

NOTE

Synthesis and Antibacterial Activity of Some Oximes, Semicarbazones and Thiosemicarbazones

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A series of oximes, semicarbazones and thiosemicarbazones have been synthesized from 2,4-dihydroxyacetophenone; 2,4-dihydroxy-5-nitroacetophenone and 2,4-dihydroxy-5-bromoacetophenone and their antibacterial activity have been studied. The compounds have been characterised by elemental analysis and IR spectra.

Many heterocyclic compounds have been synthesized and checked for their antibacterial activity. Oximes, semicarbazones, thiosemicarbazones, hydrazones, chalcones etc., and their derivatives are also reported to be active as antilepral¹, antitubercular², antiviral³, antimalarial⁴, anticancer⁵ and antibacterial⁶⁻⁸ drugs. We synthesized a series of oximes, semicarbazones and thiosemicarbazones from 2,4-dihydroxyacetophenone; 2,4-dihydroxy-5-nitroacetophenone and 2,4-dihydroxy-5-bromoacetophenone. They are characterised by elemental analysis and IR data. Their antibacterial activity have been studied against *S. aureus* and *E. coli*.

All the melting points were determined in open capillaries and are uncorrected. Elemental analysis were carried out on Carlo Erba Elemental Analyzer (Model 1106). The IR spectra were recorded on a "Perkin-Elmer" Spectrophotometer (Model 237) in KBr pallet.

2,4-Dihydroxyacetophenone (ketone-1) was synthesized according to the method of Robinson and Shah⁹. 2,4-Dihydroxy-5-nitroacetophenone (ketone 2) was prepared by nitration of above ketone-1. It was done by using nitrating mixture (fuming HNO₃ + conc. H₂SO₄) and carrying out nitration at 0 to 5°C. The yellow coloured compound was crystallised from ethanol (m.p. 166°C, Nitrogen: found, 7.09; calculated 7.10%). 2,4-Dihydroxy-5-bromoacetophenone (ketone-3) was prepared from bromination of ketone-1 using bromine in glacial acetic acid at 20-25°C. The colourless compound was crystallised from ethanol (m.p. 171°C, Bromine: found, 34.60%, calculated, 34.63%).

Preparation of oximes: Oximes have been prepared by sodium acetate method. Ketone (0.02 mole) was dissolved in minimum quantity of ethanol. Aqueous solution of hydroxylamine hydrochloride (0.08 mole) and sodium acetate (0.1 mole) was added to it. The solution was refluxed on a water-bath at 75-80°C for 4 h. It was crystallised from ethanol.

Preparation of semicarbazones: A mixture of ketone (0.01 mole), semicar-

bazide (0.015 mole) were taken in 30 mL of ethanol and 5 mL of acid was added. The mixture was refluxed on water-bath at 75–80°C for 4 h. Excess of ethanol was distilled off and yellow solid was obtained. It was crystallised from ethanol.

Preparation of thiosemicarbazones: A mixture of ketone (0.01 mole), thiosemicarbazide (0.015 mole) were taken in 30 mL of ethanol and 5 mL of acid was added. The mixture was refluxed on water-bath at 80–85° for 4 h. Excess of ethanol was distilled off and yellow solid was obtained. It was crystallised from ethanol.

The none compounds synthesized are as follows:

Compound No.	Name of Compound
(I)	2,4-Dihydroxyacetophenone oxime
(II)	2,4-Dihydroxy-5-nitroacetophenone oxime
(III)	2,4-Dihydroxy-5-bromoacetophenone oxime
(IV)	2,4-Dihydroxyacetophenone semicarbazone
(V)	2,4-Dihydroxy-5-nitroacetophenone semicarbazone
(VI)	2,4-Dihydroxy-5-bromoacetophenone semicarbazone
(VII)	2,4-Dihydroxyacetophenone thiosemicarbazone
(VIII)	2,4-Dihydroxy-5-nitroacetophenone thiosemicarbazone
(IX)	2,4-Dihydroxy-5-bromoacetophenone thiosemicarbazone

The analytical data of these compounds are presented in Table-1.

IR spectra of the compounds showed the following important absorption bands.

Oximes: $\nu(\text{O—H})$ stretching 3500–3380 cm^{-1} , $\nu(\text{C=N})$ stretching 1635–1620 cm^{-1} , $\nu(\text{N—O})$ stretching 1125–1020 cm^{-1} .

Thiosemicarbazones: Besides $\nu(\text{O—H})$ stretching bands as above, $\nu(\text{C=S})$ stretching band at 1310–1260 cm^{-1} , $\nu(\text{C=N})$ band 1610–1595 cm^{-1} and $\nu(\text{N—H})$ stretching band at 3250–3210 cm^{-1} were observed.

Semicarbazones: Besides $\nu(\text{O—H})$ stretching, $\nu(\text{C=N})$ stretching and $\nu(\text{N—H})$ stretching bands as in thiosemicarbazone, $\nu(\text{C=O})$ stretching band was observed at 1725 cm^{-1}

TABLE-1
PHYSICAL DATA OF COMPOUNDS

Compd. No.	m.f.	m.p. (°C)	% Analysis, found (calcd.)			
			N		S	
I	C ₈ H ₉ O ₃ N	204	8.36	(8.38)	—	—
II	C ₈ H ₈ O ₅ N ₂	241	13.14	(13.20)	—	—
III	C ₈ H ₈ O ₃ NBr	223	5.74	(5.69)	—	—
IV	C ₉ H ₁₁ O ₃ N ₃	221	20.07	(20.09)	—	—
V	C ₉ H ₁₀ O ₅ N ₄	244	22.02	(22.04)	—	—
VI	C ₉ H ₁₀ O ₃ N ₃ Br	182	14.53	(14.58)	—	—
VII	C ₉ H ₁₁ O ₂ N ₃ S	121	18.78	(18.66)	14.22	(14.24)
VIII	C ₉ H ₁₀ O ₄ N ₄ S	212	20.71	(20.73)	11.86	(11.87)
IX	C ₉ H ₁₀ O ₂ N ₃ SBr	128	13.80	(13.81)	10.52	(10.54)

The listed compounds were evaluated for their inhibitory effect against *Staphylococcus aureus* and *Escherichia coli* by agar diffusion technique described by Bryant¹⁰. It was observed that all the compounds showed good activity against -ve bacteria *E. coli*, but poor activity against +ve bacteria *S. aureus* (Table-2).

TABLE-2
PHARMACOLOGICAL DATA OF COMPOUNDS

Compound No.	Microbial spectrum ($\mu\text{g}/\text{disk}$)*	
	<i>Staphylococcus aureus</i>	<i>Escherichia coli</i>
I	+	++
II	+	++
III	++	++
IV	+	++
V	+	++
VI	+	++
VII	+	++
VIII	+	++
IX	+	++

*Growth of inhibition zone diameter (+) \leq 10 mm, (++) $>$ 10 mm, concentration of compound = 50 $\mu\text{g}/\text{disk}$.

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