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Synthesis, characterization & antimicrobial screening of 1-(substituted phenyl)-2,5-bis(ethylsulfanyl)-1H-pyrrole-3,4-dicarbaldehydes

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ABSTRACT

The heterocyclic compounds are very much importance due to their biological activities. The formyl group attached to pyrrole molecules make them promising precursors for further synthetic transformation. Thioether compounds possess broad spectrum biological activities such as fungicidal[8], insecticidal, herbicidal & plant growth regulating activities. Some heterocyclic thioether derivatives have been also reported to exhibit good antiviral activities[7]. Due to these uses many workers are interested in the synthesis of thioether compounds with heterocycles[1-3]. To achieve our aim we diformylated succinimides using Vilsmeier- Haack reagent to get 2,5 dicloro – 3,4 diformyl (N- substituted phenyl) pyrroles. The succinimides in turn were obtained from succinic acid and substituted anilines. The diformylated compounds were then converted into thioether derivatives by treating with sodium sulphide, ethyl bromide in dry DMF as solvent[12-13]. All the compounds were characterized and screened for antimicrobial activities.

Key words: Vilsmeier- Haack reaction ,Formylation, Thioether derivatives

INTRODUCTION

A great variety of thioether compounds with heterocycles have been synthesized due to their broad spectrum biological activity such as fungicidal, insecticidal, herbicidal, & plant growth regulative activities. Some heterocyclic thioether derivatives exhibit good antiviral activities[4-6].

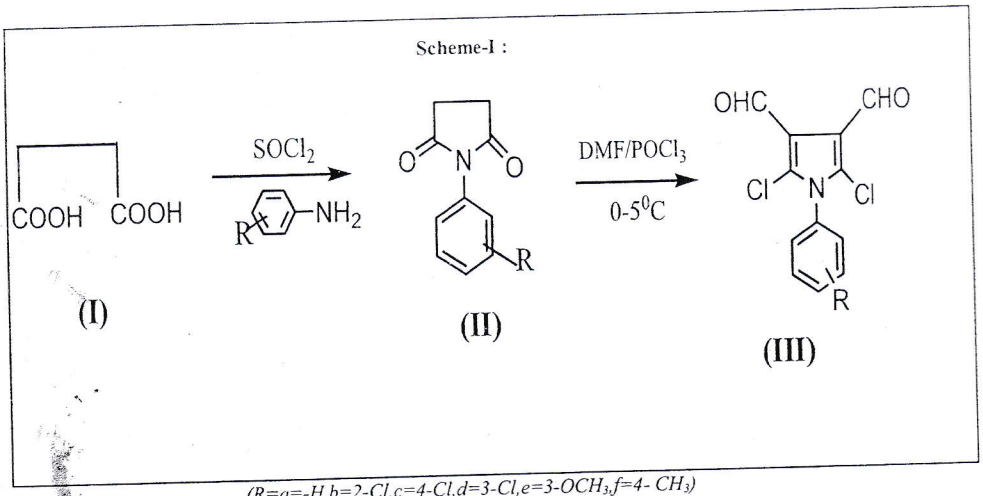
For this purpose, succinimides where diformylated using Vilsmeier-Haack reaction .to form 2, 5-dichloro -3, 4-diformyl (N-substituted phenyl pyrroles. the succinimides in tern were synthesized from succinic acid & substituted anilines. the dichlorodiformyl pyrroles having formyl group & chlorine atom at ortho position to each other show promising precursors for other novel pyrrole derivatives.

MATERIALS AND METHODS

All melting points were determined in open capillary & are uncorrected. I.R. spectra were Recorded on Perkin-Elmer spectrum. ^{1}HNMR were recorded on Bruker DRX 500 MHz. NMR spectrometer with DMSO-d6 as a solvent using TMS as internal reference . (chemical shift in δ ppm).

