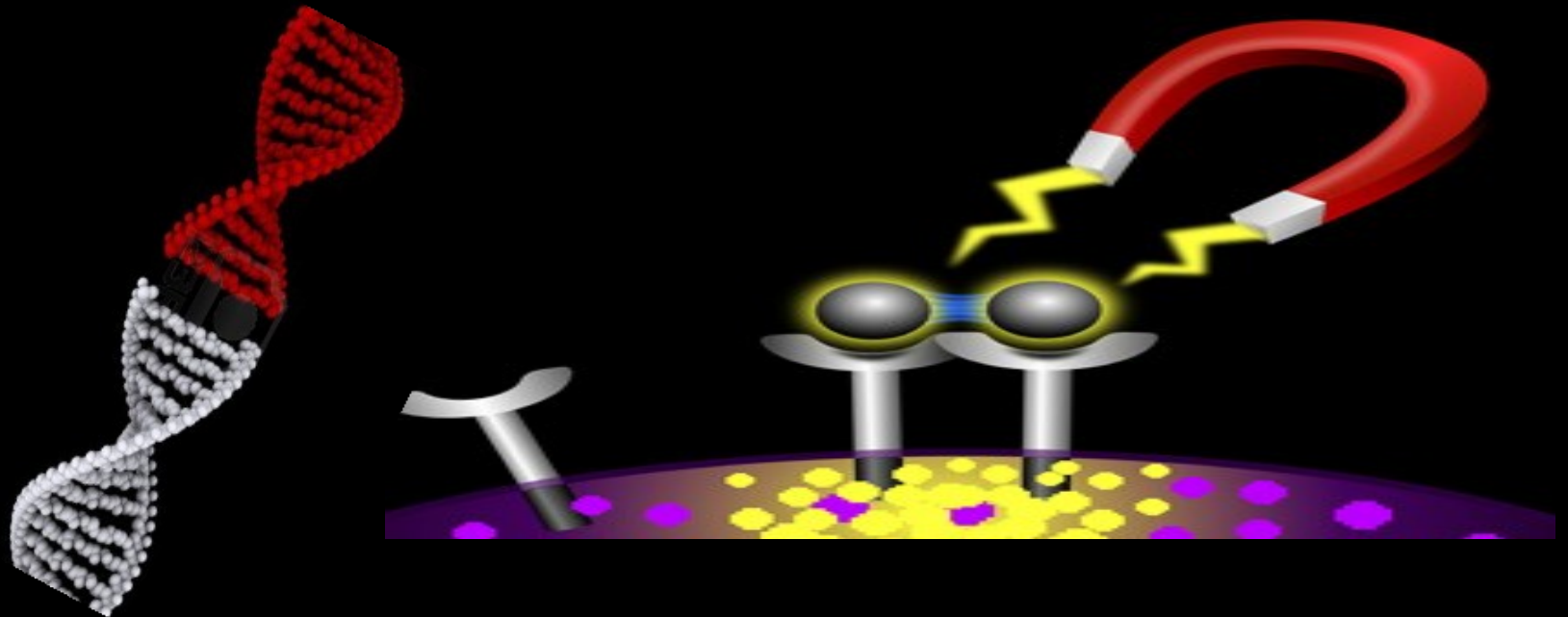


**SYNTHESIS OF IRON OXIDE
NANOPARTICLES
AND
FUNCTIONALIZED WITH SILICA
FOR
DNA PURIFICATION**



CONTENT

- Objectives
- Introduction
- Synthesis of iron oxide nanoparticles
- Synthesis of silica coated iron oxide nanoparticles
- Characterization of silica coated iron oxide nanoparticles
- Purification of DNA

OBJECTIVES

- To purify DNA with a high level of purity and efficacy using nanotechnology .
- To synthesize magnetically active iron oxide nanoparticles .
- To modify the surface of these particles with silica using different methods.
- To use the surface modified material as a silica based DNA purification system.

INTRODUCTION.

- The purification of DNA is fundamental in biological research.
 - With the ability to remove DNA from an organism, scientists can observe, manipulate, and classify the DNA
 - Scientists can identify genetic disorders or diseases from studying DNA
 - They can possibly find cures for these causes by manipulating or experimenting with this DNA
 - Scientists can accurately sort organisms into classes because of DNA uniqueness. If we didn't have DNA extraction, it would be a lot harder to decide which organisms are different from each other.

