Synthesis, Characterization& Antimicrobial Activity of Mixed Metal Oxides of Iron Cobalt Nickel and Zinc.

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Abstract

Mixed metal oxides are the potential intermediates for the synthesis of semiconducting materials .Has wide application in solid state chemistry as nanomaterials.mixed metal oxides of transition metals are well known for their role in semiconducting materials.in the present study ,an attempt has been made synthesis these materials and characterize them by various methods such as IR UV etc.The synthesized solid materials iron ferrites,nickel ferrites and zinc ferrites posess significant antimicrobial activity with *Ecoli and Staphylococusaureus*.

Keywords: Ammonium oxalate, iron nickel, zinc solid state material, antimicrobial activity,UV,IR etc.

Introduction:

Research in the field of Solid state materials has gained immense importance because of their variety of application in the field of technology including Rf system ,permanent magnets ,advanced memories ,sintered electrodes microwave devices ,sheath technology ,catalysis, semiconducting materials ,etc. The solid state materials of COFE2O4,$NiFe2O_4$ and specially due to ferromagnetic behavior has typical application in the field of magnets and semiconductors.

The materials can be prepared by methods such as co precipitation ,microwavesynthesis,sol gel methods.At present investigation the typical precipitation method has been attempted,method suggesting easy way for preparation ,under normal conditions with good yield of product and purification. Iron ferrite, cobalt ferrite nickel ferrite and zinc ferrite materials were tested for biological application by pathogenic microorganism such as pseudomonas,Ecolietc.The magnetic properties tested by gyoy balance

Materials and Methods

All reagents used were of analytical grade (Merck). Standard solutions Prepared. Iron sulphate heptahydrate,Nickelsulphate.hexahydrate,zinc sulphate heptahydrate,Ammoniumoxalatate,petri plates, agar agar powder(antimicrobial activity).

Experimental:

Synthesis of Cobalt,nickel,iron and zinc ferrites.

A) Synthesis of iron ferrites:

In this methos 1:1:2 mole ratio in the stoichiometric amount has been prepared (metal to ligand ratio)

In 250 ml beaker take3.5 gm of iron sulphate in 20 ml Distilled water.add 1-2 drops of conc.H2SO4.In another beaker take 4 gm ammonium oxalate monohydrate ,dissolved in 100ml warm water .Heat both the solution.Add ammonium oxalate solution to metal solution with costant stirring at about 80 0 C.PPT will formed filterd off at bucknerfunnel,thencalcined the precursor material at about 600 -800 0 C.

By the similar method all ferrites were prepared.[7, 10]

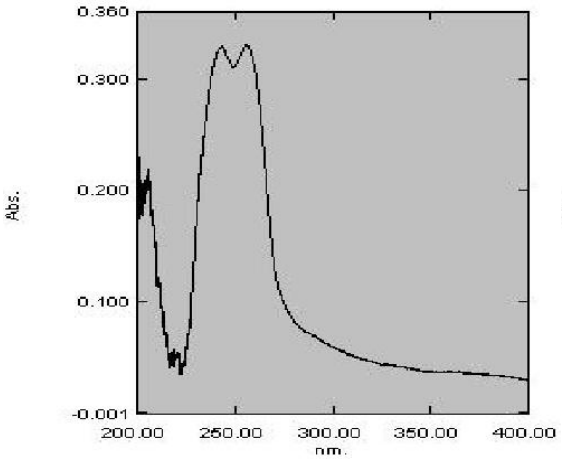
Chracterization:

For characterization the following method were adopted[4]

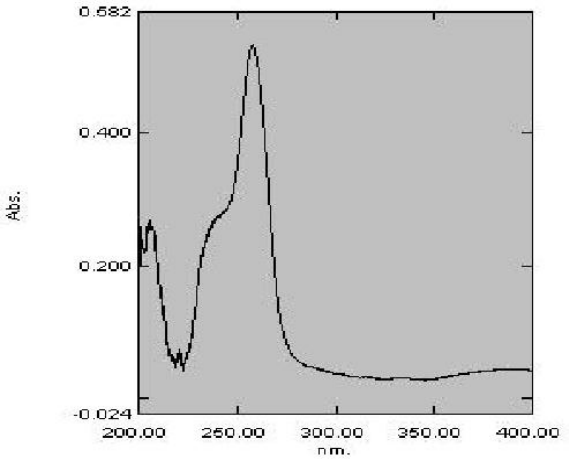
i) UV ii) IR iii) MAGNETIC STUDY.

