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Synthesis and antibacterial activity of semicarbazone derivatives of some carbonyl compounds

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ABSTRACT

A number of aliphatic and aromatic semicarbazone derivatives have been prepared by the condensation of a variety of ketones with semicarbazide. The products have been characterized by analytical and spectral methods. The semicarbazone derivatives were screened for antibacterial activity by well diffusion method, using nutrient agar medium, and some of the products have shown biological activities against common test organisms.

Key words : Synthesis, semicarbazone, ketones, antibacterial activity.

INTRODUCTION

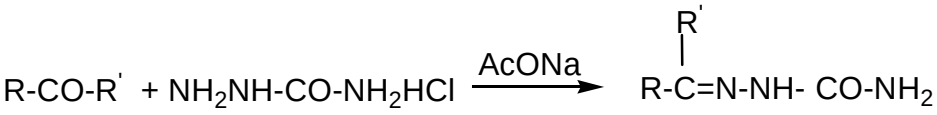
The semicarbazides, which are the raw material of semicarbazones, have been known to have biological activity against many of the most common species of bacteria[1-3] Semicarbazone, themselves are of much interest due to a wide spectrum of antibacterial activities[4]. Recently some workers had reviewed the bioactivity of semicarbazones and they have exhibited anticonvulsant[5,6], antitubercular[7] Accordingly and by considering the biological potential of semicarbazone, here in, the synthesis of some of these derivatives is reported and evaluated for antibacterial activities.

MATERIALS AND METHODS

Experimental

Melting points were determined on Stuart apparatus and uncorrected in open capillary and the literature values were generally in agreement with the observed measurements. IR spectra were recorded on a FTIR-1615 of Perkin-Elmer spectrophotometer in KBr pellets. The NMR spectra were recorded on Bruker AMX-500 spectrometer in (d_6) DMSO. Chemical shifts relative to TMS used as internal standard were obtained in δ unit, the spectral analysis were carried out at Cairo university, Egypt. Physical and spectral data are given in table 1.

The semicarbazones were synthesized according to the following general equation.



General procedure for preparation of semicarbazone derivatives[8]

A solution of semicarbazide hydrochloride (0.01 mol in 25 mL water) was added into the solution of ketone (0.01 mol in 15 mL ethanol) containing sodium acetate (2 g). The reaction mixture was refluxed with stirring for 1 hour, the solid products obtained were recrystallized from ethanol.

Table 1:The physical and spectral data of the semicarbazone derivatives

Compd No.	Compd Name	M.p.^{o}C (Lit.M.p.)	IR (KBr) ע Cm^{-1}	^{1}HNMR (d_6-DMSO) δ ppm
I	2-Butanone semicarbazone	144-6 (146)	3470(NH),2998(CH)1740(CO),1610(C=N)	0.9(s,3H,CH_3); 1.0(t,3H,CH_3); 1.4(q,2H,CH_2);6.0(s,2H,NH_2)7.0(s,1H,NH)
II	3-Methyl-2-butanone semicarbazone	113-6 (114)	3450(NH),3000(CH)1735(CO),1618(C=N)	0.9(s,3H,CH_3);1.1(d,3H,CH_3);1.01(d,3H,CH_3); 1.3(d,2H,CH_2);1.8(m,1H,CH(CH_3)$_2$), 5.9(s,2H,NH_2); 7.1(s,1H,NH)
III	Cyclopentanone semicarbazone	208-10 (209)	3465(NH) 2995(CH)1725(CO)1624(C=N)	1.3(m,8H,4CH_2); 6.1(s,2H,NH_2); 7.0(s,1H,NH)
IV	Cyclohexanone semicarbazone	166-8 (167)	3475(NH) 2980(CH) 1730(CO)1630(C=N)	1.3(m,10H,5CH_2); 5.8(s,2H,NH_2); 6.9(s,1H,NH)
V	Benzophenone semicarbazone	163-165 (164)	3480(NH) 3010(CH) 1725(CO)1640(C=N)	6.0(s,2H,NH_2); 6.8(s,1H,NH); 7.4-7.7(m,10H,Ar-H)
VI	Benzoin semicarbazone	206-8 (206)	3460(NH) 3300(OH) 2990(CH) 1728(CO) 1628(C=N)	4.0(s,1H,OH); 6.1(s,2H,NH_2); 7.0(s,1H,NH); 7.3-7.8(m,10H,Ar-H)
VII	Benzil semicarbazone	243-5,Di (244)	3468(NH) 3000(CH) 1730(CO)1632(C=N)	6.1(s,2H,NH_2); 7.1(s,1H,NH); 7.4-7.7(m,10H,Ar-H)

Biological assay of semicarbazone derivatives

Antibacterial activity of semicarbazone derivatives have been carried out against several types of bacteria such as, E.Coli; S.aureus and P.aregenosa, using nutrient agar medium by well diffusion method[9]. All compounds were suspended in aqueous solutions in different concentrations ranged from 10-100mg/ml, the cultures were carried out at the botany department, faculty of science in Garyounis university. The results are expressed on MIC (minimal inhibitory concentration), solvent blanks were run against each test organism in all assays and the experimental biological data is given in table II.

Table II: Antibacterial activity data of semicarbazone derivatives

Compound	*E.coli*	*S. aureus*	*P.aregenosa*
I	25	38	35
II	26	30	28
III	24	32	30
IV	25	33	31
V	24	26	20
VI	25	36	32
VII	28	34	34
Antibiotics	----------	----------	----------
Amprelox	22	34	34
Vibromycin	29	38	10

RESULTS AND DISCUSSION

The compounds I-VII have been characterized on the basis of satisfactory physical and spectral data (tables 1). In general the IR spectra exhibited bands at 1620 ± 10, 1710 – 1740 and 3150-3500 cm^{-1} which been attributed to the different functional groups present in the products which are mainly C=N, C=O, C-H, OH and N-H. The proton NMR data are also outlined in table 1.

As far as the biological activities concern the results are shown in table 2, it seems that those compounds exhibit variable effects and almost the same potency as standard drugs, except that all compounds exhibited high potent against *p.aregenosa* than vibromycin.

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