- Current DNA purification methods have several drawbacks.

ex: centrifugation with ethanol

preparations using commercial purification kits

- These methods often involve,
 - the use of toxic and mutagenic chemicals.
 - time consuming.
 - difficult to scale up.
 - damage the separated DNA.
 - require large equipments and high volumes of reagents and samples.

- Even though the surface of iron oxide MNPs could be modified by a number of organic and inorganic materials, silica has been chosen for our purpose.
- This is because
 - silica possesses good stability
 - can be used in organic or inorganic solutions without swelling
 - it is bio compatible
 - silica coating possesses a large amount of terminated silanol that can attach specific ligands to the surface of the MNPs.

SYNTHESIS OF IRON OXIDE NANOPARTICLES


Solutions of Fe (III) and Fe (II) were mixed.



Under N₂ atmosphere NH₃ was added.




Resulting black color complex was centrifuged at 12,000 rpm for 20 mins at 10 °C.



The precipitate was washed twice with double distilled water and was dried inside a vacuum desiccator.

SYNTHESIS OF SILICA COATED IRON OXIDE NANOPARTICLES

The iron oxide nanoparticles were mixed with ethanol, distilled water, ammonia and tetraethyl ortho silicate (TEOS) at room temperature.



The mixture was stirred for approximately two hours.



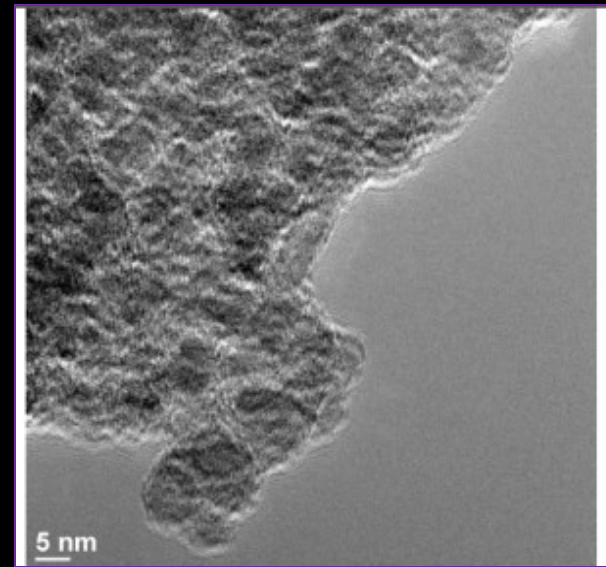
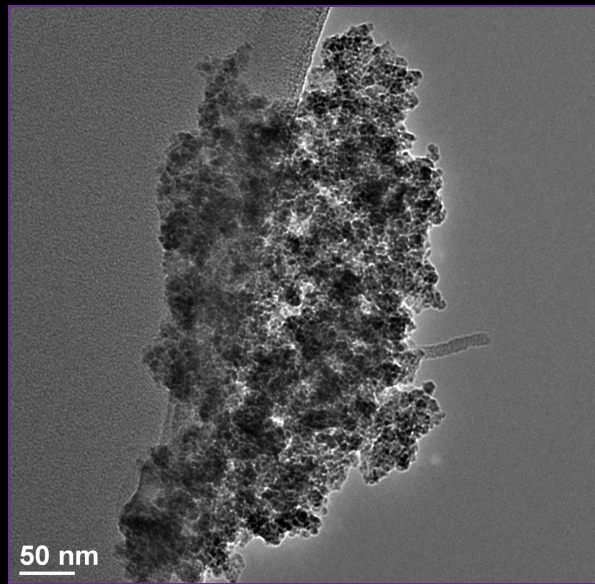
Silica functionalized iron oxide MNPs were characterized using TEM and FT-IR spectroscopy.

