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Short Communication

Vibrational Spectra of Transition Metal Doped Sodium Hydrogen Maleate Trihydrate Single Crystals

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Abstract

Transition metal ion doped sodium hydrogen maleate trihydrate single crystals were grown by slow evaporation method at room temperature. The vibrational spectra of the crystals were studied using Fourier Transform Infra-Red spectroscopy. FTIR studies were carried out to confirm the presence of functional groups associated with the crystals.

Keywords: Vibrational Spectra of Transition Metal Doped Sodium Hydrogen Maleate Trihydrate Single Crystals

Introduction

The crystal structure of sodium hydrogen maleate trihydrate (hereafter NHMT) crystal was studied by G. Olovsson et al[1]. FTIR studies of sodium hydrogen maleate trihydrate crystal were recently presented by B. Rajagopal et al[2].

Methodology

When a molecule absorbs or emits electromagnetic radiation, either a change in bond length (stretching) or bond angle (bending) is possible and can be recorded with the help of FTIR spectrophotometer. Slow evaporation method was used to obtain single crystals of copper, nickel and zinc ions doped with Trihydrated Sodium Hydrogen Maleate, at room temperature. The presence of functional groups in the samples under study was recorded using ATR mode Bruker Alpha spectrophotometer in the range 500 cm^{-1} to 4000 cm^{-1}.

Results and Discussion

FTIR Studies: The characteristic assignment of wave number of the FTIR spectrum of Cu^{2+}:NHMT, Zn^{2+}:NHMT and Ni^{2+}:NHMT crystals are presented in figure-1, figure-2 and figure-3 respectively. The assignments are in good agreement with that of the absorptions obtained in carboxylic compounds in the literature[2,3].

