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Synthesis of 1,2,4-Trihalophenothiazin-3-ones and Their Conversion into (1,4)-Benzothiazino-(2,3-b)-Phenothiazines

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1,2,4-Trihalophenothiazin-3-ones (III) were prepared by condensing 2-amino benzenthiols (I) with chloranil/bromanil (II) in 1 : 1 molar ratio. Compounds (III) were further condensed with the same or different 2-aminobenzenthiol (IV) which afforded 1,4-benzothiazino-(2,3-b)-phenothiazines (V).

INTRODUCTION

Phenothiazinone and phenoxazine derivatives containing amino quinone system have been studied for biological and pharmaceutical activities and to obtain useful pigments[1–5]. Triphenodithiazines form an important class of compounds among the dyes of thiazine series[6]. Dyes of this series are useful for dying cotton, cellulose materials, rubber, paper and plastics in various shades[7–12]. In continuation of our interest in the synthesis and usages of these compounds, we wish to report the synthesis of some new phenothiazinone (III) and (1,4)-benzothiazino-(2,3-b)-phenothiazine derivatives (triphenodithiazines) (V).

In the present work 1,2,4-trihalophenothiazin-3-ones (III) were prepared by the reaction of subsituted 2-aminobenzenthiols (I) and chloranil/bromanil (II). The compound (III) was further condensed with same or different 2-aminobenzenthiol (IV) which afforded symmetrical substituted (1,4)-benzothiazino-(2,3-b) phenothiazines (Va,b) and unsymmetrical (1,4)-benzothiazino-(2,3-b)-phenothiazines (Vc–j Scheme-I). Symmertical triphenodithiazines (Va,b) were also prepared by an alternative single step procedure. In this method chloranil/bromanil was condensed with substituted 2-amino benzenthiol in a molar ratio of 1 : 2 (Scheme-II). The products prepared by single step method were identical (TLC, IR and mixed melting point) with those obtained by two step reaction.

RESULTS AND DISCUSSION

1,2,4-Trihalophenothiazin-3-ones exhibit strong band in the region 1675–1620 cm^{-1} due to C═C stretching vibration. In chloro derivatives band in the region

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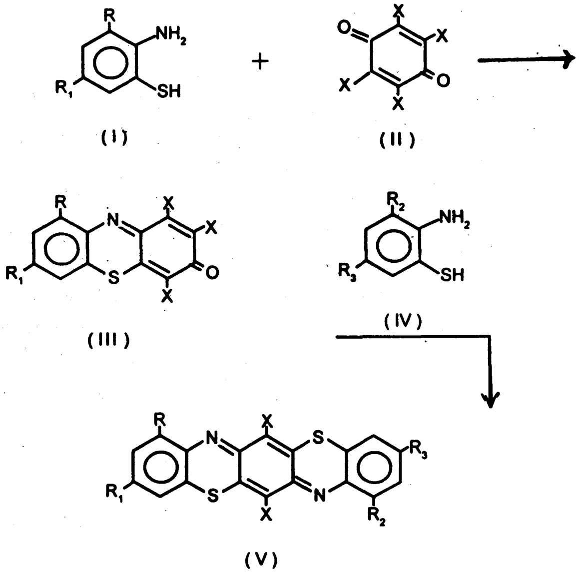
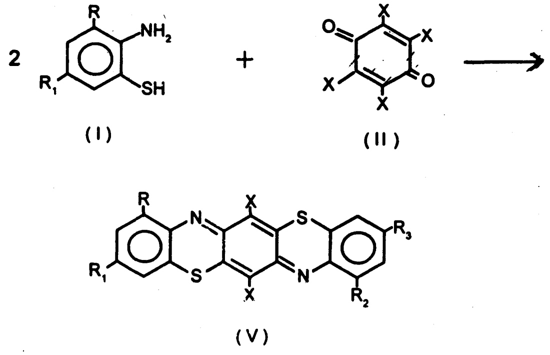
765–745 cm^{-1} is due to C—Cl stretching vibrations and in bromoderivatives band in the region 580–560 cm^{-1} is due to C—Br stretching vibrations. The bands in the region 1600–1200 cm^{-1} can be assigned to C—C and C—N ring vibrations. Similarly 1,4-benzothiazeno-(2,3-b)-phenothiazines show sharp and medium bands in the region 1625–1600 cm^{-1} which are due to C—C, C—N ring vibrations and 580–560 cm^{-1} band is appeared due to C—Br stretching vibrations.