General procedure for synthesis of 1-(N-substituted phenyl) –pyrrolidine -2,5-dione II (a-f)
A mixture of succinic acid (11.8 gm,0.1 m) & thionyl chloride (26.18 gm,2.2m) was refluxed for 30 minutes in 5 ml benzene , different aromatic amines (0.1 m) were dissolved. This solution of aromatic amines was added slowly in above reaction mixture. Then the reaction mixture was refluxed till complete HCl gas was evolved. The product obtained was cooled & Recrystalized from Ethanol to give pure 1 –(N- substituted phenyl)-pyrrolidine-2,5- dione II(a-f)

Scheme-I :



(R=a=-H,b=2-Cl,c=4-Cl,d=3-Cl,e=3-OCH_3,f=4- CH_3)

(IIa) 1-(phenyl) pyrrolidine-2,5-dione.
Mol. Formula: $C_{10}H_9O_2N$, Physical nature: shiny green, M.P: 150^{0}C ,Yield (%): 95%, IR (KBr)cm^{-1} : 2900 (>CH_2), 1726 (>C=O), 1464 (ArC=C), 1287 (C-N). H^{1}NMR (300 MHz, DMSO d_6, δppm): 2.78 (s,4H)), 7.5-6.98 (m,3H,Ar-H). C^{13}NMR: 27.6(CH_2), 176(>C=O), 135(C-N), 121(Ar-H). Elemental analysis Calculated for $C_{10}H_9O_2N$: C-68.57, H-5.14, N-8.05. Found: C-68.50, H-5.10, N-8.00.

(IIb) 1-(2-chloro phenyl) pyrrolidine-2,5-dione
Mol. Formula: $C_{10}H_8O_2NCl$, Physical nature: Yellowish, M.P: 150^{0}C, Yield (%): 92%. IR (KBr) cm^{-1} : 2994 (>CH_2), 1702 (>C=O), 1419 (ArC=C), 1202(C-N). H^{1}NMR: (300MHz, DMSO-d_6, δppm): 2.70 (s,4H), 7.4-6.80 (m,3H,Ar-H). C^{13}NMR: 27.20 (>CH_2), 170 (>C=O), 134 (C-N), 120 (Ar-H) Elemental Analysis; Calculated For $C_{10}H_8O_2NCl$: C-57.00,H-4.27,N-6.65, Found : C-56.98, H-4.25, N-6.50,

(IIc) 1-(4-chloro phenyl) pyrrolidine -2,5-dione.
Mol. Formula: $C_{10}H_8O_2NCl$, Physical nature: light pink, M.P: 164^{0}C, yield (%): 90%. IR (KBr) cm^{-1} : 2990 (>CH_2), 1710 (>C=O), 1420 (ArC=C), 1200 (C-N). H^{1}NMR (300 MHz,DMSO-d_6, δppm): 2.72 (s,4H), 7.3-6.90 (m,3H,Ar-H). C^{13}NMR: 26.2(>CH_2) ,170 (>C=O), 138(C-N), 128 (C-Cl). Elemental Analysis: Calculated For $C_{10}H_9O_2NCl$: C-57.00, H-4.27, N-6.65. Found: C-56.90, H-4.20, N-6.45.

(IId) 1-(3-Chlorophenyl) pyrrolidine -2,5 - dione
Mol. Formula : $C_{10}H_8O_2NCl$, Physical nature: yellowish, M.P: 115^{0}C, Yield (%): 90%, IR (KBr) cm^{-1} : 2990 (>CH_2), 1730.32 (>C=O), 1425 (ArC=C), 1206 (C-N). H^{1}NMR: (300 MHz,DMSO-d_6,δppm): 2.78 (s,4H), 7.3- 6.90 (m,3H,Ar-H). C^{13}NMR: 27.2 (>CH_2), 174 (>C=O), 132 (C-N), 123 (Ar-H). Elemental Analysis: Calculated For $C_{10}H_8O_2NCl$: C-57.00, H-4.27, N-6.65. Found: C-56.90, H-4.15, N-6.50.

