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Structural, mechanical, thermal, optical and antifungal properties of pure and nickel doped ninhydrin non liner single crystals

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A conventional method was adopted to prepare pure ninhydrin (NH) and nickel doped ninhydrin (N1NH) single crystals. The present investigation focused on various properties of as grown NH and N1NH crystals. Monoclinic crystal structure with $P2_1$ space group which is attractive phenomena were noticed in structural mode of grown NH and N1NH crystals. Various vibrations of functional groups related to NH and nickel doped N1NH crystals were assigned from Fourier-transform infrared peaks of good resolution. Energy-dispersive X-ray spectrum presents the percentage of carbon, oxygen and nickel occurs in the sample. The strength of the samples have deliberated with the help of Vicker's microhardness tester. The decomposition point of both NH and N1NH crystals has been measured by thermal analysis. The dielectric constant of both NH and N1NH crystals was also determined. Green emission which denotes second harmonic generation (SHG) process for the samples generally confirms the nonlinear optical (NLO) activity of the NH and N1NH crystals and it has been tested successfully based on the technique of Kurtz-Perry. The SHG efficiency values of NH and N1NH samples are comparable with KDP which has been used as reference sample as it is being used commercially. Basically, NH and N1NH crystal samples were used for many medical applications. Therefore, the antifungal activity was also focused for investigation against two famous fungi like *Aspergillus niger*, *Aspergillus flavus*.

Keywords: Single crystals, Structural properties, Optical properties, Thermal analysis, Vicker's hardness, Dielectric studies, Antifungal activity

1 Introduction

Generally the material whose light intensity is very high in non linear media and produce laser light will be utile in optical switching, optical computing, high-speed optical modulators, high-density optical storage and ultra-fast optical switches applications¹⁻³. Those materials will be transparent in optical regions and their phase matching should be interactive to withstand in laser damaging⁴. The above said features are almost fulfilled by organic materials so most of them are used in device fabrication of nonlinear optical (NLO) materials⁵. Ninhydrin is an important starting material in the organic synthesis of heterocyclic compound. Ninhydrin reacts with amino acids and it produce purple violet colour it can be used in the field of chromatogram, food industry, microbiology, protein science and forensic science⁶⁻⁹. Most of the organic crystals have high

nonlinear efficiency but poor thermal and mechanical properties and which may be enlighten by doping proper inorganic metals.

Nickel nitrate is an inorganic crystalline salt which is taken as the dopant material. From the literature reports, it has been concluded that pure ninhydrin^{6,7}, 1 mole% copper nitrate and 1 mole% cadmium nitrate doped ninhydrin⁸, 0.2 mole% copper chloride doped ninhydrin⁹ and 1 mole% zinc nitrate doped ninhydrin crystals¹⁰ having good linear and NLO property. To the best of our knowledge, no literature was found in 1 mole% nickel doped ninhydrin crystals. Hence, in this point of view, nickel nitrate was doped with pure ninhydrin sample to enhance the mechanical and thermal behaviors along with that structural analysis have been done to observe different parameters. Efficiency of the samples in generating second harmonic mode was also measured for further NLO applications along with determination of antifungal activities.

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