International Journal of Scientific Research in Physics and Applied Sciences
Vol.8, Issue.3, pp.54-59, June (2020)
DOI: https://doi.org/10.26438/ijsrpas/v8i3.5459

Research Paper

E-ISSN: 2348-3423

Growth and Characterization Studies of an Organic Nonlinear Optical Crystal - Oxalic Acid Dihydrate

A. Gandhimathi[1*], R.T. Karunakaran[2], A. Elakkina kumaran[3], S. Prabahar[4], R. Sathyalakshmi[5]

[1]Research and Development Centre, Bharathiar University, Coimbatore-641 046, Tamilnadu, India
[2,4]Dept. of Physics, Government Arts College, Udumalpet-642 126, Tamilnadu, India
[3]Dept. of Physics with Computer Applications, LRG Government Arts College for Women, Tiruppur-641 604, Tamilnadu, India
[5]Dept. of Physics, Chikkaiah Naicker College, Erode-638 004, Tamilnadu, India

**Corresponding Author: mathiepsix@gmail.com, Tel.:+91 9843188313*

Available online at: www.isroset.org

Received: 26/May/2020, Accepted: 05/June/2020, Online: 30/June/2020

Abstract— An organic nonlinear optical (NLO) material, oxalic acid dihydrate (OAD) was grown by slow evaporation technique of solution growth method using the solvent tetrahydrofuran at constant temperature (35 °C). Single crystal X-ray diffraction (XRD) was utilized to determine the lattice parameters of the grown crystal and the crystalline nature was examined by powder XRD. The existence of various functional groups was observed by Fourier transform infrared (FT-IR) analysis. From Ultra violet-visible (UV-vis) study, the lower cut-off wavelength was indicated as 237 nm. The dielectric and photoconductivity analyses were also performed for the developed OAD crystal. The improved Kurtz and Perry powder technique was employed to find the second harmonic generation efficiency (SHG) of the crystal. The characterization results obtained throws light on the grown OAD crystal and conveys that is a good material to be utilized in the field of non-linear optics and applications.

Keywords—NLO organic crystal, OAD, XRD, SHG, Dielectric, Photoconductivity.

I. INTRODUCTION

Nonlinear optical materials proficiently reveal nonlinear optical phenomena, which are modification of light wavelength, amplification of light and conversion of the refractive index based on optical intensity. NLO crystals have high conversion efficiencies for second harmonic generation and that they are transparent in the visible and ultraviolet range which contributes them for fabricating various devices within the field of optoelectronics and photonics [1, 2]. Hence, Organic NLO materials are to be explored and extensively studied. The superiority of organic materials is that they will be modified and tuned with respect to their chemical structure and properties of materials based on our requirement i.e. they have large structural diversity [3]. Oxalic acid is a toxic organic compound belonging to the family of dicarboxylic acids and is also effective and viable compound for studies in the field of photonics in which two carboxyl clusters are combined instantly [4]. In 1953, Ahmed and Cruickshank first studied the crystal structure of oxalic acid dihydrate [5]. Further different authors have carried out research on the charge density of OAD [6-8]. L. Torgesen and J. Strassburger took up the work on the growth of oxalic acid and single crystals using various solvents and the solvent reactions on crystal nature have been reported [9]. Tetrahydrofuran (C_4H_8O) is an organic solvent; it can dissolve a wide variety of organic compounds and has a reasonable low boiling point. The low boiling point of a solvent is appropriate one as it could be removed easily by evaporation. From this incitement, this research work was undertaken to grow oxalic acid dihydrate ($C_2H_6O_6$) crystal using the solvent tetrahydrofuran from slow evaporation technique of solution growth method and the grown crystal has been placed to different experimental techniques like XRD studies, FTIR spectroscopy, UV-vis spectroscopy, dielectric study, photoconductivity analysis and powder SHG test.

Section I contain the introduction of the NLO materials, Oxalic acid dihydrate single crystal and the solvent tetrahydrofuran. Section II consist the related work of the OAD crystal, Section III involves the materials and methods, Section IV describes the result and discussion and section V explain the conclusion and future scopes.

