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Decolonization of MB Dye ($C_{16}H_{18}ClN_3S$) under the Natural Light Using Pristine and Zn–Y Substituted $CoFe_2O_4$ as a Catalyst

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$Co_2Fe_2O_4$ NPs were made using the sol-gel ignition technique employing citric acid ($C_6H_8O_7.6H_2O$) as a reducing agent to oxidizing agent with a ratio of 1:3. A thorough study of the effects of divalent Zn^{2+} and trivalent Y^{3+} ion on their structural, Infra-red, morphological, magnetic, DC-electrical, optical, and photocatalytic activity. All of the samples have crystallized to a cubic spinel structure with a single phase space group Fd_{3m} according to the analysis of the XRD pattern consisting of the intense reflections (220), (311) (222), (400), (422), (511), (440), (533), and (444). Transmission electron microscopy (TEM) suggested the particle size range of ~27 nm; and demonstrates the agglomerations on the tip of MNPs, which are ideal for increasing surface area, and infrared study verifies the spinel structure. With a decrease in the hysteresis loop for the Zn–Y ligand, the magnetic hysteresis loops demonstrate a ferrimagnetic character. With Zn–Y, magnetic characteristics are noticeably affected; saturation magnetization (Ms) 70.9133 to 59.2148 emu/g; and coercivity (Hc) 1900.30 to 193.96 Oe both exhibit a decrease. The DC-electrical resistivity image reveals the CFMNPs' semiconducting nature and the optical energy bandgap demonstrates a decrease from their original state. The MB dye's decolorization demonstrates the amazing deterioration in a short amount of time 20 to 80 minutes range was observed to be 35.88, 61.92, 76.40, and 94.07 %.

Introduction

Many scholars are currently interested in the structural, morphological, optical, magnetic, electrical, dielectric, etc. properties of ferrite nanoparticles due to their numerous uses. Ferrites have a wide variety of uses in the fields of magnetic storage media, flame retardancy, sensors, catalysts, highly efficient photocatalysts, and electromagnetic wave absorbers in the MHz range.[1] Due to its special characteristics, including high coercivity, saturation magnetization, high chemical stability, and high cubic magneto-crystalline anisotropy, the cobalt ferrite occupies a particular position in the study compared to all other spinel-structured ferrites.[2] The physical characteristics of cobalt ferrite (CF) are essential in terms of applications, and the desired characteristics can be readily controlled by substituting a dopant element. Due to the Fe^{3+} ions' nearly identical or larger ionic radius, there are two different kinds of rare-earth ions. Researchers agree that rare-earth ions are happy prospects to improve application-oriented properties of ferrite NPs, according to recent trending papers.[3] The typical chemical formula for spinel ferrite (SFNP) is: $(A)^{[2+]}[B]_2^{[3+]}O_4$; where (A) stands for other divalent metallic cations (such as Co^{2+}, Zn^{2+}, Ni^{2+}, and Mn^{2+}) and [B] stands for trivalent cations.[4] One of the crucial requirements for NPs to function as photocatalytic materials is that they have excellent anions and cations binding capacities.[5] In the medical sciences, such as cancer therapy,[6] fluorescent imaging,[7] bio-tagging,[8] sensor,[9] photosensor,[10] numerous transducers,[11] and photocatalytic applications pure and mixed metal oxides play a significant part.[12] The most popular uses for ferrite materials among scientists and academics are for wastewater purification and photocatalytic applications, both of which are used in industry.[13] Because industrial effluent from the textile industry makes up the majority of it, toxic organic pollutants play a significant part in the pollution of the planet. Hazardous substances like organic pollutants, antibiotics, and dyes like methylene blue, Evance blue, Congo red, RhB, Direct blue 129 dye, Methyl orange, and Azo dye are all present in the effluent from the textile industry.[14] Out of the entire amount of pigments produced worldwide, 50% are azo dyes. This has an impact on marine life, sea plants, human life, and other creatures that regularly come into touch with the sea, river, or big natural stream of water flowing in a channel to the sea, lake, or another such stream.[15] Dye products used in the

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Structural Investigation of Li^+ doped Cobalt ferrite Nanoparticles

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ABSTRACT

Now a day spinel ferrite nonmaterial's are studied more due to their widespread applications in the electronics industry and energy storage devices. The Li^+ doped Cobalt ferrites with the general formula $Co_{1+x}Li_xFe_{2-x}O_4$ (x =0.0, 0.1, 0.2, 0.3, 0.4) were prepared using wet chemical method i.e. sol-gel auto combustion method. Structural characterization of the samples was carried out using X-ray powder diffraction technique. The XRD confirmed the cubic phase of $Co_{1+x}Li_xFe_{2-x}O_4$ ferrite with the crystallite size. The crystallite size and other structural parameters such as lattice constant, volume of a cubic unit cell, X-ray density, and porosity of the samples are calculated. The lattice parameter of the sample was found to be increases with increasing Li^+ content (x). The porosity is increased with increasing Li^+ content as evident from XRD. Crystallite size is calculated by using Debye Scherrer method. The sol–gel auto-combustion method was used for synthesize substituted Cobalt spinel ferrite. This is a novel method as it is combination of the chemical sol–gel process and the combustion process. The present work was to synthesize Li^+ doped Cobalt ferrite using citrate assisted sol-gel auto combustion and to understand

