



Synthesis, Growth And Characterization Of L-Aspartic Acid Doped With Potassium Dihydrogen Phosphate Of Single Crystal.

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Abstract:

In this study we present the growth and characterization of L-aspartic acid doped potassium dihydrogen phosphate single crystal a novel composite material with potential application in non-linear optics and bio photonics. The single crystal were grown using the solution growth method with controlled doping of L-aspartic acid into the potassium dihydrogen phosphate KDP matrix. The growth process well defined single crystal with uniform doping concentrations. X-Ray diffraction (XRD) analysis was confirmed the crystalline nature and crystallographic orientation of the single crystal. The obtained XRD patterns exhibited characteristic peaks corresponding to both KDP and L-Aspartic acid indicates successful of dopant into the crystal. The optical properties of

single were investigated using UV-Visible spectroscopy, revealing changes in the optical absorption and transmissions spectra compared to pure KDP crystals. FTIR analysis states that pure functional groups are present in the crystal

Keywords: Potassium Dihydrogen Phosphate, L-Aspartic Acid and Slow evaporation.

1.Introduction:

Nonlinear optical compounds have recently attracted attention due to the their potential applications in optical data storage, optical memory storage frequency conversion ,optoelectronics, light modulation,signal conversion, optical second harmonic generation,optical switching, and photonics[1-4]. The numerous application of nonlinear optical

crystals in the vast field of science and technology made the process of search of the new NLO crystal and improvement in the properties of the known crystal a never stopping process. KDP crystals is widely used and thoroughly studied NLO crystal. Many researches have tried to modify the properties and growth rate of the KDP crystal by either changing the growth conditions. The NLO and other properties of the crystal have been improved by doping. In the present investigation the L-Aspartic acid was added in the KDP and it observed. The L-Aspartic acid doped KDP crystal were grown by Slow evaporation technique and subjected to X-Ray diffraction ,FTIR spectroscopy, UV-visible spectral analysis .

2.Materials and Methods

2.1 Materials. Both chemicals KDP and Potassium Dihydrogen Phosphate were obtained from the high AR grade. Double distilled water was used throughout the experiment. Whatman no.1 filter papers were used for filtration. And NaOH solution were purchased from Hema Lab. All glassware used after washed well. Stirring machine is used.

2.2 Synthesis

The Slow evaporation method was used to grow the crystal. Dissolve the desired amount of KDP in distilled water to form a saturated solution. This solution will serve as the growth medium for the crystals. Prepare a separate solution L-aspartic acid in distilled water. The concentration of L-aspartic acid will depend on the desired doping level and

start stirring. Mix the saturated KDP solution the L-aspartic acid solution in the desired ratio. This will introduce L-aspartic acid molecules into the KDP crystal lattice during crystal growth. Allow the solution gently to cool and evaporate under the room temperature to promote the crystal growth. A gradual cooling process can help in obtaining larger and more uniform crystals Optionally seed crystals can be added to facilitate nucleation and promote the growth of larger crystals.

To grow the crystal L-Aspartic acid doped with KH_2PO_4 single crystal (14.71g) was completely dissolved in 50ml of distilled water. Then L-aspartic acid (1.85g) was added to the potassium dihydrogen phosphate solution, and solution is stirred for 9 hours to attain a transparent solution Finally, the combined solution was filtered with Whatman No.1 filter paper in order to obtain the purified solution from unwanted foreign particles. The filtered solution was kept in a beaker for a slow evaporation process and crystal were harvested after 15 days.

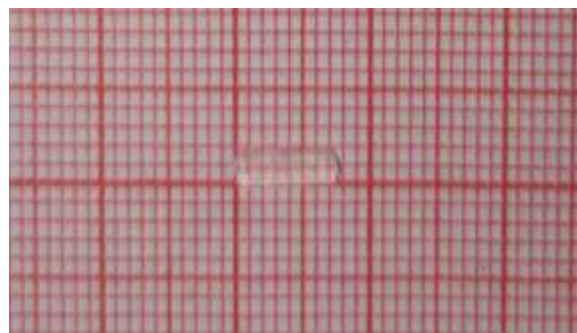


FIG:1 PHOTOGRAPHY OF L-ASPARATIC ACID DOPED KDP GROWN CRYSTAL

3.RESULT AND DISCUSSION

3.1 XRD Analysis: The good optical crystal was powdered finely and powdered X-ray diffraction characterization using the Druker Germany D8 Advanced power X-ray diffractometer. The intensity data were recorded by continuous scan in 2θ made from 10° to 60° . The recorded X-ray pattern shown in figure : 4.2. The good Crystalline nature was confirmed from the single sharp peak. The crystal of tiny was subjected to single crystal x- ray diffraction analysis. Using the Druker instrument the cell lattice and space group were found. The powder X-Ray diffraction pattern of pure L-Aspartic acid doped KDP crystals with strong peaks

