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Synthesis of organometallic complexes of cholic acid

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ABSTRACT

Cholic acid & metal ions both have antibacterial, antiviral, antifungal ,antimalarial , antitubercular, anticancer, spermicidal , antiallergic activity etc, therefore, their organometallic complexes were prepared to have synergistic effect. Cholic acid is one of the lead molecule for preparing organometallic complexes & their complexes were found to have more active pharmacological activity.

Key words: Cholic acid, Organometallic complexes.

INTRODUCTION

Cholic acid, a main bile acid, is a biosurfactant involved in the digestion of dietary lipids .It is commercially available at low cost. Futhermore , it has an unusual molecular structure with some special characteristics, such as the facial amphiphilicity. The carboxylic acid & three hydroxylic groups can act as synthesis handles. For these reasons cholic acid is a suitable building block for new functional molecules.

Cholic acid, a natural biodetergent has been reported to exhibited antibacterial[11-14], antiviral[5], antifungal[4], antimalarial[10] , antitubercular[10], anticancer[9], spermicidal[2, 3] , antiallergic [6,7,8]etc. Since cholic acid is a suitable building block for new molecules or in other words, it is a lead compound for the development of various compounds, therefore, it is thought worthwhile to select it for the above research work.

The antimicrobial activity of metal chelates was found to be in the order[1]:

$Cd^{II} > Ni^{II} > Mn^{II} > Cu^{II} > Zn^{II} > Co^{II} > Fe^{II}$

Cholic acid is one of the lead molecule for preparing organometallic complexes & their complexes were found to have more active antifungal activity because of synergistic effect of cholic acid as well as metal ions.

Method for preparation of Organometallic Complexes of Cholic Acid

The methanolic solution of cholic acid (AR grade) with methanolic solution of inorganic metallic salts were mixed with frequent stirring. If required , refluxed the above mixture on waterbath for an appropriate interval of time. Cooled it, filtered it under vacuum & washed it with water, alcohol & ether. Dried it completely & collected it for further analysis. First physical and then spectral

Compound code	Mol. formula	melting poi nt	solubility	colour	Rf value	λmax
CA	$C_{24}H_{40}O_5$	198 °C	DMF,DMSO	White	0.666a	207.2 (0.126)
ZA	$C_{48}H_{80}O_{10}Zn$	245 °C	DMF,DMSO	White	0.612a	212.8 (0.091)
CDN	$C_{48}H_{80}O_{10}Cd$	270 °C	DMF,DMSO	Off white	0.725a	207.2 (0.082)
NA	$C_{48}H_{80}O_{10}Ni$	258 °C	DMF,DMSO	Sea green	0.671a	202.4 (0.079)
CON	$C_{48}H_{80}O_{10}Co$	220 °C	DMF,DMSO	Light brown	0.617a	209.6 (0.110)
LA	$C_{48}H_{80}O_{10}Pb$	236 °C	DMF,DMSO	Off white	0.617a	206.4 (0.105)
CN	$C_{48}H_{80}O_{10}Ca$	262 °C	DMF,DMSO	White	0.724a	208.8 (0.084)
CCL	$C_{48}H_{80}O_{10}Co$	240 °C	DMF,DMSO	Light pink	0.612a	204.0 (0.058)
MA	$C_{48}H_{80}O_{10}Hg$	265 °C	DMF,DMSO	Grey	0.671a	217.6 (0.057)
MCL	$C_{48}H_{80}O_{10}Hg$	281 °C	DMF,DMSO	Off white	0.677a	223.0 (0.058)
AN	$C_{24}H_{40}O_5Ag$	283 °C	DMF,DMSO	Dark brown	0.692a	204.8 (0.055)
BN	$C_{72}H_{120}O_{15}Bi$	260 °C	DMF,DMSO	Off white	0.725a	218.0 (0.051)
BSN	$C_{72}H_{120}O_{15}Bi$	260 °C	DMF,DMSO	Off white	0.724a	202.0 (0.138)
CUA	$C_{48}H_{80}O_{10}Cu$	240 °C	DMF,DMSO	Persian blue	0.800a	208.8 (0.095)
CUS	$C_{48}H_{80}O_{10}Cu$	300 °C	DMF,DMSO	Light blue	0.700a	204.0 (0.097)