II. RELATED WORK

The mechanism of thermal dehydration of monocrystalline oxalic acid dihydrate was studied under polarizing microscope in constant and linearly elevated temperatures by thermogravimetry [10]. Effects of water on crystallization in terahertz spectra: anhydrous oxalic acid and its dihydrate were presented [11]. X-ray analysis of hydrogen bonding within the structure of oxalic acid dihydrate [12] was explained and the gamma irradiation

effects on the characteristics of potassium hydrogen oxalate oxalic acid dihydrate were studied optically [13]. Growth of oxalic acid single crystal and its different properties [14], pure and tryptophan doped oxalic acid crystal for antimicrobial activity [15] and Glycine oxalic acid for SHG efficiency [16] were also reported.

III. MATERIAL AND METHODS

Commercially available oxalic acid dihydrate was dissolved by tetrahydrofuran and the mixture was stirred well for about one hour by a magnetic stirrer. The saturated solution of OAD was filtered through a Whatmann (No 42 grade) filter paper into a clean dry beaker, to get rid of the suspended impurities. The filtrate was kept at a constant temperature water bath for crystal growth and the temperature of the bath was kept at 35 °C. Owing to slow evaporation of the solution, high quality optical single crystals of oxalic acid dihydrate were harvested within 15-20 days time. The snapshot of grown OAD crystal is displayed in figure 1.

IV. RESULTS AND DISCUSSION

Single crystal X-ray diffraction analysis

A Bruker AXS X-ray diffractometer was used for single crystal XRD analysis to describe the unit cell parameters of the as grown OAD crystal. The identified cell parameters are a=6.108 Å, b=3.610 Å, c=11.849 Å, V=254.3 $Å^3$ and β=103.29°. This determines that the OAD single crystal befits to monoclinic system along with a space group of $P2_1/n$.

Powder X-ray diffraction analysis

The powder XRD pattern of OAD crystal was performed by JEOL-JDX 8030 X-ray diffractometer along Nickel filtered CuKα (λ=1.5405 Å) radiation. The sample was scanned for 2θ values from the range 10-90° at a scan rate of 2° per minute. The diffraction pattern recorded for the grown crystal is shown below in figure 2. The sharp and well-defined Bragg's peaks affirm the crystallinity of the grown sample. The prominent peak has been obtained at 2θ values of 12.127° and the XRD record consists of several low intensity lines also.