SAMPLE	$\alpha = \beta = \gamma$	STRUCTURE
L-Aspartic acid doped with Potassium dihydrogen phosphate	$a = b \neq c$ $\alpha = \beta = 90^\circ$ $\gamma = 120^\circ$	Hexagonal

Table.1. Single crystal X-Ray diffraction

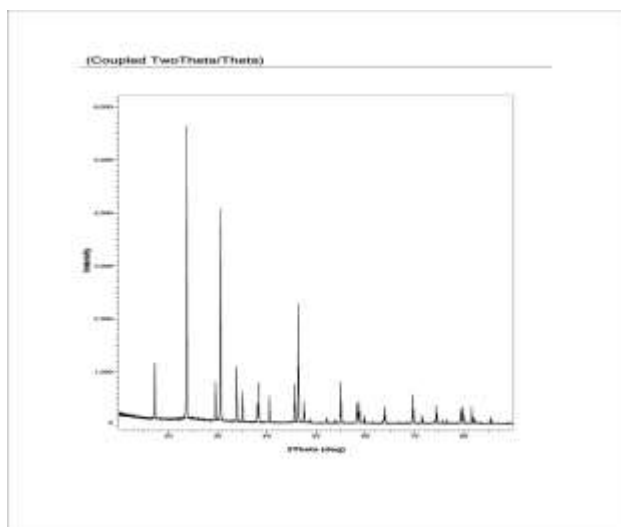


Fig.2.XRD spectrum of L-Aspartic acid doped with KDP

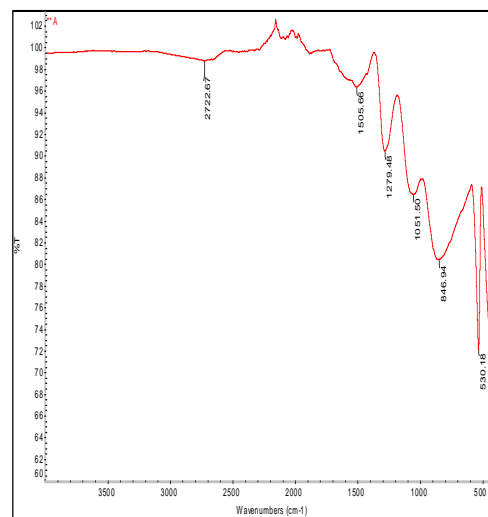


Fig.3.FTIR spectrum of KDP doped with L-aspartic acid

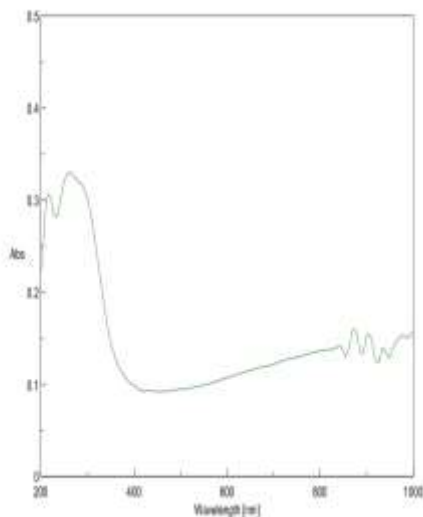
3.2 FTIR ANALYSIS

The FTIR analysis of L-aspartic acid doped with KDP crystal was carried out between the range of wave number $3500-500\text{cm}^{-1}$ using KBr pellet. The resulting spectrum is shown in fig 4.3. The intense sharp peaks in this band is a 2722.67cm^{-1} may be assigned to OH stretching vibration. The peak in this band is 1505.66cm^{-1} assigned as C=C stretching vibration. The peak in this band is a

1279.48cm⁻¹ assigned as C-OH stretching vibration. The peak in this band is 1051.50cm⁻¹ assigned as OH stretching. The peak at 846.94cm⁻¹ assigned C-H stretching. the peak at 530.89cm⁻¹ assigned as Cu-O stretching.