Keywords :X-ray diffraction, spinel ferrite, Nanoparticles, Sol-gel auto combustion, Bulk density, Porosity

I. INTRODUCTION

The cubic spinel structured cobalt ferrite nanoparticles have been the subject of current interest because of their applications in electric devices and telecommunication which often differs from their bulk counterpart [1]. The properties such as high saturation magnetization, high coercivity, strong anisotropy as well as chemical stability are not observed in the bulk sample. Spinel ferrite has general formula $(A^{2+})[B_2^{3+}]O_4^{2-}$ where A^{2+} and B^{3+} are the divalent and trivalent cations occupying tetrahedral (A) and octahedral [B] sites[2]. Ferrite has Face-centered cubic structure and cations and oxygen anions formulation. When divalent cation occupies both tetrahedral as well as octahedral sites, inverse spinal is formed [3]. Similarly, a mixed structure can also be formed when divalent cations is distributed in both sites. The $CoFe_2O_4$ is a partially inverse spinel with Co^{2+} ions, occupy the octahedral [B] site and Fe^{3+} ions occupy both tetrahedral (A) site and octahedral [B] site [4]. Substituted cobalt ferrites are widely used as magnetic materials due to their low dielectric losses. Large number of researchers have been carried out work on the structural, morphological, magnetic, electrical, dielectric, optical etc. properties of spinel cobalt ferrites with a view to improve these properties for the desired

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Curie Temperatureand Initial Permeability Studies of Nickel–Copper Spinel Ferrite

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ABSTRACT: Polycrystalline soft spinel ferrite samples having the chemical formula $Ni_{1-x}Cu_xFe_2O_4$ with varying **x** (x = 0.0, 0.2, 0.4, 0.6, 0.8, 1.0) were prepared by standard ceramic technique. The formation of single phase cubic spinel structure of all the samples was characterized by X-ray diffraction technique. X-ray diffractograms did not show any impurity phases. The values of lattice constant increases as Copper (Cu^{2+}) percentage increases. The initial permeability μ_i was measured by measuring inductance (L) using LCR-Q meter. It is found that $\mu_i$increases with Cu substitution .Curie temperature measured through permeability versus temperature plot.

Keywords: Ferrite, Initial Permeability, Curie Temperature.

I. INTRODUCTION

The magnetic oxides, namely ferrites, having the formula MFe_2O_4 have been investigated extensively by many workers because of their interesting combined property of magnetic conductor and electrical insulator. They are of great importance to the technologists and academicians owing to their remarkable electrical and magnetic properties. The high electrical resistivity, low eddy current and dielectric loss, high saturation magnetization, chemical stability etc. are the important aspects of ferrite material which make them useful in many applications. These aspects are highly sensitive to the preparation methodology [1], amount of constituent metal oxide [2], sintering condition [3] etc. Usually, ferrites are prepared by ceramic technique. It is well-known that the properties of ferrite materials are influenced by the material composition and microstructure. The sintering temperature, sintering time, sintering atmosphere etc. also plays an important role in governing the properties of ferrites [4].

Spinel ferrites are important in several applications, hence studies of structural, electrical, magnetic and other properties of spinel ferrites is very essential [5-6]. The interest in these materials is sustained till date because of their applications in the field of drug delivery, multilayer chips, magnetic recording, sensors, catalysts, etc. The substitution of divalent, trivalent and tetravalent ions in spinel ferrites leads to diversification in various properties. The properties of spinel ferrites can be modified by substituting the various kinds of cations. In the literature, many reports are available on the structural, electrical and magnetic properties of Zn, Cd, Al, Cr, Ti,Mn substituted spinel ferrites [7-8].

In the present work, the properties of Nickel ferrites were modified by substituting Cu^{2+} ion in place of Ni^{2+} ions with a view to improve the permeability properties. We report the structural and initial permeability studies of $Ni_{1-x}Cu_xFe_2O_4$with x = 0.0, 0.2, 0.4, 0.6, 0.8, 1.0.