(IIe) 1-(3-methoxy phenyl) pyrrolidine -2,5-dione
Mol, Formula: $C_{11}H_{11}O_3N$, Physical nature:shiny black, M.P: 170^{0}C, Yield (%): 95%., IR (KBr) cm^{-1} : 2924 (>CH_2), 1723 (>C=O), 1419 (ArC=C), 1202 (C-N). H^{1}NMR: (300 MHz, DMSO-d_6, δppm): 2.78 (s,4H), 3.648 (s,3H,CH_3), 7.6-7 (m,3H,Ar-H). C^{13}NMR: 26.5 (>CH_2), 137 (C-N), 120 (Ar-H), 172 (>C=O). Elemental Analysis: Calculated For $C_{11}H_{11}O_3N$; C-64.39, H-5.36, N-6.82. Found: C-64.30, H-5.25, N-6.50.

(II f) 1-(4- methyl phenyl) pyrrolidine -2,5- dione
Mol. Formula: $C_{11}H_{11}O_2N$, Physical nature: shiny brown, M.P: 150^{0}C, Yield (%): 90%. I.R (KBr) cm^{-1} : 2928(>CH_2), 1700 (>C=O), 1400 (Ar C=C), 1205 (C-N). H^{1}NMR: (300MHz, DMSO-d_6, δppm): 2.60 (s,4H), 2.8 (s,3H,CH_3), 7.5-7 (m,3H,Ar-H).C^{13}NMR: 25.6(>CH_2), 132 (C-N), 120 (Ar-H), 170 (>C=O). Elemental analysis: Calculated For $C_{11}H_{11}O_2N$; C-69.84, H-5.82, N-7.40. Found: C-68.90, H-5.60, N-7.10.

General procedure for the synthesis of 2,5-dichloro-1-(N-substituted phenyl)-1H- pyrrole -3,4-dicarbaldehyde III(a-f)
To a cooled dimethyl formamide (0.24 moles) freshly distilled $POCl_3$ (0.12 moles) was slowly added in a dropwise fashion with constant stirring at 5-10^{0}C. Then the succinimides II (a-f) (0.12 moles) were slowly added to a cooled Vilsmeier - Haak reagent in small aliquots at a time with constant stirring using magnetic stirrer. The reaction mixture was heated at 60-70^{0}C For 6 hrs. This mixture was kept overnight & was then slowly added to crushed ice

with stirring & stirred for another 30 min .Then the resulting clear coloured solution was reacted with 40% NaOH (50ml) maintaining the temp below 50^{0}C.The reaction mixture was then heated at 50-60^{0}C. for half an hour which after cooling in an ice bath coloured compounds were obtained. These compounds were recrystallized with aqueous methanol as solvent to give pure product III(a-f)

(IIIa) 2,5-dichloro-1-(phenyl) -1H- pyrrole-3,4-dicarbaldehyde.
Mol.Formula: $C_{12}H_7O_2NCl_2$, Physical nature: yellowish, M.P: 162^{0}C, Yield (%): 85%. IR (KBr) cm^{-1}: 2860 (-CHO), 1705.93 (>C=O), 1507.61 (ArC=C), 1187 (C-N), H^{1}NMR: (300MHz,DMSO-d_6, δppm): 7.8-7.28 (s,4H, Ar-H), 10.38 (br.s, 2H,2-CHO). C^{13}NMR:141 (C-N), 129 (Ar-H), 119 (C-Cl), 191 (-CHO) Elemental Analysis: Calculated For $C_{12}H_7O_2NCl_2$; C-53.73, H 2.61, N-5.22. Found : C-53.70, H-2.58, N-5.19.

