



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

In the name of Allah, Most Gracious,
Most Merciful

Lecture # 20

**Course: Nanotechnology &
Nanostructures**

Instructor: Dr. Zohra Kayani

Topic:

Bio and Nanomaterials Based on Fe₃O₄

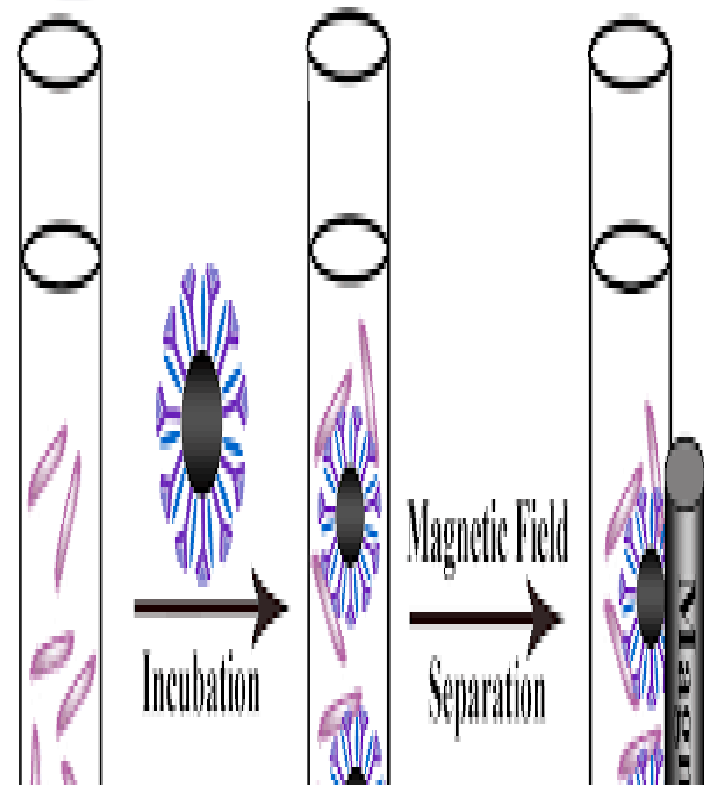
LIST OF CONTENTS:

- Bio and Nanomaterials Based on magnetic properties
- Magnetic nanoparticles
- Fe₃O₄ nanoparticles have enormous potential in the fields
- Method for preparation of nanoparticles
- Physical Method
- Wet Chemical Method
- Microbial Method

Bio and Nanomaterials Based on magnetic properties:

To the unique properties of magnetic nanomaterial such as

- superparamagnetism
- large surface-to-volume ratio
- low toxicity
- easy separation under external magnetic fields

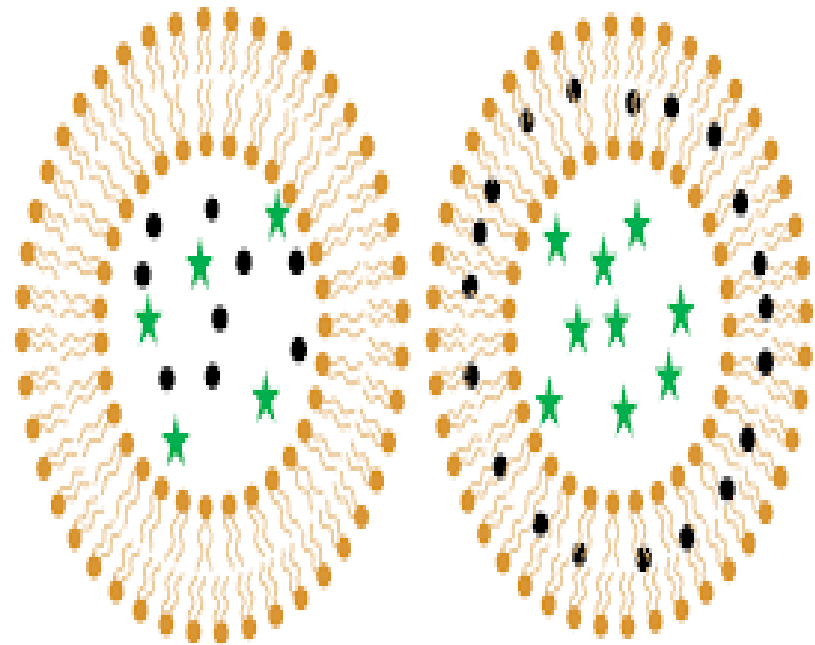


Magnetic Nanospheres:

Magnetic nanoparticles are a class of **nanoparticle** that can be manipulated using **magnetic** fields. Such particles commonly consist of two components: a **magnetic** material

For example

• **Fe₃O₄**



• Magnetic nanoparticle

★ Drug

Fe₃O₄ nanoparticles have enormous potential in the fields:

- immobilization

biomaterials

- Bioseparation

- environmental treatment

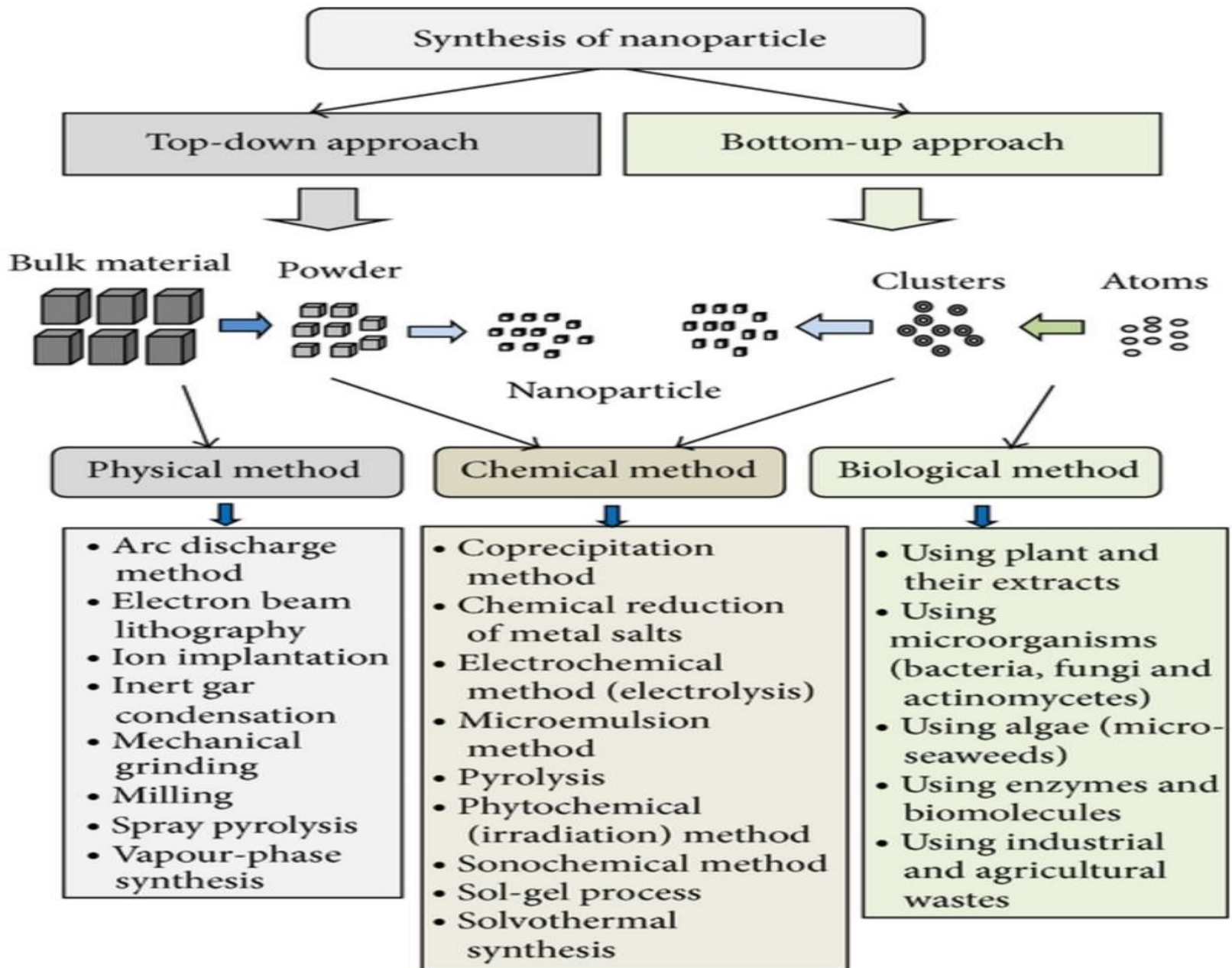
- Biomedical

- bioengineering usage

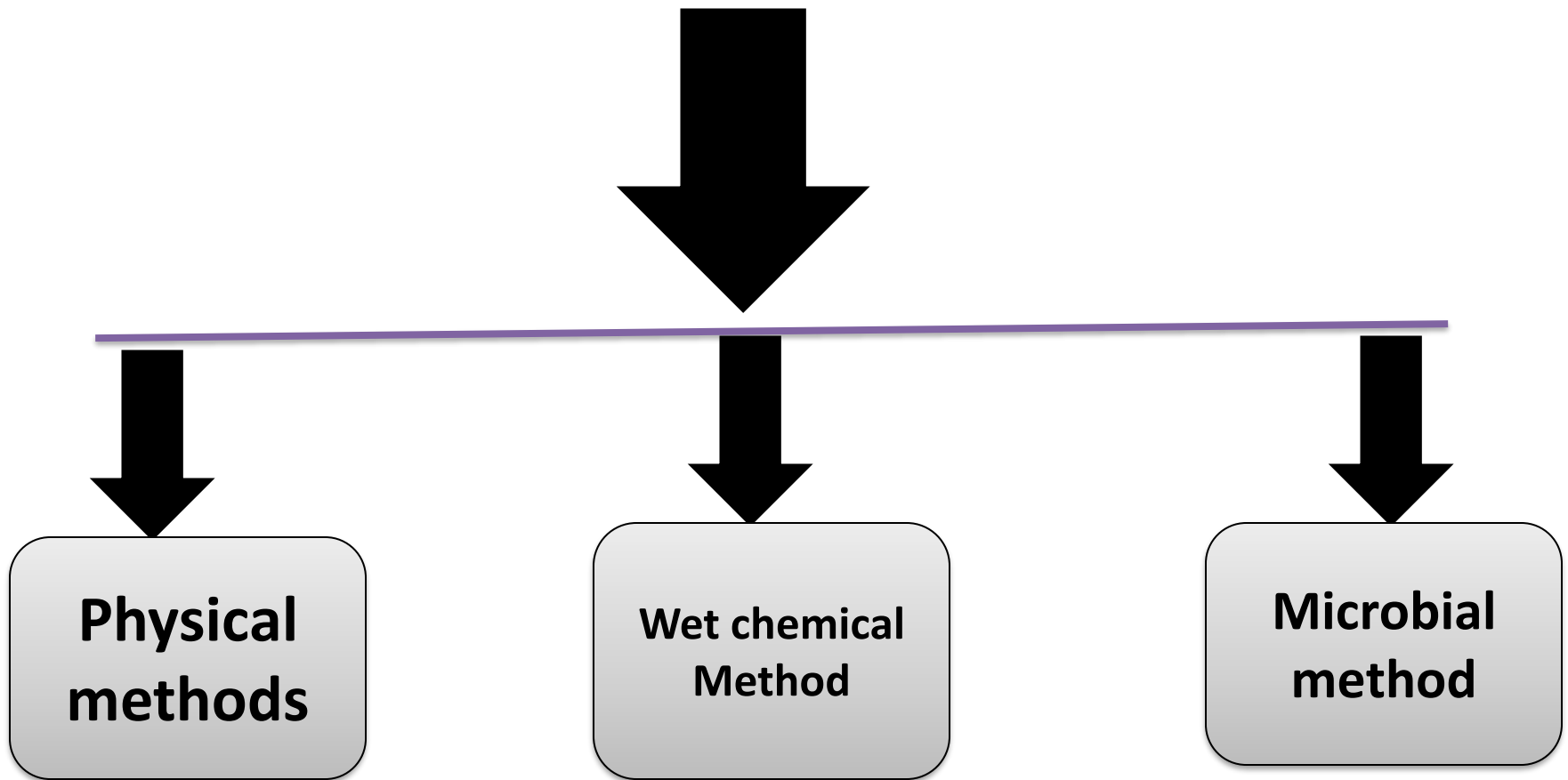
- food analysis.