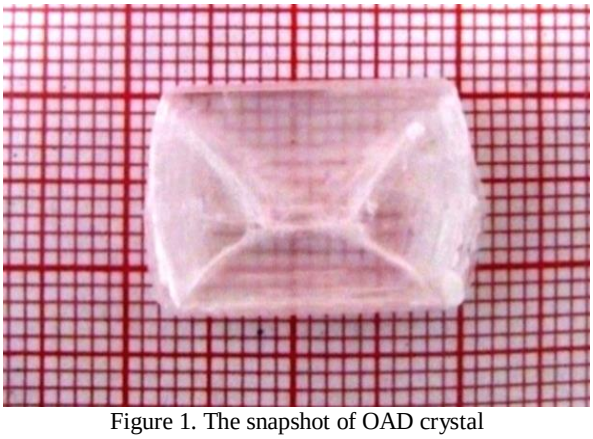


Figure 1. The snapshot of OAD crystal

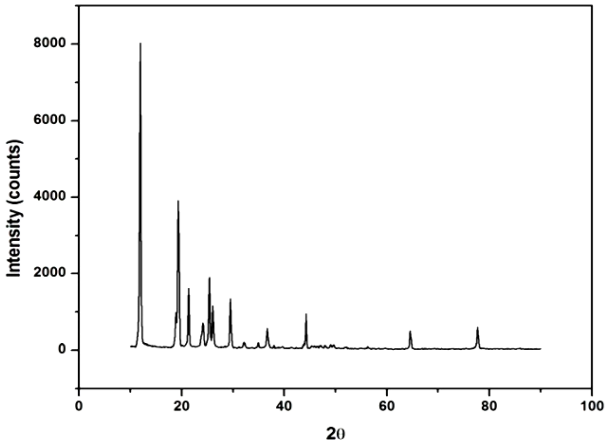


Figure 2. Powder XRD pattern of OAD crystal

UV- visible spectroscopy

Optical absorption spectrum conveys inexorable detail regarding the structure of the molecules by reason of the absorption in the UV and visible light includes stimulation of electrons in an orbit from the ground state to the excited energy state [17]. During UV spectral analysis the optical transmittance window, the transparency and the lower cutoff wavelength is pre-eminent for the realization of SHG output within the range using diode laser. The electronic absorption spectrum of the OAD crystal was recorded by employing a Perkin-Elmer Lambda 35 spectrometer in the wavelength region from 200 to 1100 nm. The Electronic absorption spectrum indicates the change in that the percentage of absorption in the defined wavelength range and this spectrum obtained for the sample under study is shown in figure 3 and it displays the fact that OAD crystal is optically transparent (around 90%) in the entire visible region. These kinds of high transparent materials are suitable for optoelectronic applications [18, 19]. The lower cut-off wavelength of grown OAD single crystal was found to be 237 nm.

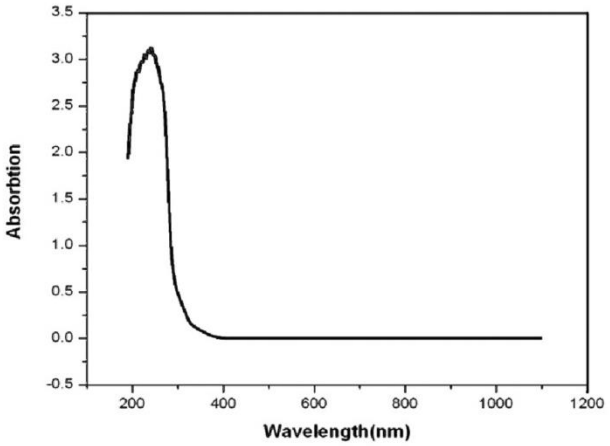


Figure 3. Electronic absorption spectrum of OAD crystal

FT-IR spectral analysis

The FTIR spectrum brings particulars about the molecular structure of the compound, modes of vibration and the presence of functional groups. The analysis has employed Thermo Nicolet V-200 FT-IR spectrometer by KBr pellet

method within the wave number range of 450 to 4500 cm^{-1}. The recorded FT-IR spectrum of OAD sample is presented in figure 4. From the observations the presence of following specific groups were corroborated. The strong OH band is 3476 cm^{-1} attributed to fundamental stretching vibrations of –OH groups. The C=O stretching mode vibration is obtained at 1690 cm^{-1}. The absorptions at 1255 cm^{-1} is assigned for C-OH vibration and also the peak at 720 cm^{-1} is assigned for O-H out of plane bending. These values are strongly suited with the previous reported values [20].

Dielectric study

The dielectric properties are related to the electro-optic property of materials. The dielectric study was preformed for the grown crystal with 3532-50 Hioki LCR meter in the frequency range from 50 Hz to 5 MHz at various temperatures (273 K, 283 K, 293 K, 303 K, 313 K, 323 K and 333K). The opposite faces of the crystal were coated with an electronic grade silver paste for good electrical contact betwixt the crystal and the electrodes. A silver pasted crystal was kept in between copper plates and the measurement was taken. Dielectric constant of the material has been calculated using the formula given below.

$$\varepsilon_r = \frac{Cd}{\varepsilon_o A}$$

Where, 'C' is the capacitance of the crystal, 'd' denotes the thickness of the crystal, 'A' indicates the area of the crystal and 'ε_o' denotes the permittivity of free space (8.85×10^{-12} Farad/m). Figure 5 depicts the variation of the dielectric constant with applied frequency for the sample at different temperatures. At a particular applied frequency, it is found that the dielectric constant increases with temperature. Further the dielectric constant is very high at low frequencies and have become stable at high frequencies as it leads to the space charge polarization. Figure 6 indicates the dielectric loss increases in low frequencies and decreases at high frequencies. When the temperature increases, dielectric loss also rises. Low value of dielectric loss retains the sample in enhanced optical quality with low defects [21, 22].