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Synthesis, Characterization and Biological Evaluation of Schiff's bases containing Indazole Moiety

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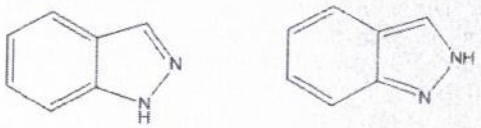
ABSTRACT

Indazole containing derivatives represent one of the most important heterocycles in pharmaceuticals. Substituted indazole derivatives bear a variety of functional groups and display versatile biological activities. A series of new Indazolyl derivatives have been prepared from commercially available N-substituted-3-indazole carboxylic acid and methanol with sulphuric acid. Synthesis of these compounds proceeds through the formation of 1-ethyl-1H-indazole -3-carboxylate, by acidic esterification, then conveted in to 1-ethyl-1H-indazole -3-hydrazide using hyrdazine hydrate in ethanol at reflux temperature. Then 1-ethyl-1H-indazole-3-hydrazide was condensed with different substituted benazadehydes using catalytic amount of conc. sulphuric acid in ethanol. Some of the synthesized derivatives were then evaluated for antibacterial activity against different bacterial strains which shows good Antibacterial activities.

Keywords: Indazole derivative, anti-bacterial, Esterification, Hydrazine

INTRODUCTION

The nitrogen-containing heterocycles are important building blocks for many bioactive natural products and commercially available drugs. As pharmacologically important derivatives, they have attracted considerable attention from chemists [1]. Indazoles are one of the most important classes of nitrogen-containing heterocyclic compounds bearing a bicyclic ring structure made up of a pyrazole ring and a benzene ring. Indazole usually contains two tautomeric forms, 1H-indazole and 2H-indazole (Figure 1).



1H-indazole 2H-indazole

Figure 1: Indazoles.

Since 1H-indazole is more thermodynamically stable than 2H-indazole, it is the predominant tautomer [2].

Indazole derivatives scracely occur in nature, but this particular nucleus in a variety of synthetic compounds possesses a wide range of pharmacological activities, such as anti-inflammatory, antiarrhythmic, antitumor, antifungal, antibacterial, and anti-HIV activities [3-8].

Diversely substituted indazole-containing compounds furnished with different functional groups represent significant pharmacological activities and serve as structural moiety in drug molecules. For example, niraparib has been widely used as an anticancer drug for the treatment of recurrent epithelial ovarian, fallopian tube or primary peritoneal, breast and prostate cancer [9]. Pazopanib is a tyrosine kinase inhibitor, which has been

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Efficacy of augmentative release of *Bracon hebetor* say (Hymenoptera: Braconidae) for biological control of *Earias vittella* (Fabricius) (Lepidoptera: Noctuidae)

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Abstract
Bracon hebetor say is important biocontrol agent of the larval stage of many pests of economic importance. Present study was carried out to evaluate the efficacy of *B. hebetor* as a biological control agent against okra fruit and shoot borer, *Earias vittella*. Efficacy of augmentative release of *B. hebetor* as biological control of *E. vittella* in field was evaluated during the period from February to June 2021. Total number of parasitized larvae of *E. vittella* by *B. hebetor* were recorded at 1, 5, 10 and 15 days after release (DAR). A 74.8 % maximum field parasitization percentage of *B. hebetor* to *E. vittella* larvae was recorded at 5 Days after release (DAR) followed by 10 DAR and 15 DAR. The study revealed that, *B. hebetor* parasitizes about74.8% under field conditions. The augmentative release was effective and larval mortality was increased.

Keywords: Augmentative release, biological control, *Bracon hebetor*, *Earias vittella*, okra. Parasitization, *Corcyra cephalonica*, Polyphagous, Ectoparasitoid

Introduction

The spotted bollworm, *Earias insulana* (*Boisduval*) and *Earias vittella* (*Fabricius*) (Lepidoptrra: Noctuidae) are serious a polyphagous insect pest of many economic crops widely distributed in North Africa, India Pakistan and other countries of the world. (A. J. Memon et al., 2004) feeding on a Malvaceous plant it lays eggs individually on leaves, floral buds and on tender fruits. Small brown caterpillars bore in to the top shoots and feeds inside the shoot before fruit formation. The infested fruits become unfit for consumption.