IR spectras were taken on JASCO 100 IR spectrophotometer

Compound Code	Peaks(cm^{-1})	Inference
BSN-I	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3248.65,3066.73 present	Bonded OH(s) of COOH present
	1243.91 present	C-O(s) of alcoholic O-H present
	1187.70-1097.43 present	C-O(s) of O-H deformation of alcoholic O-H present Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1097.43 present	Free OH (b) present
	1371.18, 1325.33 present	Carboxylate anion(s) asymmetric present
	1646.08, 1611.87,1551.21present	Carboxylate anion(s) symmetric present
	1403.37 present	
CN-II	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3248.65,3066.73 present	Bonded OH(s) of COOH present
	1243.91 present	C-O(s) of alcoholic O-H present
	1187.70 present	C-O(s) of O-H deformation of alcoholic O-H present Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1097.43 present	Free OH (b) present
	1325.33 present	Carboxylate anion(s) asymmetric present
	1611.87,1551.21 present	Carboxylate anion(s) symmetric present
	1403.37 present	
ZA-III	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent

	3650-3590 present	O-H (s) of free alcohol present
		3251. 36,3066.35 present1243.88 present1175.22 present1096.68 present1325.34 present
		Bonded OH(s) of COOH presentC-O(s) of alcoholic O-H presentC-O(s) of O-H deformation of alcoholic O-H presentSec., alicyclic 5 or 6-membered C-O of alcohol of free OH presentFree OH (b) present
	1646.08 present	Carboxylate anion(s) asymmetric present
	1399.07 present	Carboxylate anion(s) symmetric present
	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3247.23,3180.81,3065.93 present	Bonded OH(s) of COOH present
	1243.35 present	C-O(s) of alcoholic O-H present
	1187.60,1012.88 present	C-O(s) of O-H deformation of alcoholic O-H present
MCL-IV		Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1097.01 present	Free OH (b) present
	1399.07,1369.58,1324.34 present	Carboxylate anion(s) asymmetric present
	1646.08, present	Carboxylate anion(s) symmetric present
	1369.58 present	
NA-V	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590,3414.40 present	O-H (s) of free alcohol present
	3248.40,3065.40 present	Bonded OH(s) of COOH present
	1240.55 present	C-O(s) of alcoholic O-H present
	1174.19 present	C-O(s) of O-H deformation of alcoholic O-H present
	1096.90 present	Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1321.65 present	Free OH (b) present
	1679.26,1614.18,1546.54 present	Carboxylate anion(s) asymmetric present
	1402.82 present	Carboxylate anion(s) symmetric present
MA VI	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3251.36,3065.35 present	Bonded OH(s) of COOH present
	1243.88 present	C-O(s) of alcoholic O-H present
	1175.22,1013.25 present	C-O(s) of O-H deformation of alcoholic O-H present Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1096.68 present	Free OH (b) present
	1399.07, 1325.34 present	Carboxylate anion(s) asymmetric present
	1646.08, present	Carboxylate anion(s) symmetric present
	1399.07 present	
CCL-VII	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3248.98,3189.03,3066.61present	Bonded OH(s) of COOH present
	1243.81 present	C-O(s) of alcoholic O-H present
	1187.67,1013.29 present	C-O(s) of O-H deformation of alcoholic O-H present

		Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1097.34 present	Free OH (b) present
	1371.34, 1325.21 present	Carboxylate anion(s) asymmetric present
	1644.94,1692.26 present	Carboxylate anion(s) symmetric present
	1403.09present	
AN-VIII	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3248.40,3065.40 present	Bonded OH(s) of COOH present
	1240.55 present	C-O(s) of alcoholic O-H present
	1174.19 present	C-O(s) of O-H deformation of alcoholic O-H present
		Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1096.90 present	Free OH (b) present
	1321.65 present	Carboxylate anion(s) asymmetric present
	1614.18,1546.54 present	Carboxylate anion(s) symmetric present
	1402.82 present	
LA-IX	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3249.49,3066.88 present	Bonded OH(s) of COOH present
	1243.64 present	C-O(s) of alcoholic O-H present
	1187.16 present	C-O(s) of O-H deformation of alcoholic O-H present
	1097.31present	Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1371.26,1325.14 present	Free OH (b) present
	1612.90,1550.89 present	Carboxylate anion(s) asymmetric present
	1403.00 present	Carboxylate anion(s) symmetric present
CON-X	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3248.53,3066.14 present	Bonded OH(s) of COOH present
	1243.74 present	C-O(s) of alcoholic O-H present
	1187.72,1124.04 present	C-O(s) of O-H deformation of alcoholic O-H present
		Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1097.30 present	Free OH (b) present
	1369.58,1325.11 present	Carboxylate anion(s) asymmetric present
	1609.21,1551.01 present	Carboxylate anion(s) symmetric present
	1403.11 present	
BN-XI	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3249.49, 3066.88 present	Bonded OH(s) of COOH present
	1243.64 present	C-O(s) of alcoholic O-H present
	1187.16 present	C-O(s) of O-H deformation of alcoholic O-H present
		Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present