of





METHODS FOR PREPARATION OF Fe_3O_4 NANOPARTICLES

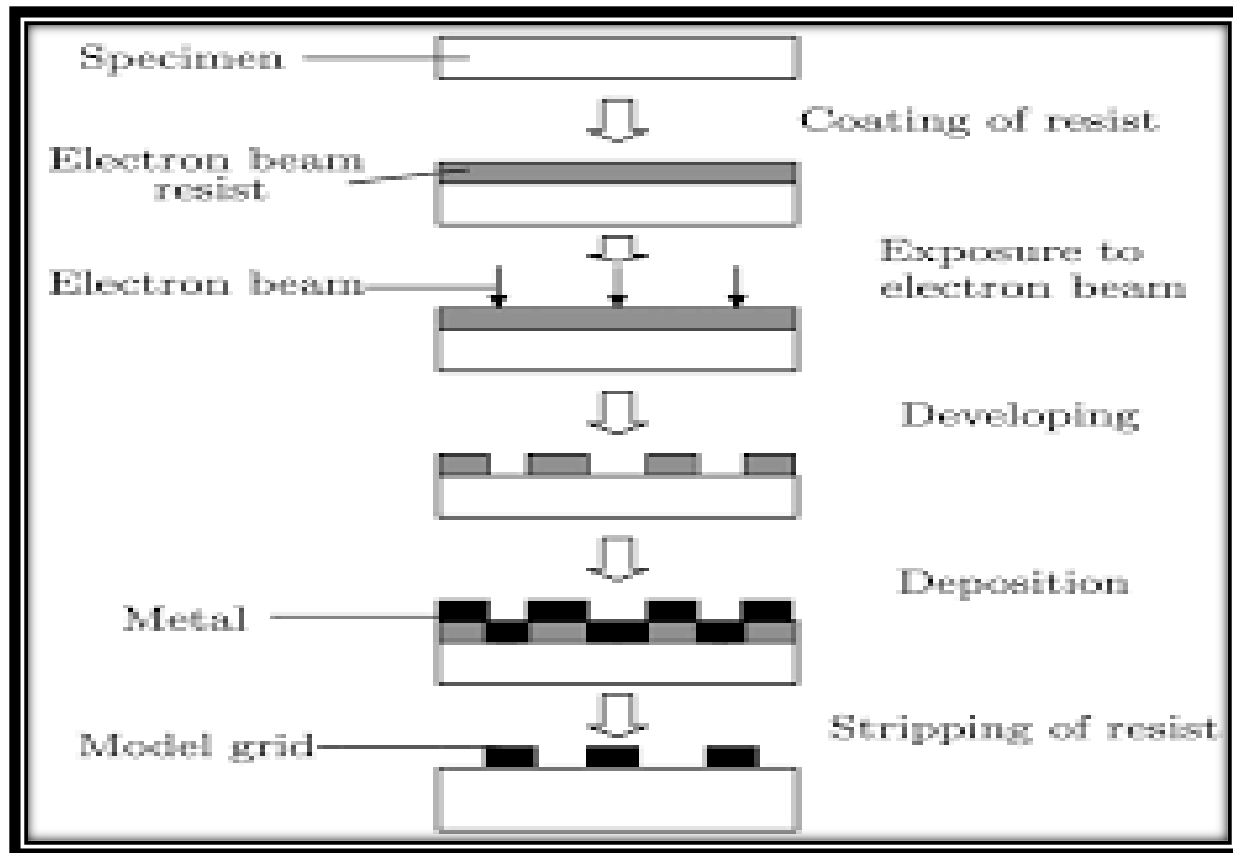


PHYSICAL METHODS

There are number of physical method which is used to prepare nanoparticle

- Electron beam lithography
- Gas-phase deposition
- Mechanical techniques.
