to fish may involve endocytosis pathways, diffusional pathways, mucus pathways, direct toxicity to gills and intestines, etc.

copper nanoparticles

Characterization of copper nanoparticles:

- TEM images confirmed that copper nanoparticles are approximately spherical in shape.



Bioactivities of copper-based nanoparticles

Copper is one of the useful nutrients required for normal functioning of human body such as:

- Brain development and maintenance brain health
- The health of skin and connective tissues
- Wound healing
- Function of heart and blood vessels

Antimicrobial activity:

- antibacterial
- antiviral
- antiparasitic

Toxicity issues:

studies the effect of copper nanoparticles on dorsal root ganglion (DRG) of rat.

Exposure concentrations (10–100 μM) and sizes (40, 60, and 80 nm) for 24 h result cell death

- In liver:

High concentration cause hepatic injuries , inflammation and fibrosis

- In spleen:

Decrease of lymphocytes and splenic fibrosis

- In lungs:

Inflammation, collagen deposition and fibrosis

Possible mechanisms of antimicrobial action

copper nanoparticles after penetrating the bacteria :

- inactivate their enzymes, generating hydrogen peroxide
- DNA molecules and disturb the helical structure
- Some nanoparticles may enter cells via endocytosis
- directly interact with oxidative organelles such as mitochondria
- Production of (ROS) that can induce DNA strand, breaks and affect gene expression