CHARACTERIZATION OF SILICA COATED IRON OXIDE NANOPARTICLES

**Fourier
transform
infrared
spectroscopy
(FTIR)**

**Transmission
electron
microscopy
(TEM)**

TEM images of silica coated iron oxide MNPs obtained during the study

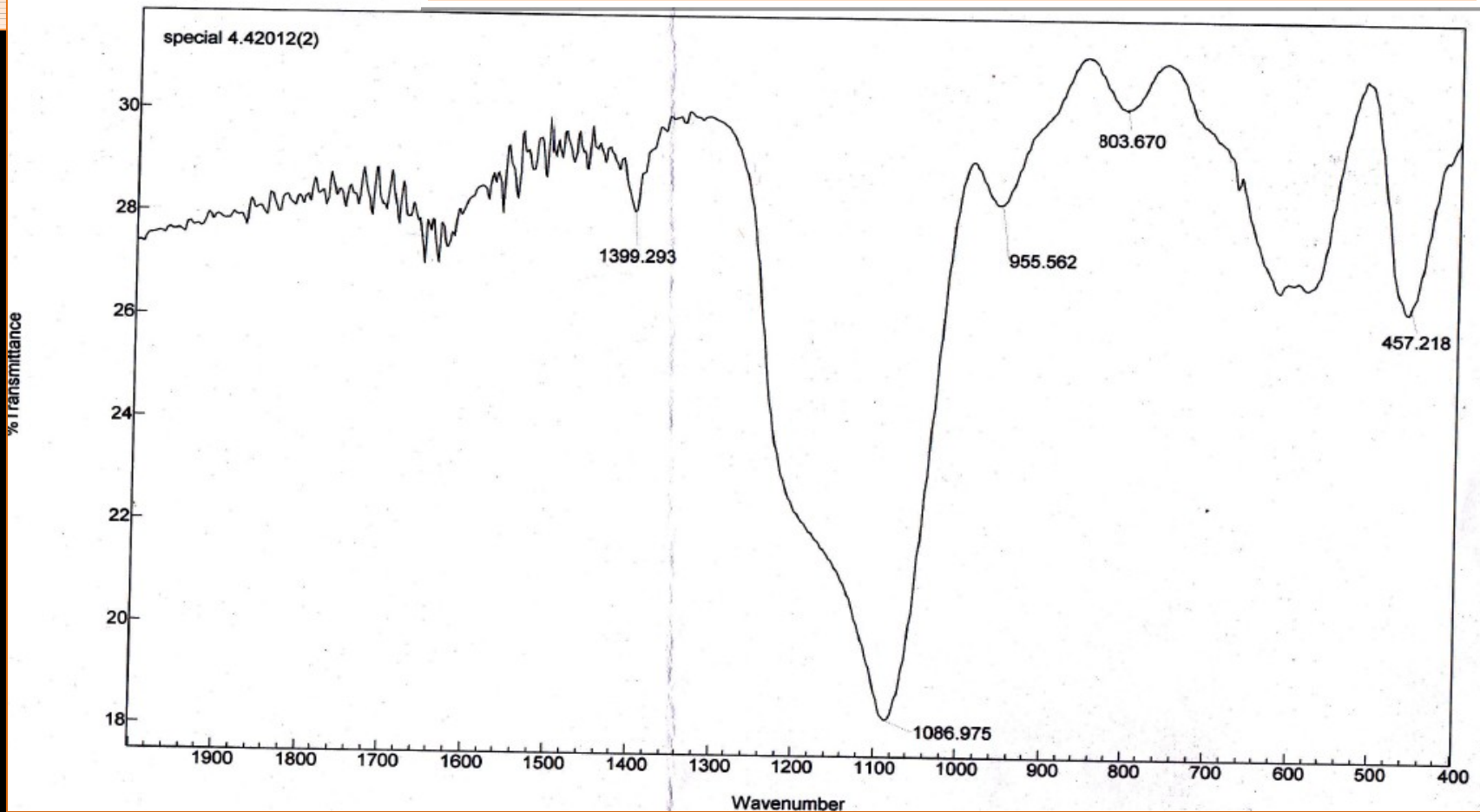


The particle size is 5 – 10 nm

FT-IR spectrum of silica coated iron oxide MNPs obtained during the study

Varian Resolutions Pro


Silica coated iron oxide nanoparticles




- After silica is coated on the surface of iron oxide nanoparticles, the main characteristic absorption bands are
 - Si–O–Si stretching at 1086 cm^{-1}
 - Si–OH stretching at 955 cm^{-1}
 - Si–O bending at 803 cm^{-1}
 - Si–O–Si bending at 457 cm^{-1}

PURIFICATION OF DNA


Silica coated iron oxide MNPs were washed with ethanol and with distilled water and then was suspended in the binding buffer



This was then added to a mixture of human genomic DNA, a binding buffer and water.



Then the sample was gently mixed at room temperature for 5 – 10 mins.