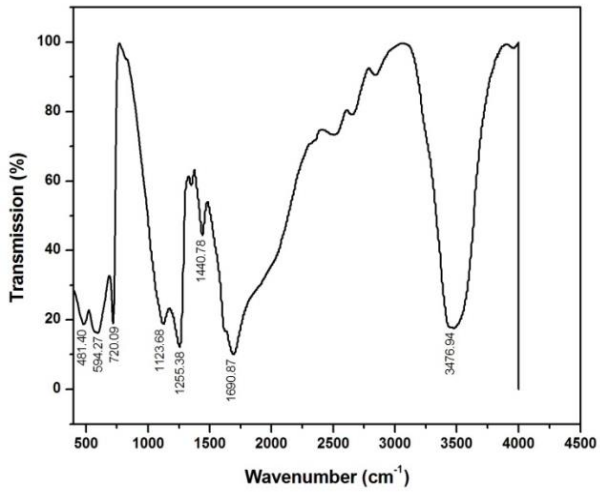


Figure 4. FT-IR spectrum of OAD crystal

Photoconductivity analysis

Photoconductivity is an optical occurrence in which a material becomes more conductive because of the absorption of electromagnetic radiation like visible light, UV light or gamma radiation. Photoconductivity study was carried out utilizing a Keithley electrometer (Model 6517B) at different temperature along with applied input voltage from 1 V to 10 V. Polished crystals were selected and thin copper wire was connected on both the sides of the sample with the assistance of silver paste. 100 W halogen lamp consisting iodine vapour and tungston filament has been used as a radiation source for the photoconductivity analysis. The variations in conductivity of sample in the presence of light as well as in the absence of light (dark current) were recorded. Photocurrent and dark current measurements were performed as a function of applied electric field. The figure 7 conveys the variation of the photocurrent and dark current with the applied input voltage. Current is directly proportional to the applied input voltage; it is obvious that the dark current is greater than photocurrent. It is concluded that OAD single crystal reveals that the negative photoconductivity nature on the basis of the reduction of charge carriers in the presence of radiation [23].

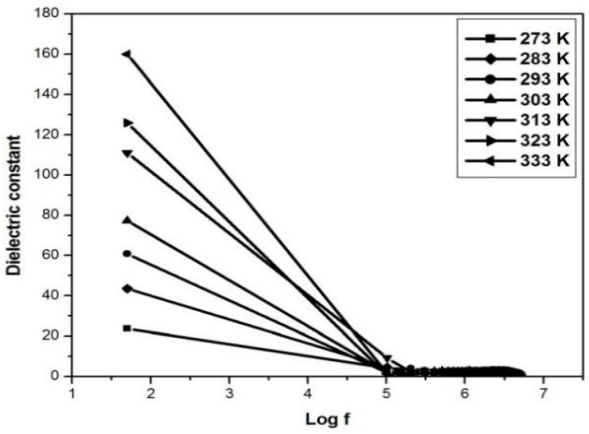


Figure 5. Dielectric constant Vs log frequency at various temperatures for OAD crystal

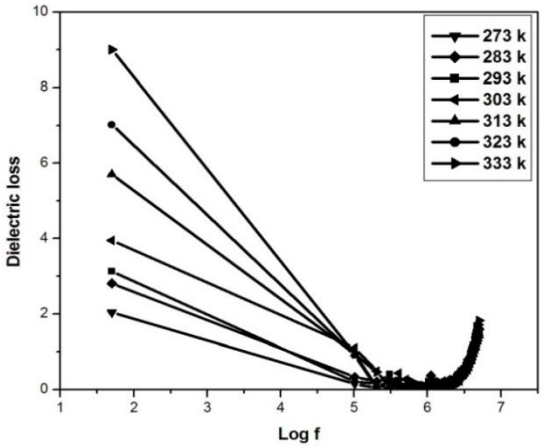


Figure 6. Dielectric loss Vs log frequency at various temperatures for OAD crystal