- Externally controlled tools like traditional workshop or microfabrication equipment are often involved in physical methods

Electron beam lithography



WET CHEMICAL METHOD

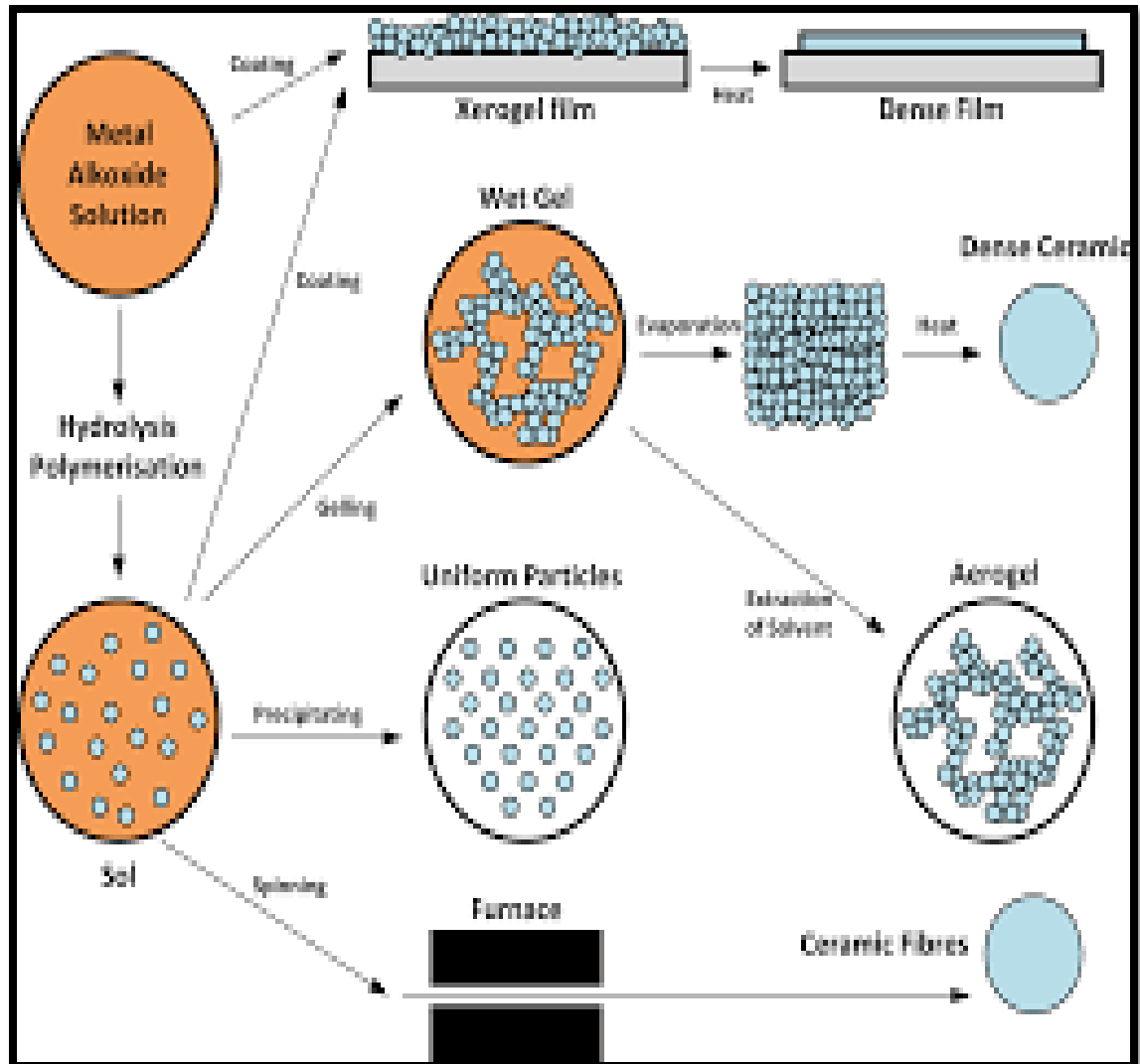
There are number of Wet chemical method which is used to prepare nanoparticle

