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Infrared spectral analysis for barium ion bound guargum – *graft*- acrylamide

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Abstract
Guargum- graft- acrylamide (G – g – Am) is a water soluble polymer. It has good industrial use. G – g – Am binds Cu $^{2+}$ and Y^{3+} at different pH range. It also binds Ba^{2+} at high pH – IR spectra for barium ion bound G – g – Am (G – g – Am - Ba^{2+}) indicates involvement of – COOH groups and -OH groups of polymer in binding Ba^{2+}. According to Nakamoto's reference, bidentate bridging structure is expected for $-COO^-$ group from polymer in binding Ba^{2+}.

Keywords: Graft copolymer, barium ion, bidentate, Infrared spectra, polymeric precursor

1. Introduction
Guargum is a water soluble natural polymer [1]. Its structure is shown in fig.1. Guargum- graft- acrylamide (G – g – Am) is a modified natural polymer [2]. It is a good floculent for metallic ions [2]. It binds Y^{3+}, Ba^{2+} and Cu $^{2+}$ at different pH range [3]. Study on Cupric ion bound G – g – Am (G – g – Am – Cu $^{2+}$) and yttrium ion bound G – g – Am (G – g – Am – Y^{3+}) has been already reported [4]. In this present investigation most likely structure for barium ion bound G – g – Am (G – g – Am - Ba^{2+}) has been reported basing on IR spectral study.

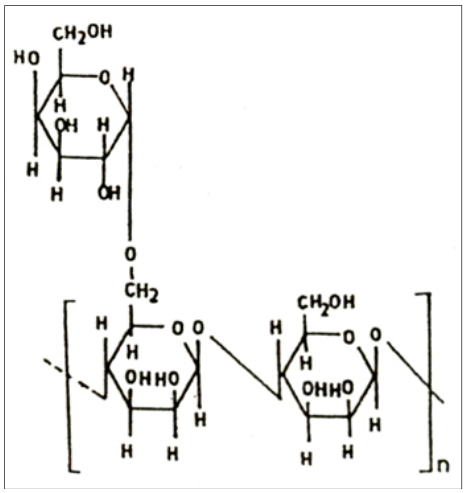


Fig 1

2. Materials and Methods
(i) Guargum- graft- acrylamide
Guargum- graft- acrylamide (G – g – Am) has been obtained from Rheological Laboratory of Materials Science Centre of I. I. T. Kharagpur, India. It has high molecular weight. ESCA study shows, it contains approximately 68 atom % C, 11 atom % N and 22 atom % O [5]. From thermal analysis it was possible to understand that grafting has taken place [6].

(ii) Barium ion bound G – g – Am
G-g-Am-Ba^{2+} has been prepared by dissolving G-g-Am in water and mixing barium nitrate solution. pH of the mixture has been raised by adding sodium hydroxide solution.

Precipitate like mass obtained is washed with water for some time and then with methanol for some time and dried in an oven for IR spectral study.

(iii) G-g-Am-Na^+

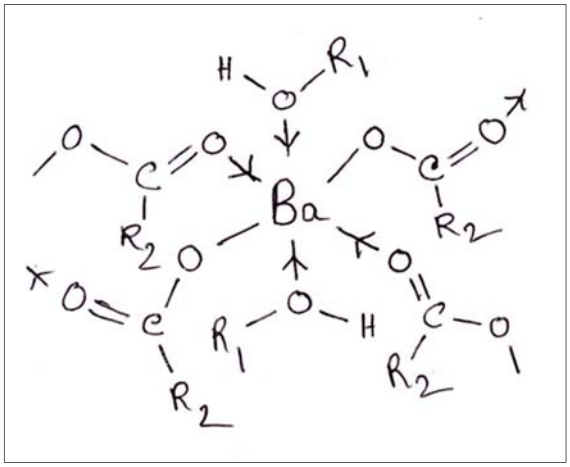
G-g-Am-Na^+ has been prepared by mixing aqueous solution of G-g-Am with queous solution of sodium hydroxide and the mixture is immediately poured into methanol for precipitation. Precipitate is washed with water for some time and dried in an oven for IR spectral study.

(iv) IR spectra

Perkin-Elmer model 883 spectroscope has been used in this present investigation. Spectral range covered from 4000 cm^{-1} to 200 cm^{-1}. KBr pellet technique has been used for IR spectral study.