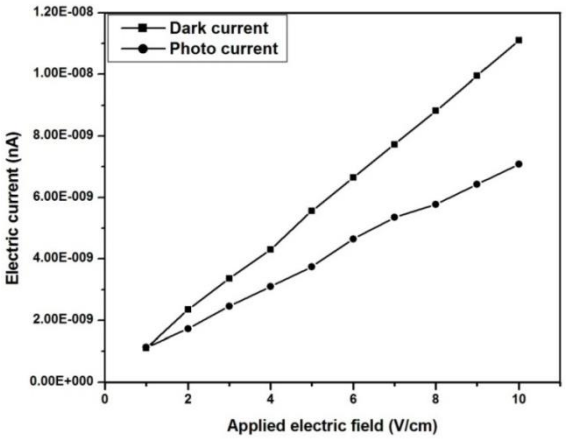


Figure 7. Variation of photocurrent and dark current with applied field

Powder SHG measurement

The basic and broadly adopted technique to affirm the SHG from second order NLO materials is that the Kurtz and Perry powder technique. The powder SHG test for the grown OAD single crystal was performed by using modified Kurtz and Perry powder SHG method [24]. The SHG efficiency of the crystal was calculated by Q-switched Nd: YAG laser with the input wavelength of 1064 nm. The laser input pulse of 3.2 mJ was directed towards the sample and the SHG nature is affirmed by the green light emission. The output signal of 19 mV was obtained for OAD single crystal under study. The KDP was used as the reference material and the SHG efficiency of OAD single crystal is found to be 1.8 times higher than that of KDP.

The SHG efficiencies of certain reported oxalic acid mixed crystals along with UV cutoff wavelength are compared with OAD and specified in table 1. It is noticed that OAD crystal exhibits high SHG efficiency when compared to the other mixed organic crystals and OAD crystal in the present study is relatively a promising NLO material for nonlinear optical applications.

Table 1. Optical property of oxalate crystals

Crystal	UV cut off wavelength (nm)	SHG efficiency
L – Arginine semi – oxalate [25]	-	0.32
L – Citrulline oxalate [26]	311	0.40
Glycinium oxalate [27]	305	0.87
Lithium hydrogen oxalate monohydrate [28]	-	0.91
L – Alaninium oxalate [29]	250	1.20
γ – Glycine ammonium oxalate [30]	-	1.48
Oxalic acid dihydrate [Present work]	237	1.80

V. CONCLUSION AND FUTURE SCOPE

Optically good characteristic oxalic acid dihydrate single crystals were effectively grown by slow evaporation solution growth technique using the solvent tetrahydrofuran at a constant temperature (35 °C). The cell parameter values are determined by single crystal XRD and the powder XRD analysis authenticates the crystalline nature of the grown crystal. The high transparency of the crystal is leads itself as an apt material for optoelectronic applications. FT-IR analysis substantiates the modes of vibration of the molecular groups present in the crystal. From the dielectric study, dielectric constant is very high at low frequency and increases with rise in temperature. The grown crystal reveals the negative photoconductivity nature and the second harmonic generation efficiency is 1.8 times greater than that of KDP. The good transparency, low dielectric constant and low dielectric loss with high nonlinearity have corroborated the OAD crystal as a promising material for the fabrication of SHG and optoelectronic devices.

REFERENCES

[1] M. Lenin, G. Bhavannarayana, P. Ramasamy, "Synthesis, growth and characterization of a nonlinear optical crystal-glycine lithium chloride", *Optics Communications*, Vol.**282**, Issue.**6**, pp.**1202-1206**, **2009**. Doi: 10.1016/j.optcom.2008.08.048.

[2] J. Thomas Joseph Prakash, S. Kumararaman, "Growth and characterization L-asparagine thiourea monohydrate (LATM): A nonlinear optical single crystal", *Materials Letters*, Vol.**62**, Issue.**24**, pp.**4003–4005**, **2008.** Doi: 10.1016/j.matlet.2008.05.055.

