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RESEARCH ARTICLE

Synthesis and Antimicrobial Activity of Azo Compounds Containing *m*-Cresol Moiety

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Abstract: Several azo compounds were synthesized by using simple diazotization reaction pathway. The synthesized compounds contains drug moiety of *m*-cresol which shows excellent antimicrobial activity. Structure of all compounds was confirmed by ^{1}H NMR and IR spectral data.

Keywords: *m*-Cresol, Azo compounds, Antimicrobial activity

Introduction

Azo compounds constitute one of the largest class of industrially synthesized organic compounds, potent in drug and cosmatics[1]. Azo dyes have been most widely used in dying textile fibers, biomedical studies, advanced applications in organic synthesis & high technology areas like lasers, liquid crystalline displays, electro-optical devices and ink jet printer[2-4] as well as shows variety of interesting biological activities including antibacterial[5-8] and pesticidal[9] activities. The azo dyes posses antiseptic and antiprotozoal properties and also promote wound healing. The cationic dyes are more active in acidic medium and preferably attack on gram positive bacteria as compared to anionic dyes. Most common azo dyes used as antiseptics are scarlet red & diamazon[10]. The medicinal properties of azo compounds particularly synthesized from acetyl salicylic acid, thymol, aldimine and *b*-napthol *etc*. have been frequently reported. However, paucity of information could be traced on the synthesis of azo compound containing m-cresol moiety. Hence, taking into consideration the possibility of antibacterial potential of azo compounds containing *m*-cresol moiety, the present studies have been carried.

Experimental

The chemicals used in the present studies are of synthetic grade, Merck company Ltd. The products were characterized by ^{1}H NMR & IR. The M.Ps. were determined by open capillary method and uncorrected. The IR spectra were recorded on Perkin-Elmer spectrum-One

FTIR instrument in the form of KBr pallet.^{1}H NMR spectra, were recorded in $CDCl_3$ on a Bruker Avance II 400 NMR spectrometer using TMS as an internal standard. The purity of compounds was checked by TLC. The crude products were recrystallized from 50% ethanol.

General procedure for synthesis of diazo compounds[13,14]

Substituted aromatic amines were mixed with 2.5 mL conc. HCl & 2.5 mL (4 N) cold solution of $NaNO_2$ was added with the stirring. The temperature of the reaction was maintained up to 0-5 ^{0}C. Diazonium salt solution prepared above was added drop wise to the alkaline solution of *m*-cresol. The reaction mixture stirred for 10-20 miniutes maintaining the temperature 5-10 ^{0}C. The colored products obtained is filtered and washed with water dry the product and recrystallised from proper solvent.

Results and Discussion

Spectroscopic study

I.R. and ^{1}H NMR spectra show the expected signals which corresponds to various groups present in each compounds (Figure 1). The I.R. and ^{1}H NMR spectral data are shown in Table 1. A total of eight derivatives of *m*-cresol have been synthesized, purified and further used individually to analyze its antimicrobial activity against four human pathogens *viz*: *E.coli*, *S.aureas*, *S. typhi* and *Pseudomonas* species. The results reveled that, (Table 2) there was miraculous inhibition of *E.coli* species as compared to pathogens. *S.aureas* and *Pseudomonas* species. The derivative **3a, 3b, 3c, 3d, 3e, 3f, 3g** and **3h** was found to be significant in inhibiting the *E.coli* species with zone of inhibition at 11, 9, 8, 6, 12, 11, 9 and 8 mm respectively. *Salmonella* showed zone of inhibition with the diameter of 10, 10, 9, 8, 11 and 10 mm due to an activity of **3a, 3b, 3c, 3d, 3f, 3g** and **3h** respectively. Only compound **3e** not showed inhibitory action against *salmonella*. The compound **3a, 3b, 3d, 3e, 3f** and **3g** showed 7, 7, 9, 9, 10 and 8 mm of zone of inhibition against test pathogen *Pseudomon aeruginosa*. Only compound **3h** have not showed antibacterial activity against *Pseudomonas aeruginosa*. The derivative **3c, 3d, 3e, 3f, 3g** and **3h** was found to be significant in inhibiting the *S. aureus* species with zone of inhibition at 9, 8, 10, 12, 8 and 6 mm respectively. It was observed that *S. aureus* species were not inhibited by **3a** and **3b** only.