Okra crop is severely infested by fruit borer losses quality and quantity of the crops fruit (Bohmfalk et al., 2001). Many pests cause 69% yield reduction including leaf roller, jassid, fruit and shoot borer, also larvae of spotterd bollworm. Yield losses up to 49 to 74 % at Bangalore, Karnataka (Krishnaiah, 1980) 15 % at Ludhiana, Punjab (Brar et al., 1994), 31.81% at Coochbehar, West Bengal (Ghosh et al., 1999. It was estimated about 69 % loss in marketable yield due to attack of this insect on okra (Rawat and Sahua, 1973). The parasitoids are important natural enemies of crop pests. *Bracon hebetor* say (Hymenoptera: Braconidae) is a cosmopolitan, gregarious larval ectoparasitoid that attacks the larval stage of several lepidopteron species. (Brower et.al) *Bracon hebetor* female first paralyse their host in a "Wandering phase" by injecting paralytic venom and ovipositing variable number of eggs on the surface of paralyzed host larva. (Mukti and Thomas 2010). King et al., (1985) reported that field release of braconid parasitoid, *Chelonus blackbburni* Cameron at 50,000 adult's ha^{-1} gave promising control of *E. vittella*. With least fruit infestation of 11.64% Mani et al., (2005) reported the natural incidence of B. hebetor B. greeni and Trichogramma spp. In okra fields. Efficacy of braconids on okra fruit borers is very scare G. Thanavendan and S. Jiyarani (2009). So the present study aimed to evaluate efficacy of augmentative field release of *B.hebetor* to control E. *vittella*.in farmer fields.

Materials and methods

1. Collection and rearing of *Bracon hebetor*

Initial culture of *Bracon hebetor* was obtained from the National Institute of plant health management Rajendranagar (NIPHM). The *B. hebetor* was reared on *Corcyra cephalonica* larvae to increase the population of adults for experiment in the laboratory at 27°C temperature and 60% relative humidity. 50% honey solution was given as a food for adult *Bracon hebetor*.

2. Experiment

The Present study was conducted in Okra field of Malichinchora village Newasa Ahmednagar District Maharashtra during the period February to June 2021 for the eco-friendly management of Okra shoot and fruit borer through biocontrol agents. The crop was raised as per agronomic practices without chemical control. Adult *Bracon hebetor* were kept in a test tubes of 25 mm x150 mm size and carried out from the laboratory to the fields. Open mouth of the test tube containing adult *Bracon* was closed with cotton plug. Adult *B. hebetor* released at the rate of around 50 adults per m^2 (M: F = 20:30) field was divided in to four plots (150 m^2) and ridges (1 m) were made in each plot. Treatment was applied at seven days interval up to crop maturity. The *Bracon* treated plot was covered by fine mosquito net supported by bamboo sticks to protect the drift flying effects at least for 24 hrs. We found 2- 4 *E. vittella larvae* per plant. Sampling was done weekly, in each plot by placing a 0.5m.x 0.5m wooden quadrant on the ground at 10 m. interval. The Okra plant in each quadrant were checked for the number of all live and parasitized *Earias vittella* larvae from the top, middle and bottom of okra plants.

Results and discussion

In Okra field, parasitism of the *E. vitella* by *B. hebetor* was first observed at experimental plots 24 hours after release of parasitoid. Mean density of the pest larvae (live & parasitoid) in plot no. 1 was 0.8, 3.2, 3.6 and 2.2 larvae 1st, 5th, 10th and 15th day respectively. While in plot no.2 was

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"INFLUENCE OF HOST DIET ON BIOLOGICAL PARAMETERS OF *BRACON HEBETOR* SAY (HYMENOPTERA: BRACONIDE)"

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Abstract : *Bracon hebetor say* is a gregarious cosmopolitan polyphagous, ectoparasitoid lepidopteron larvae of stored products and field crop pests. Parasitoid prefers a particular host species. However, preference of host by parasitoid depends on the diet of the host. The biological parameters of parasitoid are affected by host diet. The present work designed to evaluate the influence of different host diet on egg hatching percentage, oviposition, developmental duration of various immature stages and longevity of adult male and female of *Bracon hebetor*. *Bracon hebetor reared* on the larvae of *Helicoverpa armigera* fed with different host plants viz tomato, chickpea, pigeon pea, soya bean, Brinjal, cowpea and artificial diet. *Bracon hebetor* proved best on the larvae of *Helicoverpa armigera* reared on chickpea. *Bracon hebetor* parasitoid can be used as biocontrolling agent of *Helicoverpa armigera* under field conditions.

Keywords: *Bracon hebetor, Helicoverpa armigera,* life stages, lepidopteron host, ectoparasitoid, Host diet, biological, parameter, biocontrolling agent.

INTRODUCTION

Helicoverpa armigera is a polyphagous pest and major economic threat which causes severe yield losses on wide variety of agricultural crops cotton, chickpea, corn, tomato, Brinjal, sorghum, soya bean, groundnut worldwide. *Helicoverpa armigera* larvae are voracious foliar feeders as early instar and late instar larvae attack developing fruits and seeds results into yield loss. In India damage caused by *Helicoverpa armigera* resulting into 69% yield loss. (G. Thanavendan and S. Jeyarani 2009) It feeds on over 300 species from 68 plant families around the world, including major crops such as cotton, soya bean, maize, pigeon pea, chickpea marigold and wide range of horizontal crops (pearce et al., 2017). Resistance to many pesticides have been detected over the last few years (Smagghe et al. 1999). Applying insecticides with different modes of action from different classes has not been