[3] A. Wooster, "Experimental crystal growth", Plenum press, **New York**, **1957**.

[4] R. Manimekalai, R. Punniyamoorthy, S. Chidambaram and G. Pasupathi, "Crystal growth and impact a bisthiourea on structural, optical, thermal and mechanical behavior of potassium sulphato oxalate- a novel semi organic nonlinear optical material", *International Journal of Scientific Research in Physics and Applied Sciences*, Vol.**6**, Issue.**5**, pp.**41-47**, **2018**.

[5] F.R. Ahmed, D.W.J. Cruickshank, "A refinement of the crystal structure analyses of oxalic acid dihydrate", *Acta Crystallographica*, Vol.**6**, Issue.**5**, pp.**385-392**, **1953.** Doi: 10.1107/S0365110X53001083.

[6] P. Coopens, T.M. Sabine, R.G. Deleplane, J.A. Ibers, "An experimental determination of the asphericity of the atomic charge distribution in oxalic acid dihydrate", *Acta Crystallographica Section B*, Vol.**B25**, pp.**2451-2458**, **1969**. Doi: 10.1107/S0567740869005929.

[7] E.D. Stevens, P. Coopens, "Experimental electron density distributions of hydrogen bonds. High - resolution study of α – oxalic acid dihydrate at 100K", *Acta Crystallographica Section B*, Vol.**36**, pp.**1864-1876, 1980**. Doi: 10.1107/S0567740880007388.

[8] J. Dam, S. Harkema, D. Feil, "The electron density of α – oxalic acid dihydrate at 100K by X-ray diffraction: A contribution to the IUCr commission on charge, spin and momentum densities project on the accurate determination of electron densities", *Acta Crystallographica Section B*, Vol.**39**, pp.**760-768, 1983**. Doi: 10.1107/S0108768183003377.

[9] L. John Torgesen, John Strassburger, "Growth of oxalic acid single crystals from solution: Solvent effects on crystal habit", *Science*, New Series, Vol.**146**, pp.**53-55**, **1964**. Doi: 10.1126/science.146.3640.53.

[10] Haruhiko Tanaka, Kazuhiro Kawabata, "Thermal dehydration mechanism of oxalic acid dihydrate ii. Single crystal material",

Thermochima Acta, Vol.**92**, pp.**219-222**, **1985**. Doi: 10.1016/0040-6031(85)85856-1.

[11] M.D. King and T.M. Korter, "Effect of waters of crystallization on terahertz spectra: anhydrous oxalic acid and its dihydrate", *Journal of Physical Chemistry A*, Vol.**114**, Issue.**26**, pp.**7127-7138**, **2010**. Doi: 10.1021/jp101935n.

[12] G.E. Pringle, "X-ray analysis of hydrogen bonding in the structure of oxalic acid dihydrate", *Acta Crystallographica*, Vol.**7**, pp.**716-720**, **1954**. Doi: 10.1107/S0365110X54002186.

[13] K. Mahendra, Kavya K.Nayak, Brian Jeevan Fernandes, N.K. Udayashankar, "Gamma irradiation effect on structural, optical and electrical properties of organometallic potassium hydrogen oxalate oxalic acid dihydrate single crystal", *Journal of Materials Science: Materials in Electronics*, Vol.**29**, Issue.**22**, pp.**18905-18912**, **2018**. Doi: 10.1007/s10854-018-9888-0.

[14] A. Ponchitra, K. Balasubramanian, K. Muthu Sorna Meena, "Growth, structural, optical and mechanical properties of Oxalic acid single crystal", *International Journal of Science, Engineering and Management*, Vol.**2**, Issue.**12**, pp. **160-162, 2017**.