	1097.31 present	Free OH (b) present
	1371.26 present	Carboxylate anion(s) asymmetric present
	1609.92,1548.77 present	Carboxylate anion(s) symmetric present
	1402.50 present	
CDN-XII	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol
	3262.95,3192.79,3070.23 present	Bonded OH(s) of COOH present
	1244.59 present	C-O(s) of alcoholic O-H present
	1179.37 present	C-O(s) of O-H deformation of alcoholic O-H present
	1095.76 present	Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1402.50, 1328.04 present	Free OH (b) present
	1609.92,1548.77 present	Carboxylate anion(s) asymmetric present
	1402.50 present	Carboxylate anion(s) symmetric present
CUA-XIII	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3248.65,3066.73 present	Bonded OH(s) of COOH present
	1243.91 present	C-O(s) of alcoholic O-H present
	1187.70 present	C-O(s) of O-H deformation of alcoholic O-H present Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1097.43present	Free OH (b) present
	1325.33 present	Carboxylate anion(s) asymmetric present
	1611.87,1551.21 present	Carboxylate anion(s) symmetric present
	1403.37 present	
CUS-XIV	3000-2500 absent	O-H(s) of COOH absent
	1725-1700 absent	C=O(s) of COOH absent
	3650-3590 present	O-H (s) of free alcohol present
	3262.95,3192.79,3070.23 present	Bonded OH(s) of COOH present
	1244.59 present	C-O(s) of alcoholic O-H present
	1179.37 present	C-O(s) of O-H deformation of alcoholic O-H present Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1095.76 present	Free OH (b) present
	1328.04 present	Carboxylate anion(s) asymmetric present
	1646.05,1609.92,1548.77 present	Carboxylate anion(s) symmetric present
	1402.50 present	
CA	2930.6,2591.3 present	O-H(s) of COOH present
	1641.3 present	C=O(s) of COOH present
	3677.8,3653.9,3449.4present	O-H (s) of free alcohol present
	3248.40,3065.40 absent	Bonded OH(s) of COOH absent
	1294.7 present	C-O(s) of alcoholic O-H present
	1154.2 present	C-O(s) of O-H deformation of alcoholic O-H present Sec., alicyclic 5 or 6-membered C-O of alcohol of free OH present
	1099.00 present	Free OH (b) present
	1336.00 present	Carboxylate anion(s) asymmetric absent
	1614.18,1546.54 absent	Carboxylate anion(s) symmetric absent
	1402.82 absent	

1H NMR of following compounds was taken by JEOL FX 90 Q fourier transform NMR spectrometer

Compound code	Peaks (ppm)	Inference
CA	0.67	s,3H,18-CH_3
	0.88	s,3H,19-CH_3
	0.99	d,3h,21- CH_3
	2.32-1.02	m,24H aliphatic H
	3.48	m,1H,3- CH
	3.83	bs,1H,7- CH
	3.97	bs,1H,12- CH
	4.03	d,2H, CH_2
	11.8	s,1H,COOH

In all the organometallic complexes of cholic acid, the peak at 11.8 ppm for –COOH was absent which confirms that –COOH group was involved in complexation.

characterization will be performed for its structural elucidation.

In all the organometallic complexes of cholic acid, the peak at 11.8 ppm for –COOH was absent which confirms that –COOH group was involved in complexation.

CONCLUSION

Organometallic complexes of cholic acid were prepared & structures were confirmed by physical & instrumental analysis.

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