(IIIb) 2,5-dichloro-1-(2-chloro phenyl)-1H-Pyrrole -3,4-dicarbaldehyde.
Mol. Formula: $C_{12}H_6O_2NCl_3$, Physical nature: yellowish, M.P: 90^{0}C, Yield (%): 80%. IR: (KBr)cm^{-1}: 2850 (-CHO), 1705.80 (>C=O), 1500 (ArC=C), 1190 (C-N), H^{1}NMR: (300 MHz,DMSO-d_6, δppm): 7.5-7.20 (s,4H, Ar-H), 10.20 (br.s, 2H,2-CHO). C^{13}NMR: 139 (C-N) , 125 (Ar-H), 115 (C- Cl), 190 (-CHO). Elemental Analysis: Calculated For $C_{12}H_6O_2NCl_3$ C-47.60, H-15.20, N-4.62,. Found; C-47.55, H 15.18, N-4.60.

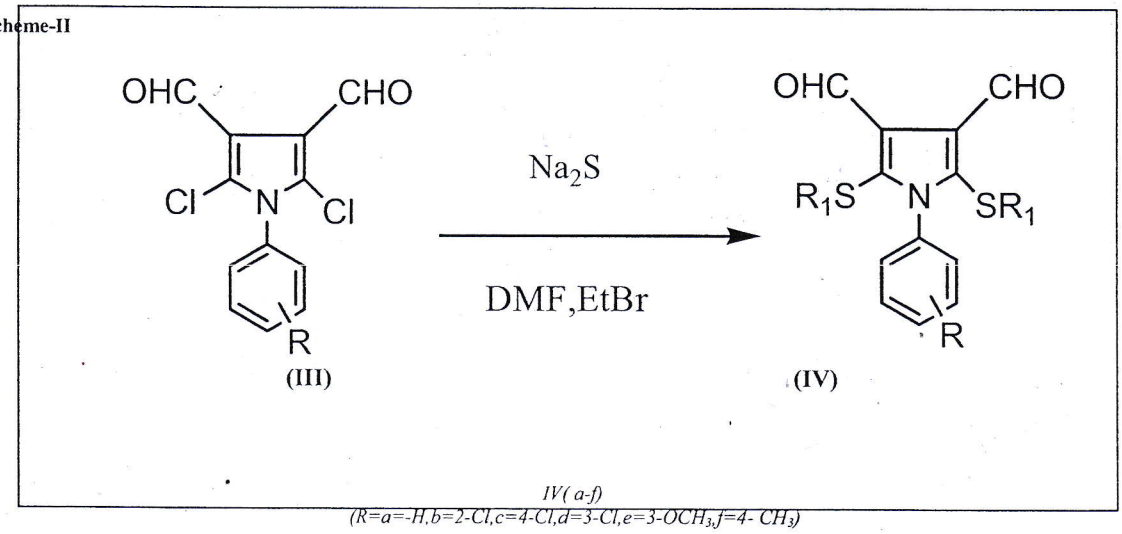
(IIIc) 2,5- dichloro-1-(4-chloro phenyl)-1H- pyrrole -3,4- dicarbaldehyde.
Mol. Formula: $C_{12}H_6O_2NCl_3$, Physical Nature: brownish, M.P: 242^{0}c, yield (%): 82%., IR (KBr) cm^{-1}: 2865 (-CHO), 1700.93 (>C=O), 1507.61 (ArC=C), 1188 (C-N), H^{1}NMR: (300 MHz,DMSO-d_6, δppm): 7.4-7.20 (s,4H, Ar-H), 10.33 (br.s, 2H,2-CHO). C^{13}NMR: 142 (C-Cl), 195 (-CHO), 133 (Ar-H), 135(C-N). Elemental Analysis; Calculated For $C_{12}H_6O_2NCl_3$ C-47.60, H-15.20, N-4.62. Found: C-47.58, H-15.10, N-4.57.