UV–Visible analysis:

analysis of materials carried out for electronic study of metals.By analyzing the transitions of metals in precursor compound.theprecence of metals was confirmed.giving expected transitions in the uvvisilble spectrum. The typical spectrum of materials can seen as-



Iron ferrite comples
(Electronic transitions)



Nickel ferrite complex

IR Specrtoscopy study:

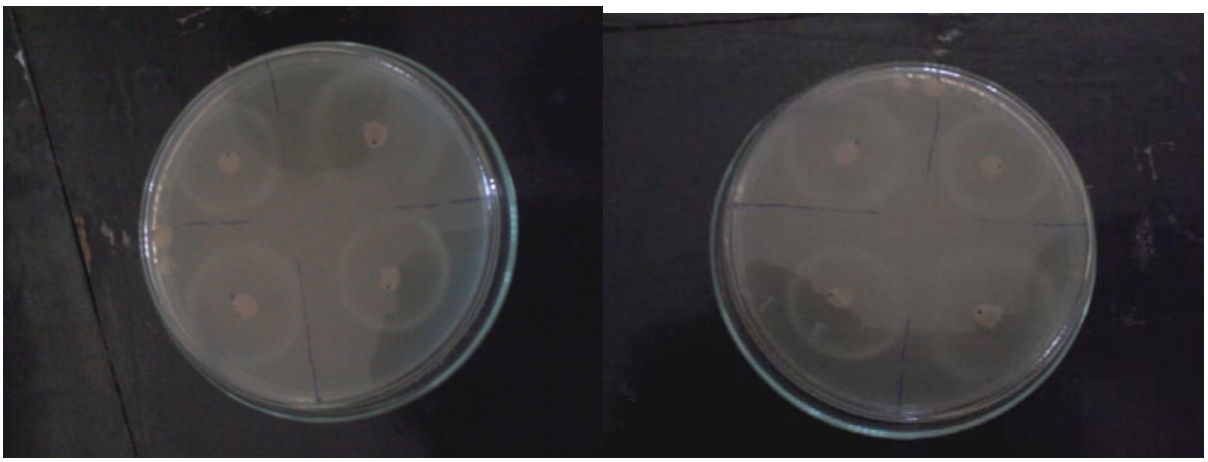
The IR interpretation of the materials was carried out to conclude the attachment of oxalates to metals in the precursor materials.the IR Sectrocopy shows the the typical IR stretch frequencies of oxalates to the metals.

Microbial Assay:

The bioassay is crucial in determining bioactivity of compounds .In the present study antimicrobial activity of zinc ,nickel and cobalt ferites tested against the microorganism such as *Ecoli and Staphylococusaureus*.the test was carried by quadrant plate method,that involves freshly prepared agar agar nutrient growth medium enciched with culture of selected microorganisms.Quadrant method

involvespreparation of four quadrant in a single petri plate ,so as to carry out simultaneous study of all the selected materials.[5]

Study shows, this method is developed best at room temperature.In this metod after pouring the culture of microorganism and sample in petri plate ,plates were incubutated for overnight at 40 ^{o} C.



A) Ni,Co,Fe,Zn ferrites in *E. Coli* B) Ni,Co,Fe,Zn Ferrites in *Staphylococus aureus.*

S.N	COMPLEX	*Staphylococus aureus* (Inhibition zone mm)	*E.coli* (Inhibition zone mm)
1	Nickel ferrite	10	10
2	Iron ferrite	12	09
3	Zinc ferrite	09	11
4	Cobalt ferrite	11	13

Results and conclusions

The study of mixed valence compound gives a route to various applications in the solid state materials. Various methos can be adopted for the synthesis of these materials but easy and cheap method suggested to prepare solid state materials like nickel,coblalt ,iron and zinc ferrite is precipitation method.By studying bioassay of s these materilas the zone of inhibition suggested that the compounds has antibacterial activity at room temperature and these materials can be used in biomedical applications.

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