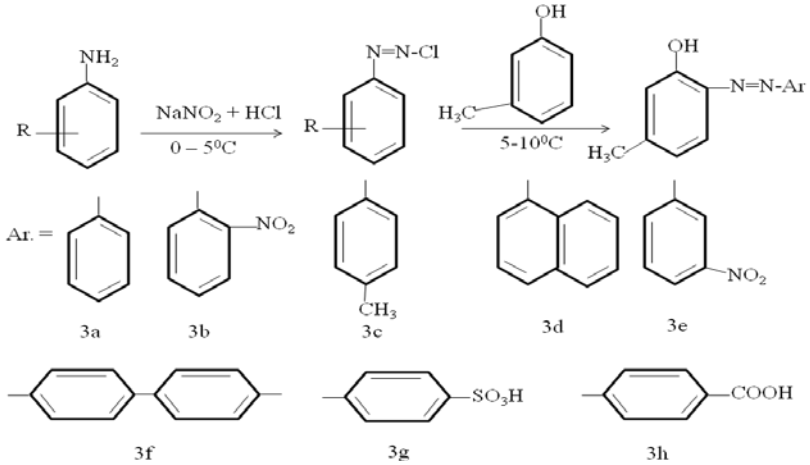

Figure 1. Synthesis of compounds

Table 1. IR & ^{1}H NMR spectral data

3a	IR	3667(OH Stretching), 2948(C-H of CH_3),1609 (C=C of Aromatic), 1590(N=N).
	NMR	2.3(s 3Hof CH_3), 6.8 (m, 1H of Ar-H).7.44(m, 1H of Ar-H).7.47(m, 1H of Ar-H).7.5(s, 1H of Ar-H).7.73(m, 1H of Ar-OH). 7.7(m, 2H of Ar-H). 7.85(m, 2H of Ar-H).
3b	IR	3411(OH Stretching), 3071(C-HofCH$_3$),1638 (C=C of Aromatic), 1591(N=N),1503(NO_2).
	NMR	2.3(s 3Hof CH3), 6.6 (m, 1H of Ar-H).6.9(m, 1H of Ar-H).7.3(s,1H of Ar-H). 7.5(m, 1H of Ar-H).7.8(m, 1H of Ar-OH). 8.0(m, 1H of Ar-H). 7.85(m, 2H of Ar-H).
3c	IR	3130(OH Stretching),3037(C-H$_3$),2920(C-HofCH$_3$), 1590 (C=C of Aromatic), 1504(N=N),
	NMR	2.2 (s,3H of CH_3) 2.4 (s,3H of CH_3) 5.2 (b,1H of Ar-H)6.8 (m,1H of Ar-H) 7.3(m,2H of Ar-H)7.71 (m,1H of Ar-OH) 7.78 (m,3H of Ar-H)
3d	IR	3335(OH Stretching),3055(C-HofCH$_3$), 1592.4 (C=C of Aromatic), 1500(N=N).
	NMR	2.2 (m,3 H of C-H$_3$),6.8(m,1H of Ar-H), 7.1 (m,1 H of Ar-H) 7.8 (b,7H of Ar-H) 7.9 (m,1H of Ar-OH) 8.0 (m,1H of Ar-OH)
3e	IR	3452 (OH Stretching), 3076 (C-HofCH$_3$), 1595 (C=C of Aromatic), 1522(N=N),1343 (NO_2).
	NMR	2.3 (s,3 H of C-H$_3$), 6.5(m,1H of Ar-H), 7.0 (m,1 H of Ar-H) 7.5 (m,1H of Ar-H) 7.7 (m,1H of Ar-H),7.9 (m,1H of Ar-H), 8.2 (m,1H of Ar-H)), 8.5 (m,1H of Ar-H)), 8.7 (m,1H of Ar-OH).
3f	IR	3282(OH Stretching),2920(C-HofCH$_3$),1593(C=CofAromatic), 1504(N=N),1464(C=CofAromatic).
	NMR	2.1 (m,3 H of C-H$_3$), 2.2(s,3H of CH_3), 2.5 (m,2 H of Ar-H) 6.9 (m,2H of Ar-H) 7.6 (m,2H of Ar-H),7.7 (m,2H of Ar-OH), 7.9 (m,3H of Ar-H),8.0 (m,3H of Ar-H)), 8.7 (m,1H of Ar-OH).
3g	IR	3466(OH Stretching),2951(C-HofCH$_3$),1594(C=C of Aromatic), 1502(N=N),1174(SO_3H).
	NMR	.2(s 3H of CH_3), 6.8(m,1H of Ar-H),7.0(m,1H of Ar-H),7.2(m,1H of Ar-H),7.7(s,1H of Ar-OH),7.8(m,2H of Ar-H),8.0(m,2H of Ar-H), 9.9(m,1H of SO_3-H).
3h	IR	3377(OH Stretching), 3192(HofCH3),1683(C=O of COOH), 1595(C=C of Aromatic), 1579(N=N),1174(SO_3H).
	NMR	2.5 (s,3H of CH_3), 6.9 (m,1H of Ar-H),7.6(s,1H of Ar-H), 7.7(m,1H of Ar-H),7.8 (s,1H of Ar-OH), 7.7 (m,1H of Ar-OH),8.0 (m,2H of Ar- H), 10.09(m,1H of COOH).

Antimicrobial activity

The compounds **3a-h** were screened for the presence of antimicrobial constituents against four microorganisms *viz., Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeroginosa* & *Salmonella* typhi, by using disc diffusion method[11]. The compounds were dissolved in ethanol to give 10 mg/1 mL solutions. Sterile discs were dipped in solutions, dried and placed on nutrient agar plates inoculated with the bacteria. The plates were incubated for 24 h and the zones of inhibition were measured using antibiotic zone reader (Hi-Media).

Table 2. Antimicrobial properties of the synthesized azo compounds zone of inhibition (mm)

Compounds	1	2	3	4
3a	11	-	10	7
3b	9	-	10	7
3c	8	9	9	-
3d	6	8	8	9
3e	12	10	-	9
3f	11	12	11	10
3g	9	8	10	8
3h	8	6	9	-

(1) *E. coli.* ***(2)*** *S. aureus* ***(3)*** *Salmonella typhi* ***(4)*** *Pseudomonas Aeruginosa*

Conclusion

No report could be traced on the same line of action. The resistance shown by the test culture against the inhibitory action of **3a** and **3b** against *S.aureus*, **3e** against *Salmonella* typhi, **3c** and **3h** against pseudomonas *Aeruginosa* as well as the basic drug resolved. It might be due to degradation potential of cultures or may be due to the problem of permeability for the compound to reach up to target organelle in the cell, whereas the significant inhibitory action of compound except above four compounds may be due to the compatibility of these compounds to diffuse and to reach and to reach up to the target for cell destruction or may not have susceptibility to the degradative enzymes responsible for its in- activation. However the optimization studies on the inhibiting compounds are needed for its systematic commercial exploitation.

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