(IIId) 2,5-dichloro -1- (3- chloro phenyl) -1H-pyrrole -3,4- dicarbaldehyde
Mol. Formula: $C_{12}H_6O_2NCl_3$, Physical nature: brownish, M.P: 84^{0}C, yield (%): 85%. IR (KBr) cm^{-1}: 2869 (-CHO), 1700 (>C=O), 1500 (ArC=C), 1180 (C-N), H^{1}NMR (300 MHz,DMSO-d_6, δppm): 7.7-7.20 (s,4H, Ar-H), 10.28 (br.s, 2H,2-CHO). C^{13}NMR: 145 (C-N), 129 (Ar-H), 190 (-CHO), 119 (C-Cl), Elemental Analysis: Calculated For $C_{12}H_6O_2NCl_3$ C-47.60, H-15.20, N-4.62, Found: C-47.58, H-15.18, N-4.60.

(IIIe)2,5-dichloro-1-(3-methoxyphenyl)-1H-pyrrole-3,4-dicarbaldehyde.
Mol. Formula: $C_{13}H_9O_3NCl_2$, Physical nature: faint white, M.P: 119^{0}C, yield (%): 85% . IR (KBr) cm^{-1}: 2861 (-CHO), 1705 (>C=O), 1590 (ArC=C), 1189 (C-N), H^{1}NMR: (300 MHz, DMSO-d_6, δppm): 3.58 (s.3H-OCH_3), 7.6-7.33 (S,4H, Ar-H), 10.40 (br.s, 2H,2-CHO). C^{13}NMR: 120 (C-Cl), 130 (Ar-H), 190 (-CHO), 135 (C-N). Elemental Analysis: Calculated For $C_{13}H_9O_3NCl_2$ C-52.34, H-3.02, N-4.69. Found: C-52.30, H-3.00, N-4.65.

(IIIf) 2,5- dichloro-1- (4-methyl phenyl) -1H- pyrrole -3,4- dicarbaldehyde.
Mol. Formula: $C_{13}H_9O_2NCl_2$, Physical nature: brownish, M.P: 186^{0}c, yield (%): 70%. IR: (KBr) cm^{-1}: 2860 (-CHO), 1708.99 (>C=O), 1507.69 (ArC=C), 1193 (C-N), H^{1}NMR: (300 MHz,DMSO-d_6, δppm): 7.1-7.20 (s,4H, Ar-H), 10.39 (br.s, 2H,2-CHO). C^{13}NMR: 140 (C-Cl), 190 (-CHO), 135 (Ar-H), 134 (C-N). Elemental Analysis: Calculated For $C_{13}H_9O_2NCl_2$ C-55.31, H-3.19, N-4.96. Found: C-55.28, H-3.13, N-4.90.

Scheme-II



IV(a-f)
(R=a=-H,b=2-Cl,c=4-Cl,d=3-Cl,e=3-OCH_3,f=4- CH_3)

General procedure for synthesis of 2,5-bis (ethyl sulfanyl)-1- (N-substituted phenyl-1H-pyrrole-3,4-dicarbaldehydes. IV (a-f)

To a solution of III (1 mmol) in dry DMF (5ml) sodium sulphide (3mmol, fused flakes) was added & stirred for 2-3 hr at rt. On completion of the reaction, the corresponding halo compound (ethyl bromide) was added & stirred for another 30-45 min.& poured in to crushed ice.The ppt obtained was filtered, dried & purified by recrystalisation from aq. ethanol to give corresponding pure 2,5-bis (ethyl sulfanyl) -1-(N-substituted phenyl)-1H- pyrrole-3,4-dicarbaldehydes .(IVa-f)

(IVa) 2.5-bis (ethyl thio) -1- phenyl-1H- pyrrole -3,4- dicarbaldehyde.