Table: 2 FTIR analysis data of L-Aspartic acid doped with KDP

Wave Number(cm ⁻¹)	Bond Assignments
2722.67	O-H stretching
1505.66	C=C stretching
1279.48	C-OH bending
1051.50	C-OH stretching
846.94	C-H bending
530.89	Cu-O stretching



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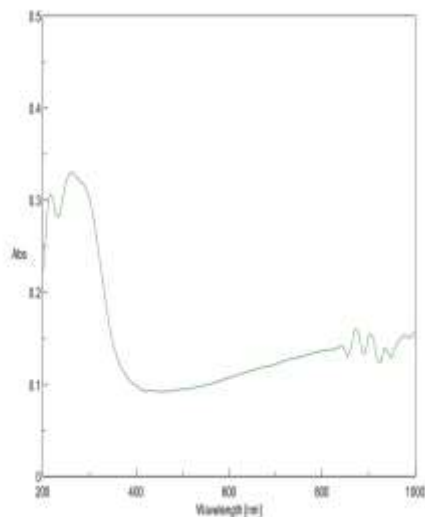


Fig:4 UV-VISIBLE data analysis of L-Aspartic acid doped with KDP

3.3 UV-VIS-NIR SPECTROMETER

The UV-Visible spectral study is useful tool to determine the transparency which is important requirement for a material optically active. The optically transmission of the spectrum of crystal was recorded in the range of 200-1000nm. Using UV-VIS-NIR spectrometer. As the crystal crystal is colourless, its transmission is very high. This is the most desirable property of the crystals used for NLO application. A large Absorption was founded in 340nm in the crystal has very low absorption in entire visible region. The entire visible region. The spectrum reveals that cut off wavelength of grown crystal 340nm has wide range transparency in the entire visible region. The optimized for the suitability of opto-electronic application. The optical transmittance of crystal is from 1000-200nm there is 100 percentage transmittance of light

4. Conclusion

Growth and characterization of L-Aspartic acid doped with potassium dihydrogen phosphate has been successfully synthesised and single crystal have been grown by slow evaporation solution techniques. The main aim of the thesis is to grow bulk crystals of L-Aspartic acid doped with potassium dihydrogen phosphate. The crystalline nature of the grown crystals was confirmed X-ray diffraction techniques. Unit cell parameters have been evaluated by powder XRD techniques. The crystal X-Ray diffraction data prove that this belongs to HEXAGONAL system. In powder X-Ray diffraction data some additionally peaks were observed in L-Aspartic acid doped with Potassium dihydrogen phosphate. Fourier Transform Infrared Spectroscopy (FTIR) analysis confirmed the presence of function groups in the grown crystal. The linear optical property studies confirmed the transmittance of the grown crystal by using the UV-VIS Spectrophotometer an analytical instrument.

References

1. H.M. Muncheryan Lasers and Opto-electronic Devices (1991) P. Jagadish and NP Rajesh: 'Effect of L-proline on the growth and NLO properties of KDP crystal', *J. Optoelectron. Adv. Mater.* 2011, **13**, (8), 962-966.

[Web of Science @Google Scholar](#)

2. Hussani SS and Dhumane NR: 'Growth and Characterization of Glycine Doped KDP Single Crystal for Optoelectronics

Applications', *Optoelectron. Adv. Mater.*, 2007, 1, (12), 707–711.

[Web of Science @Google Scholar](#)

3. J. Podder: 'The study of impurities effect on the growth and nucleation kinetics of potassium dihydrogen phosphate', *J. Cryst. Growth*, 2002, **237**, 70–75.

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[Web of Science @Google Scholar](#)

4. I. Pritula, A. Kosinova, M. Kolybayeva, V. Puzikov, S. Bondarenko, V. Tkachenko and O. Fesenko: 'Optical, structural and microhardness properties of KDP crystals grown from urea-doped solutions', *Mater. Res. Bull.*, 2008, **43**, (10), 2778–2789.10.1016/j.materresbull.2007.10.040

○ [View](#)

[Web of Science @Google Scholar](#)

5. P. R. Modiya and C. N. Patel: 'Synthesis and screening of antibacterial and antifungal activity of 5-chloro-1, 3-benzoxazol-2 (3 h)-one derivatives', *Org. Med. Chem. Lett.*, 2012, 2, (1), 1–10.

○ [View](#)

[PubMedGoogle Scholar](#)

6. A. Javed, A. Kamboj, V. K. Sharma Guohui Li *et al.*, [Youping He](#), J. Cryst. Growth(2005)

P.V. Dhanaraj *et al.* *J. Cryst. Growth*(2008), R. Rajasekaran *et al.*, *crystalGrowth*(2001)