[15] C. Muthuselvi, A. Arunkumar, G. Rajaperumal, "Growth and characterization of oxalic acid doped with tryptophan crystal for antimicrobial activity", *Der Chemica Sinica*, Vol.**7**, Issue.**4**, pp. **55-62**, **2016.**

[16] Jyotsna R Pandey, "Growth and optical properties of organic GOA crystals", *American Journal of Engineering Research*, Vol.**3**, Issue.**3**, pp.**30-36**, **2014.**

[17] S. Senthilkumar, C. Ramachandra Raja, R. Manimekalai, "Growth and Characterization of Bio-semiorganic (Ficus religiosa Chlorophyll-a) Doped Potassium Dihydrogen orthophosphate (KDP) Crystal", *International Journal of Scientific Research in Physics and Applied Sciences*, Vol.7, Issue.**2**, pp.**31-37, 2019**. Doi:10.26438/ijsrpas/ v7i2.3137

[18] J. Chandrasekaran, P. Ilayabarathi, P. Maadeswaran, "Crystal growth and characterization of L-Valine cadmium aceate a semiorganic NLO crystals", *Optics Communications*, Vol.**285**, Issue.**18**, pp. **3872-3876**, **2012**. Doi: 10.1016/j.optcom.2012.05.009.

[19] J. Glorium Arul Raj, P. Selvarajan, S. Perumal, N. Murali Krishnan, "Investigations on growth and characterization of undoped and thiourea–doped γ-glycine crystals for NLO applications", *Materials and Manufacturing Processes*, Vol.**26**, Issue.**10**, pp. **1254-1260**, **2011**. Doi: 10.1080/10426914.2010.544823.

[20] Z. Nahlovska, B. Nahlovsky, T.G. Strand, "Molecular structure of gaseous oxalic acid from electron diffraction and IR data", *Acta Chemica Scandinavica*, Vol.**24**, pp. **2617-2628, 1970**. Doi: 10.3891/acta. chem. scand 24-2617.

[21] S. Arjunan, A. Bhaskaran, R. Mohan Kumar, R. Mohan, R. Jayavel, "Effect of iodic acid dopant on the growth and structural, optical, and electrical properties of L-arginine phosphate single crystals", *Materials and Manufacturing Processes*, Vol.**27**, Issue.**1**, pp. **49-52, 2012**. Doi: 10.1080/10426914.2011.551907.

[22] K. Rajarajan, Joseph Ginson, Kumar S Ravi, I. Vetha Potheher, A. Joseph Arul Pragasam, K. Ambujam, P. Sagayaraj, "Growth and optical studies of a novel organometallic complex NLO crystal: Tetrathiourea cadmium(II) Tetrathiocyanato zinc (II)", *Materials and Manufacturing Processes*, Vol.**22**, Issue.**3**, pp. **370-374**, **2007**. Doi: 10.1080/10426910701190857.

[23] K. Ambujam, C. Preema Thomas, S. Aruna, D. Prem Anand, P. Sagayaraj, "Study of optical, electrical, and magnetic properties of Tetrakis thiourea nickel chloride single crystals", *Materials and Manufacturing Processes*, Vol.**22**, Issue.**3**, pp.**346-350**, **2007**. Doi: 10.1080/10426910701190741.

[24] S.K. Kurtz, T.T. Perry, "A powder technique for the evaluation of nonlinear optical materials", *Journal of Applied Physics*, Vol.**19**, Issue.**8**, pp.**3798-3813**, **1968**. Doi: 10.1063/1.1656857.

[25] P. Vasudevan, S. Gokulraj, S. Sankar, "Synthesis, thermal and nonlinear optical characterization of L-arginine semi-oxalate single crystals", *AIP Conference Proceedings*, Vol.**1447**, pp.**1271-1272**, **2012**. Doi: 10.1063/1.4710475.

[26] V.G. Sreevalsa, S. Jayalekshmi, "Studies on the thermal, optical and dielectric properties of a new nonlinear optical crystal- L-citrulline oxalate grown by slow evaporation technique", *Transactions of the Indian Institute of Metals*, Vol.**64**, Issue.**1-2**, pp.**205-208, 2011.** Doi: 10.1007/s12666-011-0040-6.

[27] P. Mythili, T. Kanagasekaran, R. Gopalakrishnan, "Growth and characterization of glycinium oxalate (Gox) single crystals", *Materials Letters*, Vol.**62**, Issue.**14**, pp.**2185-2188**, **2008.** Doi: 10.1016/j.matlet.2007.11.092.

