6. SUMMARY AND SUGGESTIONS FOR FUTURE WORK

6.1. Summary and Conclusions

Nonlinear optical (NLO) materials capable of efficient frequency conversion of infrared laser radiation to visible and ultraviolet wavelengths are given vital importance in view of their potential use in various applications in the modern era which includes telecommunication, optical computing, optical data storage and optical information processing. Methyl para hydroxybenzoate (p-MHB) is an organic nonlinear para substituted aromatic compound. Aiming at discovering new useful materials for academic and industrial uses, we have attempted to modify p-MHB by means of doping it separately with urea and thiourea in ten different impurity concentrations (0.2, 0.4, 0.6, 0.8, 1.0, 2.0, 4.0, 6.0, 8.0, 10.0 mole %) in each case.

Pure and impurity added p-MHB single crystals were grown by the free evaporation method from aqueous solutions. All the twenty one (including the pure one) crystals grown are stable, transparent and colourless. Lattice parameters were determined by making powder XRD measurements. Density was measured by the floatation technique. Results obtained indicate that the dopant molecules have entered into the p-MHB crystal matrix occupying interstitial positions.
The microhardness of selected seven crystals (pure p-MHB, 3 urea added and 3 thiourea added crystals) were estimated by using the Vicker’s method and it was found that the hardness of the crystals increase with the increase in impurity concentration in the case of both urea and thiourea.

The second harmonic generation property of the same seven crystals i.e. pure p-MHB, 3 urea added (0.2 mole %, 1.0 mole %, 10.0 mole %) and 3 thiourea added (0.2 mole %, 1.0 mole %, 10.0 mole %) crystals was found out by the Kurtz and Perry powder technique. It was found that the SHG value increases with the impurity concentration in the case of urea and decreases in the case of thiourea.

The electrical parameters (dielectric constant, dielectric loss, AC electrical conductivity and DC electrical conductivity) were measured for all the twenty one crystals for a fixed frequency of 1 kHz. The electrical parameters are found to increase with the increase in temperature for all the crystals but there is no systematic variation with temperature. The increase of dielectric constant with temperature has been understood as essentially due to the temperature variation of ionic polarizability. The increase of electrical conductivity (both AC and DC) with increase of temperature has been understood as essentially due to the temperature dependence of proton transport.
6.2. Suggestions for Future Work

The investigation considered in the present study was focused on the growth and characterization of single crystals. The effects of pH value on the growth conditions and morphology of the grown crystals can be investigated. Since the nucleation studies for these samples are not carried out, attempts can be made in future to investigate the nucleation parameters such as metastable zonewidth, induction period, interfacial tension, etc. to improve and investigate the optimized growth parameters for industrial crystallization. Attempts can be made to identify suitable dopants, which could provide better optical properties and thereby Nuclear Magnetic Resonance (NMR), Scanning Electron Microscopy (SEM) studies to visualize the structure and defect mechanisms. Etching studies can be made on different crystallographic faces of the crystals with suitable etchants in order to identify the dislocations.