Schene-I



Scheme-II

EXPERIMENTAL

Melting points of all the compounds were determined in open capillaries and are uncorrected. IR spectra were recorded on Perkin-Elmer model 781 in

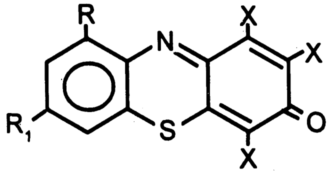
KBr/nujol. The purity of the compounds was checked on thin layers of silica-gel in various nonaqueous solvent systems. Bromanil was prepared by the method described by Torry and Hunter[13]. Substituted 2-aminobenzenthiols were prepared by the method reported in literature[14–16].

(i) Preparation of substituted 1,2,4-trihalophenothiazin-3-ones (IIIa,b)

To a suspension of chloranil/bromanil (II, 0.01 mole) in ethanol (20 mL) was added to a solution of substituted 2-aminobenzenthiol (I, 0.01 mole) in ethanol (10 mL) and anhydrous sodium acetate (0.05 mole). The reaction mixture was refluxed for 6 h. After cooling to room remperature the solid separated was filtered, washed with water and finally with 30% ethanol. The products were recrystallised from benzene. Physical data are given in Table-1.

TABLE-1

PHYSICAL DATA OF 1,2,4-TRIHALOPHENOTHIAZIN-3-ONES (III)



S.No.	Compound			m.p. (°C)	Yield (%)	m.f.	N % Found (Calcd.)
	R	R_1	X				
(a)	Br	Br	Br	154	52	$C_{12}H_2NOSBr_5$	2.27 (2.30)
(b)	Br	Br	Cl	128	54	$C_{12}H_2NOSBr_2Cl_3$	2.90 (2.95)

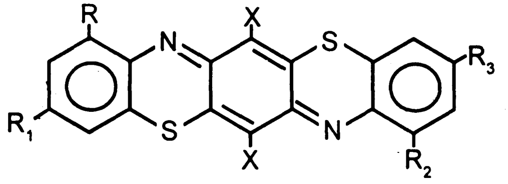
*All the compounds gave the satisfactory C, H and S analysis.

(ii) Preparation of 1,4-benzothiazino-(2,3-b)-phenothiazines (Vc–j)

Method A: To a mixture of 1,2,4-trihalophenothiazin-3-ones (III, 0.01 mole) and substituted 2-aminobenzenthiol (I, 0.01 mole) in ethanol (20 mL) was added anhydrous sodium acetate (0.05 mole). The reaction mixture was refluxed for 6 h, cooled to room temperature and the solid separated out was filtered, washed with water followed by 30% ethanol and recrystallised from benzene. Physical data are given in Table-2.

Method B: To a stirred suspension of chloranil/bromanil (0.01 mole) and 2-aminobenzenthiol (0.02 mole) in ethanol (20 mL) was added anhydrous sodium acetate (0.01 mole). The mixture was refluxed for 6 h, cooled to room temperature and the solid separated out was filtered, washed with water followed by 30% ethanol and recrystallised from benzene. Physical data are given in Table-2.

TABLE-2
PHYSICAL DATA OF SOME SUBSTITUTED 1,4-BENZOTHIAZINO-(2,3-b)-PHENOTHIAZINES (V)



S.No.	Compound					m.p. (°C)	Yield (%)	m.f.	N % Found (Calcd.)
	R	R_1	R_2	R_3	X				
(a)	Br	Br	Br	Br	Br	247	59	$C_{18}H_4N_2S_2Br_6$	3.50 (3.53)
(b)	Br	Br	Br	Br	Cl	198	59	$C_{18}H_4N_2S_2Br_4Cl_2$	3.85 (3.90)
(c)	H	H	Br	Br	Br	223	52	$C_{18}H_6N_2S_2Br_4$	4.39 (4.41)
(d)	H	H	Br	Br	Cl	218	55	$C_{18}H_6N_2S_2Br_2Cl_2$	5.08 (5.13)
(e)	H	Cl	Br	Br	Br	261	60	$C_{18}H_5N_2S_2Br_4Cl$	4.13 (4.18)
(f)	H	Cl	Br	Br	Cl	185	58	$C_{18}H_5N_2S_2Br_2Cl_3$	4.80 (4.83)
(g)	Br	Br	CH_3	Cl	Cl	201	53	$C_{19}H_7N_2S_2Br_2Cl_3$	4.65 (4.71)
(h)	Br	Br	CH_3	Cl	Br	214	48	$C_{19}H_7N_2S_2Br_4Cl$	4.06 (4.10)
(i)	CH_3	Cl	Br	Br	Br	240	49	$C_{19}H_7N_2S_2Br_4Cl$	4.06 (4.10)
(j)	CH_3	Cl	Br	Br	Cl	209	52	$C_{19}H_7N_2S_2Br_2Cl_3$	4.65 (4.71)

*All the compounds gave the satisfactory C, H and S analysis.

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