Mol. Formula: $C_{16}H_{17}O_2NS_2$, Physical nature: whitish, Mol. Wt. 287, M.P: 222^{0}C, yield (%): 85%. IR (KBr) cm^{-1} 2852 (-CHO), 1703 (>C=O), 1448 (Ar C=C), 1236 (C-N), 1016 (- SC_2H_5). H^{1}NMR (300 MH_z,DMSO-d_6 δppm): 1.25 (t,6H, J=7Hz, 2SCH_2CH_3), 7.33-7.13 (m, Ar-H), 10.15 (s,2H,2CHO), 3.08 (q. 4H,J= 7Hz, 2S CH_2CH_3). C^{13}NMR 125 (Ar-H), 140 (CN), 191 (-CHO), 30.4 (>CH_2), 14.4 (-CH_3). Elemental Analysis: Calculated For $C_{16}H_{17}O_2NS_2$ C-66.89, H-5.92, N-4.87. Found: C-66.80, H-5.88, N-4.82.

(IVb) 1-(2-chloro phenyl) -2,5- bis (ethyl thio) -1H-pyrrole -3,4- dicarbaldehyde

Mol. Formula: $C_{16}H_{16}O_2NS_2Cl$, Physical nature: whitish, Mol. Wt 321.5, M.P: 92 ^{0}C, yield (%): 87% . IR(KBR)cm^{-1} 2850 (-CHO), 1700 (>C=O), 1440 (ArC=C), 1235 (C-N), 1050(SC_2H_5). H^{1}NMR (300MHz,DMSO-d_6 δppm) 1.20 (t,6H,J=7Hz,2SCH_2CH_3), 7.30-7.10 (m,Ar-H), 10.10 (s,2H,2CHO), 3.00 (q,4H,J=7Hz,2s CH_2CH_3). C^{13}NMR: 120-122 (Ar-H), 139 (C-N), 134 (C-Cl), 190 (-CHO), 29.4 (S-CH_2), 14.2 (-CH_2-CH_3). Elemental Analysis : Calculated For $C_{16}H_{16}O_2NS_2Cl$, C-59.72, H-4.97, N-4.35. Found, C-59.68, H-4.92, N-4.30.

(IVc) 1-(4-chloro phenyl)-2-5- bis (ethyl thio)-1H-pyrrole -3,4- dicarbaldehyde

Mol. Formula: $C_{16}H_{16}O_2NS_2Cl$, M.P: 162^{0}C, Yield (%): 82%. IR (KBR) cm^{-1} 2850 (-CHO), 1700 (>C=O), 1440 (Ar-C=C), 1230 (C-N), 1015 (-SC_2H_5). H^{1}NMR: (300MHz,DMSO-d_6 δppm) 1.22 (t,6H,J=7Hz,2SC_2H_5), 7.30-7.10 (m,Ar-H), 10.10 (s,2H,2CHO), 3.05 (q,4H,J=7Hz,2SC_2H_5). C^{13}NMR: 122 (Ar-H), 142 (C-N), 190 (-CHO), 30.3 (>CH_2), 14.2 (-CH_3). Elemental Analysis: Calculated For $C_{16}H_{16}O_2NS_2Cl$. C-59.72, H-4.97, N-4.35. Found C-59.70, H-4.90, N-4.30.

(IVd) 1-(3- chloro phenyl)- 2,5-bis (ethyl thio) -1H- pyrrole-3,4- dicarbaldehyde

Mol formula: $C_{16}H_{16}O_2NS_2Cl$, Physical nature: Greyish, Mol wt. 321.5, M.P: 172^{0}C, Yield (%) : 88%. IR (KBr) cm^{-1} 2855 (-CHO), 1702 (>C=O), 1445 (Ar-H), 1233 (C-N), 1107 (-SC_2H_5). H^{1}NMR (300MHz,DMSO-d_6, δppm) 1.25 (t,6H,J=7Hz,2SC_2H_5) ,7.25-7.5 (m,Ar-H), 10.15 (s,2H,2CHO), 3.05 (q,4H,J=7Hz,2SCH_2CH_3). C^{13}NMR 128 (ArH), 139 (CN), 192 (-CHO), 30.2 (>CH_2), 14.3 (-CH_3) Elemental Analysis :Calculated For $C_{16}H_{16}O_2NS_2Cl$, C-59.72, H-4.47, N-3.35, Found: C-59.70, H-4.40, N-3.30.