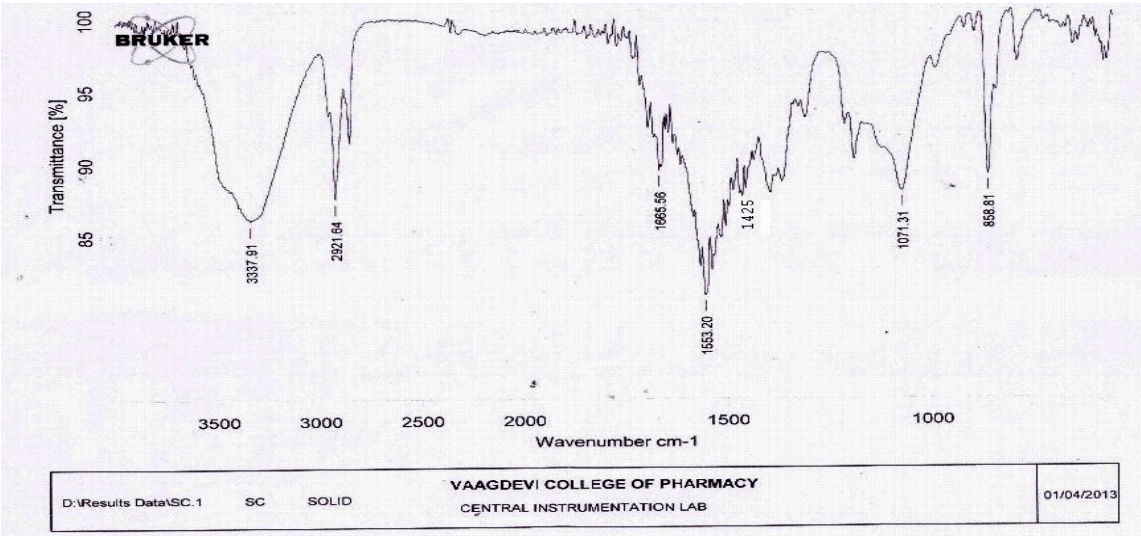

Figure-1
FTIR spectra of Cu^{2+}: Sodium Hydrogen Maleate trihydrate crystal

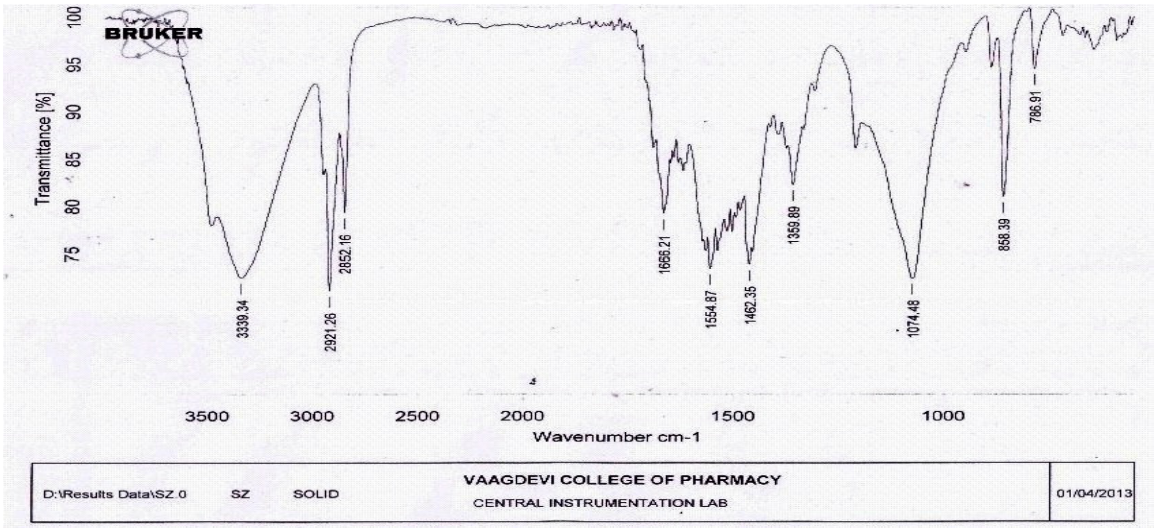

Figure-2
FTIR spectra of Zn^{2+}:Sodium hydrogen maleate trihydrate crystal

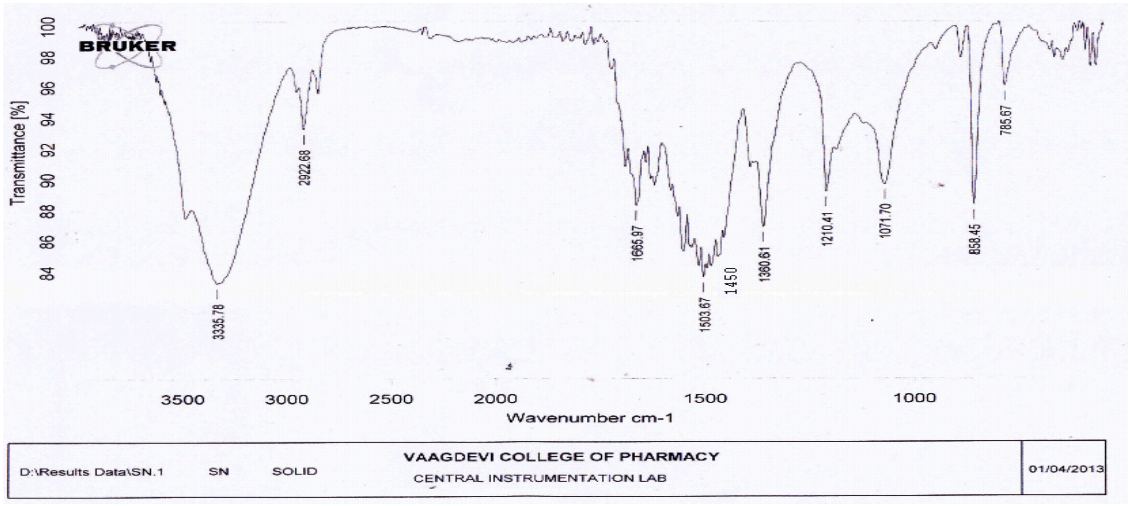

Figure-3
FTIR spectra of Ni^{2+}: Sodium hydrogen maleate trihydrate crystal

The O–H (hydroxyl) stretching appears at 3359 cm^{-1}in NHMT crystal while at 3337 cm^{-1} in Cu^{2+}:NHMT crystal, 3339 cm^{-1}in Zn^{2+}:NHMT crystal and 3335 cm^{-1}in Ni^{2+}:NHMT crystal.

The alkenyl (C-H) stretching is identified at 2927 cm^{-1}in NHMT crystal while at 2921 cm^{-1} in Cu^{2+}:NHMT crystal, 2921 cm^{-1}in Zn^{2+}:NHMT crystal and 2922 cm^{-1}in Ni^{2+}:NHMT crystal.

The band observed at 1658 cm^{-1} has been assigned to carbonyl C = O stretching in NHMT crystal while at 1665 cm^{-1} in Cu^{2+}:NHMT crystal, 1666 cm^{-1} in Zn^{2+}:NHMT crystal and 1665 cm^{-1} in Ni^{2+}:NHMT crystal.

The carboxylic asymmetric stretching is observed at 1548 cm^{-1} in NHMT crystal while at 1553 cm^{-1} in Cu^{2+}:NHMT crystal, 1554 cm^{-1}in Zn^{2+}:NHMT crystal and 1503 cm^{-1}in Ni^{2+}:NHMT crystal.

The carboxylic symmetric stretching is observed at 1399 cm^{-1} in NHMT crystal while at 1425 cm^{-1} in Cu^{2+}:NHMT crystal, 1462 cm^{-1}in Zn^{2+}:NHMT crystal and 1450 cm^{-1} in Ni^{2+}:NHMT crystal.

The stretching of C-O is assigned at 1072 cm^{-1} in NHMT crystal while at 1071 cm^{-1} in Cu^{2+}:NHMT crystal, 1074 cm^{-1}in Zn^{2+}:NHMT crystal and 1071 cm^{-1}in Ni^{2+}:NHMT crystal.

The bending is assigned at 858 cm^{-1} in NHMT crystal, Cu^{2+}:NHMT crystal, Zn^{2+}:NHMT crystal and Ni^{2+}:NHMT crystal samples under study.

Conclusion

Different modes of stretching were influenced by transition metal ion doped NHMT crystals under study.

Acknowledgements

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