Biosciences, Biotechnology Research Asia Vol. **4**(2), 749-752 (2007)

Synthesis spectral and antibacterial studies on few semicarbazones of benzaldehyde derivatives

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(Received: September 20, 2007; Accepted: October 08, 2007)

ABSTRACT

The present paper describe synthesis, spectral and antibacterial investigations on tweleve semicarbazones derived from 2-Hydroxybenzaldehyde, 3-Hydroxybenzaldehyde, 4-Hydroxybenzaldehyde, 2-Chlorobenzaldehyde, 3-Chlorobenzaldehyde, 4-Chlorobenzaldehyde, 2-Nitrobenzaldehyde, 3-Nitrobenzaldehyde, 4-Nitrobenzaldehyde. 2-Methoxybenzaldehyde, 3-Methoxybenzaldehyde, 4-Methoxybenzaldehyde. The synthesized complexes have been characterized on the basis of IR, NMR and elemental analysis after checking purity. Antibacterial studies have been studied on *staphylococcus aureus* and order of antibacterial activity was found in the following order CBSC > MBSC H≈HBSC > NBSC . The effect of structure and position of secondary group on antibacterial activity have also been investigated and in general it has been found that ortho effect reduces the antibacterial activity.

Key words: Antibacterial studies, Semicarbazones, Benzaldehyde derivatives.

INTRODUCTION

Semicarbazones are class of compounds obtained by condensing semicarbazide with suitable aldehydes or ketones. These are significant due to their biological activity[1], analytical ability and coordination behaviour. Their anticonvulsant, anticancer, antiinflammatery, antitubercular activities of this class of compounds have been investigated[2-5]. In most of the complexes, the semicarbazones(SC) coordinate to the metal ion as a bidentate ligand bonding through the oxygen atom and the hydrazine nitrogen atom[6,7]. In few cases they behave as unidentate ligands by bonding only through the oxygen atom. In certain cases semicarbazones also act as multidentate ligands if donor groups are also present in the parent aldehyde or ketone moiety. The importance of semicarbazones have been well recognized in terms of their analytical applications and biological activity, keeping these facts in mind it is worth to investigate the structure activity relation on these compounds. The present paper describes the synthesis, structure and study on biological activity of various derivatives of benzaldehyde semicarbazones on *Staphylococcus aureus*. The designing of experiments have been performed in such a way so that structure activity relation can be explored. The synthesized compounds have been characterized on the basis of spectral technique.

EXPERIMENTAL

In the present work 12 Semicarbazones were taken for study. These ligands possess N and O donor atoms. The ligands were synthesized by adding an ethanolic solution (10 ml) of respective carbonyl compound (0.01M) to a solution of (20ml) of semicarbazide (0.01M) in the same solvent and refluxing for called as 6 hours.

After refluxing the ethanolic solution for about 6 hrs, the ligands were separated out on cooling. The ligands so obtained were recrystallized from ethanol and dried in vacuo. The purity of ligands was checked by elemental analysis, IR and NMR spectra. The names of these compounds are as 2-Hydroxybenzaldehydesemicarbazone (2-HBSC), 3-Hydroxybenzaldehydesemicarbazone (3-HBSC), 4-Hydroxybenzaldehydesemicarbazone (4-HBSC), 2-Chlorobenzaldehydesemicarbazone (2-CBSC),3-Chlorobenzaldehydesemicarbazone (3-CBSC),4-Chlorobenzaldehydesemicarbazone (4-CBSC),2-Nitrobenzaldehydesemicarbazone (2-NBSC),3-Nitrobenzaldehydesemicarbazone (3-NBSC),4-Nitrobenzaldehydesemicarbazone (4-NBSC),2-Methoxybenzaldehydesemicarbazone (2-MBSC),3-Methoxybenzaldehyde semicarbazone (3-MBSC) and 4-Methoxybenzaldehydesemicarbazone (4-MBSC),

Antibacterial activity

The antibacterial activity of the compounds against S*taphylococcus aureus* have been carried out using Muller Hinton Agar media (Hi media). The activity was carried out using paper disc method. Base plates were prepared by pouring 10 ml of autoclaved Muller-Hinton agar into sterilized Petri dishes and allowing them to settle. Molten autoclaved Muller Hinton that had been kept at 48^{0}C was incubated with a broth culture of the *S.aureus* and then poured over the base plate. The discs were air dried and placed on the top of agar layer. The solutions of all compounds were prepared in double distilled water and chloramphenicol was used as a reference. The plates were then incubated for 18 h at room temperature.

RESULT AND DISCUSSION

Characterization of compounds

All the compounds were characterized on the basis of physical data, elemental analysis, IR and NMR spectra. Physical data are represented in Table 1. NMR of each compound was recorded in $CDCl_3$ or in DMSO d_6 and characterized on the basis of a specific peak in ppm using TMS as an internal standard. Charactersitic IR bands (recorded on KBr pallets) are bands are obtained in the range

Table 1: Physical Data for semicarbazones

S. No.	Compound	Colour	m.p. (°C)	Yield (%)
1	2-CB-SC	Yellowish White	230	96
2	3-CB-SC	Shiny White	232	94
3	4-CB-SC	white	264	80
4	2-HB-SC	Yellowish white	257	85
5	3-HB-SC	Light yellow	230	82
6	4-HB-SC	Off white	218	98
7	2-MB-SC	yellow	158	90
8	3-MB-SC	Light orange	182	92
9	4-MB-SC	Light orange	190	95
10	2-NB-SC	Yellow	245	96
11	3-NB-SC	Yellow white	230	90
12	4-NB-SC	Light yellow	222	85

represented as ; 3300 to 3450 cm^{-1} *v*(N-H); 3350 to 3430 cm^{-1} *v* asym(N-H) ; 1400 to 1470 cm^{-1} *v* (C=C); 1685 to1730 *v* (C=O) cm^{-1}; 1590 to 1625 *v* (C=N) cm^{-1}; 770 to 785 *v* (Ar-H) cm^{-1}

Antibacterial activity

Antimicrobial activity of all the semicarbazones have been carried out on *S. aureus*. The results have been are summarized in Table 2. All determinations were performed in duplicate. The minimal inhibitory concentration (MIC, µg/ml) was defined as the lowest concentration of compound inhibiting the growth of each strain. The minimal bacterial concentrations (MBC, µg/ml) was measured by subculturing 100 µl of each sample remaining clear in tubes containing 1 ml of fresh medium. All the ligands possess biological activity. Results of Structure activity relationship against

Table 2: Antibacterial activity of semicarbazones

S. No.	Compound	Zone of inhibition against *Staphylococcus aureus* in mm			
		25ppm	50ppm	75ppm	100ppm
1	2-CB-SC	9	8	8	9
2	3-CB-SC	12	10	10	9
3	4-CB-SC	14	12	12	11
4	2-HB-SC	9	10	11	11
5	3-HB-SC	10	11	12	12
6	4-HB-SC	11	12	13	14
7	2-MB-SC	7	8	8	9
8	3-MB-SC	8	9	10	11
9	4-MB-SC	11	12	13	14
10	2-NB-SC	7	8	8	9
11	3-NB-SC	8	10	10	12
12	4-NB-SC	9	11	12	13

Staphylococcus aureus are as

1. General order of antibacterial activity have been obtained as following order CBSC > MBSC≈HBSC > NBSC.
2. For all the semicarbazones antibacterial activity of ortho compound is less than meta and para which can be correlated with ortho effect.

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