[28] S.A. Martin Britto Dhas, S. Natarajan, "Growth and characterization of lithium hydrogen oxalate monohydrate, a new semiorganic NLO material", *Materials Letters*, Vol.**62**, Issue.**6-7**, pp.**1136-1138, 2008**. Doi: 10.1016/j.matlet.2007.07.069.

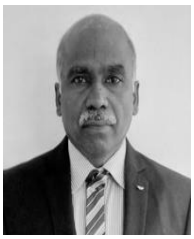
[29] S. Alfred devaprasad, J. Madhavan, "Synthesis, growth and characterization of L- alaninium oxalate a promising nonlinear optical single crystal", *Archives of Applied Science Research*, Vol.**2**, Issue.**4**, pp. **26-32, 2010**.

[30] M.N. Ravishankar, R. Chandramani, A.P. Gnanaprakash, "Optical and mechanical characterization of solution grown semi organic NLO crystals", *Rasayan Journal of Chemistry*, Vol.**4**, Issue.**1**, pp.**86-90, 2011**.

AUTHORS PROFILE

Mrs. A. Gandhimathi pursued B.Sc., (2003) from L.R.G. Govt. Arts College (affiliated to Bharathiar University), Tiruppur, M.Sc., (2005) from Kongunadu Arts and Science College (affiliated Bharathiar University), Coimbatore and M.Phil., (2009) from PRIST University, Thanjavur. Having 7 years of teaching experience at UG level and also 5 research publications in various journals**,** currently pursuing Ph.D., as a part time research Scholar in the field of crystal growth in Bharathiar University, Coimbatore, Tamilnadu, India.

Dr. R.T. Karunakaran studied B.Sc., Physics (1991) in St. Joseph's College (affiliated to Bharathidasan University), Trichy, M.Sc., Physics (1993) in AVVM Sri Pushpam College (affiliated to Bharathidasan University), Poondi. Pursued M.Phil., Physics (1999) at SRMV College of Arts and Science (affiliated to Bharathiar University), Coimbatore and awarded Ph.D., by Gandhigram Rural Institute (Deemed to be University), Gandhigram in 2009. He has put in 22 years of service in teaching and published more than 10 research articles and he has been serving as Assistant Professor of Physics in Government Arts College, Udumalpet since 2011. His research domain is Materials Science and Technology. He has guided two Ph.D., and two M.Phil., research Scholars and currently guiding four Ph.D., research Scholars.



Dr. A. Elakkina kumaran has done B.Sc., (1983) in Thiruvalluvar Govt. Arts College (affiliated to Periyar University), Rasipuram and M.Sc., (1986) in Annamalai University, Chidambaram. Pursued M.Phil., (1999) in Alagappa University, Karaikudi and completed Ph.D., (2014) as a part time research Scholar in Periyar University, Selam. With 12 years of service in teaching, currently he is working as Assistant Professor of Physics. He has published five research papers in international level and five papers in national level journals.

Dr. S. Prabahar pursued B.Sc., (2001) M.Sc., (2003) and M.Phil., (2005) in Kongunadu Arts and Science College (affiliated to Bharathiar University), Coimbatore. He has completed Ph.D., as a part time research Scholar in Anna University, Coimbatore in 2011. He is presently working as Assistant Professor of Physics and has put in 15 years teaching experience. He has published more than 25 research papers and guiding one Ph.D research scholar at present.

Dr. R. Sathyalakshmi did her B.Sc., (2002) at Sri Avinashilingam Deemed University, Coimbatore. Completed her M.Sc., (2004) in V.V. Vanniyaperumal College (affiliated to Madurai Kamaraj University), Virudhunagar and got her Ph.D degree from Crystal Growth Centre, Anna University, Chennai during 2010. She has been working as Assistant Professor of Physics since 2013 with a past experience of 3 years as Assistant Professor at SKCET, Coimbatore, Tamilnadu, India. Her work is in the field of Material Science and published 7 research papers in various international journals and also has guided one M.Phil., candidate.