3. Results and Discussion

IR spectra for G-g-Am-Na^+ and G-g-Am-Ba^{2+} are shown in fig. 2 & fig. 3 respectively. Peak near 3400 cm^{-1} in the IR spectra for G-g-Am-Na^+ and G-g-Am-Ba^{2+} can be attributed to stretching vibration of N-H of amide. Peak near about at 3000 cm^{-1} in the IR spectra for G-g-Am-Na^+ and G-g-Am-Ba^{2+} can be attributed to stretching vibration of –OH group (hydrogen bonded). Peak neat about at 2700 cm^{-1} in the IR spectra for G-g-Am-Ba^{2+} may be attributed to stretching vibration of –OH group bonded with Ba^{2+}. Peak positions at 1452 cm^{-1} and 1342 cm^{-1} in the IR spectra for G-g-Am-Na^+ can be attributed to $–COO^-$ asymmetric stretch and $–COO^-$ symmetric stretch respectively. Similarly, peak positions at 1575 cm^{-1} and 1445 cm^{-1} in the IR spectra for G-g-Am-Ba^{2+} can be attributed to $–COO^-$asymmetric stretch and $–COO^-$ symmetric stretch respectively. Difference between υ_{COO^-} asymmetric stretch and υ_{COO^-} symmetric stretch i.e. $\Delta\upsilon$ is higher for G-g-Am-Ba^{2+} than that for G-g-Am-Na^+. So according to Nakamoto's reference [7], probable mode of binding of $COO^-$to Ba^{2+} is bidentate bridging. So most likely structure for G-g-Am-Ba^{2+} is shown in Scheme-1



Scheme 1

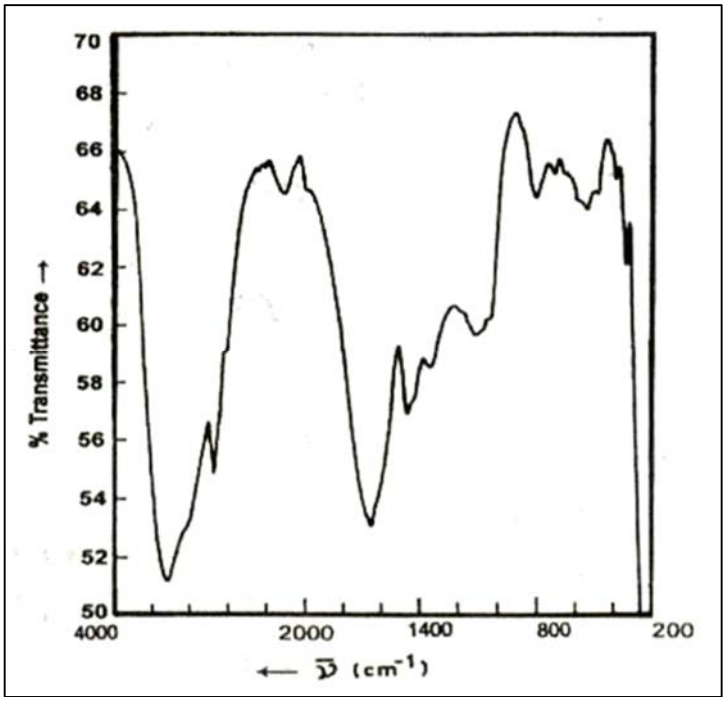


Fig 2

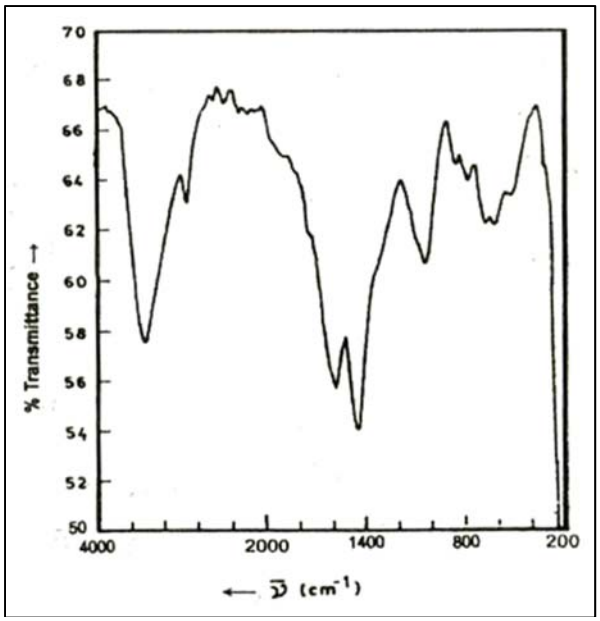


Fig 3

Conclusion

$Y_1Ba_2Cu_3O_{7-x}$ superconductor can be prepared by polymeric precursor technique [8]. Since G-g-Am can bind Y^{3+}, Ba^{2+} and Cu^{2+}, it may be used as a polymeric part. But from thermal analysis, it was possible to understand that G-g-Am-Y^{3+} has some explosive tendency [4]. Probable structure for G-g-Am-Cu^{2+} and for G-g-Am-Y^{3+} have been already reported [4]. Although in binding Y^{3+}, backbone of G-g-Am may have a role [9]. In this present investigation, it has been found that backbone of G-g-Am and $-COO^{-}$ of side chain of G-g-Am may have role in binding Ba^{2+}.

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