- Sol-gel synthesis
- Oxidation method
- Reduction method
- Flow injection synthesis
- Electrochemical method
- Aerosol/vapor phase method
- Sonochemical decomposition reactions
- Supercritical fluid method,
- Synthesis using nonreactors.

SOL-GEL

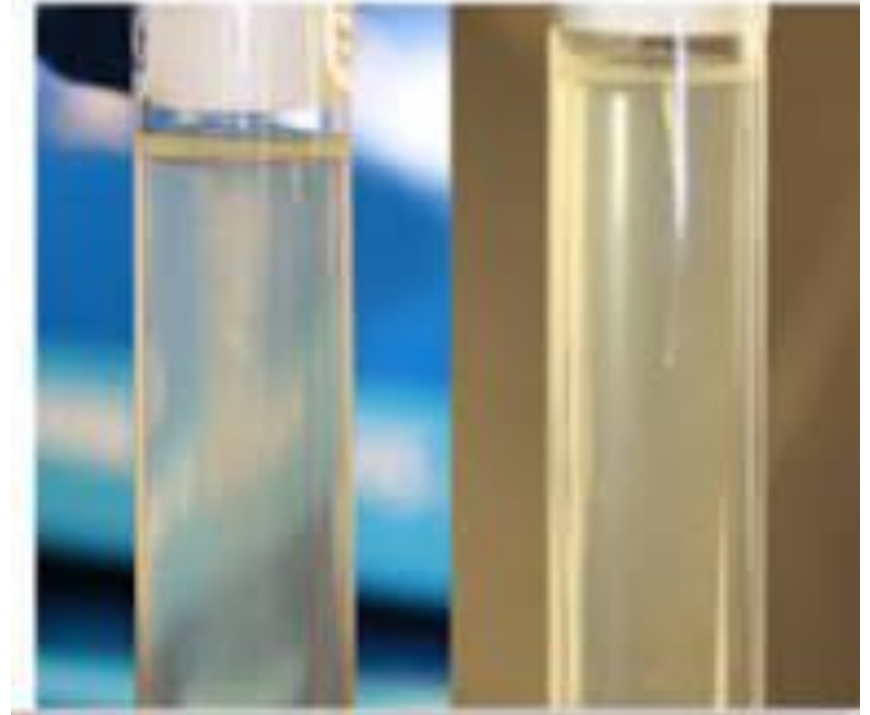
SOL: The process in which solid Nano particle dispersed in liquid.

Gel: It is semi rigid mass formed when these colloidal particle join together to form a network
There are two types of gel.



MICROBIAL METHOD

•A microbiological culture is a method of multiplying microbial organisms by letting them reproduce in predetermined culture medium under controlled laboratory conditions.



Why we use microbial method?

- **Microbial method** is an environment friendly nanoparticle formation processes which can produce 5–90 nm pure magnetite or metal-substituted magnetite without usage of toxic chemicals in their synthesis process.
- Microbial method represents an advantageous manufacturing technology with respect to high yield
 1. Good reproducibility
 2. Good scalability
 3. low costs