Next the MNPs were separated in the magnetic stand.

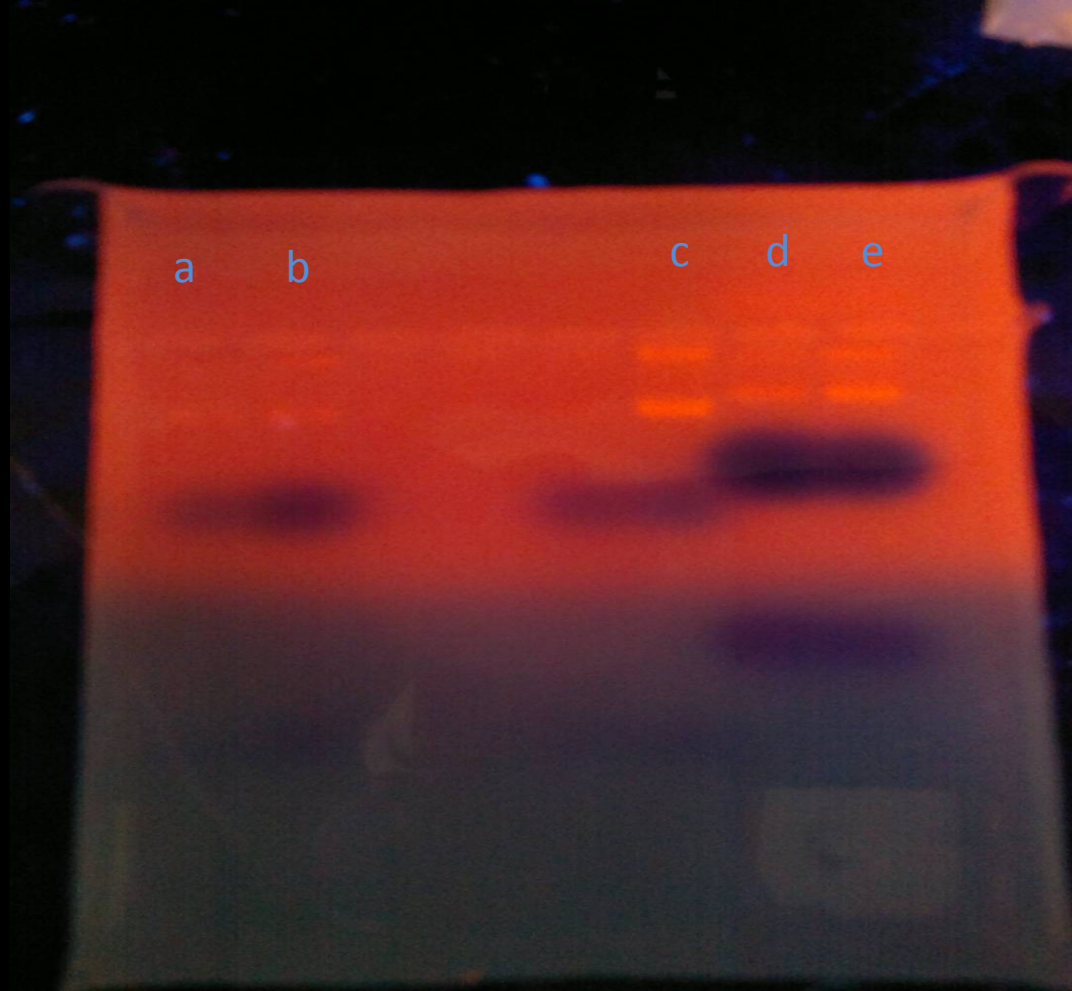


After washing the human genomic DNA was eluted from the MNPs. The eluted DNA was analyzed by agarose gel electrophoresis.

Agarose gel electrophoresis was achieved from a horizontal gel electrophoresis unit in TAE buffer to determine the efficiency of this separation.

Agarose gel electrophoresis was carried out for the eluted human genomic DNA in five different samples.

	a	b	c	d	e
Eluted DNA volume (ml)	1.00	2.00	3.00	5.00	1.00
TE buffer (ml)	9.00	8.00	7.00	5.00	9.00



From the gel picture it is clear that DNA has been separated. It also shows an efficient separation of DNA.

WORK IN PROGRESS

- Synthesis of silica coated iron oxide nanoparticles using different methods.
- Developing the method to separate single and double stranded DNA.



Thank You