(IVe) 1(3- methoxy phenyl) -2,5- bis (ethyl thio)-1H- pyrrole -3,4- dicarbaldehyde

Mol. Formula: $C_{17}H_{19}O_3NS_2$, Physical nature: whitish, Mol. Wt. 317, M.P; 119^{0}C, Yield(%): 82%. IR (KBr) cm^{-1} 2852 (-CHO), 1703 (>C=O), 1442 (ArC=C), 1236 (C-N), 1110 (-SCH_2CH_3). H^{1}NMR (300 MH_z, DMSO-d_6, δ ppm) 1.28 (t,6H, J=7Hz,2SCH_2CH_3), 7.33- 7.13 (m,ArH), 10.15 (s,2H,2CHO), 3.08 (q,4H,J=7Hz,2SC_2H_5). C^{13}NMR: 125(Ar-H), 140(C-N), 191-(CHO), Elemental Analysis: Calculated For $C_{17}H_{19}O_3NS_2$, C-64.35, H-5.99. found: C-64.30, H-5.90.

(IVf) 1-(4-methyl phenyl) -2,5-bis (ethyl thio) -1H- pyrrol -3,4- dicarbaldehyde

Mol. Formula $C_{17}H_{19}O_2NS_2$ Physical nature yellowish Mol. Wt. 301, M.P. 164^{0}C yield(%) 87% IR (KBr) cm^{-1} 2857(CHO),1705 (>C=O),1441(ArC=C),1230(C-N),1099 (-SCH_2CH_3). H^1 NMR (300 MH_z, DMSO-d_6, δ ppm) 1.35(t,6H,J=7Hz,2SCH_2CH_3),7.30-7.13 (m,Ar-H),10.18(s,2H,2CHO),3.08(q,4H,J=7Hz,2SC_2H_5). C^{13}NMR: 122(Ar-H),135(C-N),192(CHO). Elemental Analysis: Calculated For, $C_{17}H_{19}O_2NS_2$ C-67.77,H-6.31. Found C-67.70,H-6.30.

Table-1 shows physical data of compound

Comp	R	M.F	M.P (^{0}C)	Yield (%)
IIa	-H	$C_{10}H_9O_2N$	150	95 %
IIb	2-Cl	$C_{10}H_8O_2NCl$	150	92 %
IIc	4-Cl	$C_{10}H_8O_2NCl$	164	90 %
IId	3-Cl	$C_{10}H_8O_2NCl$	115	90 %
IIe	3-OCH_3	$C_{11}H_{11}O_3N$	170	95 %
IIf	4-CH_3	$C_{11}H_{11}O_2N$	150	90 %
IIIa	-H	$C_{12}H_7O_2NCl_2$	162	85 %
IIIb	2-Cl	$C_{12}H_6O_2NCl_3$	90	80 %
IIIc	4-Cl	$C_{12}H_6O_2NCl_3$	242	82 %
IIId	3-Cl	$C_{12}H_6O_2NCl_3$	84	85 %
IIIe	3-OCH_3	$C_{13}H_9O_3NCl_2$	119	85 %
IIIf	4-CH_3	$C_{13}H_9O_2NCl_2$	186	70 %
IVa	-H	$C_{16}H_{17}O_2NS_2$	222	85 %
IVb	2-Cl	$C_{16}H_{16}O_2NS_2Cl$	92	87 %
IVc	4-Cl	$C_{16}H_{16}O_2NS_2Cl$	162	82 %
IVd	3-Cl	$C_{16}H_{16}O_2NS_2Cl$	172	88%
IVe	3-OCH_3	$C_{17}H_{19}O_3NS_2$	119	82 %
IVf	4-CH_3	$C_{17}H_{19}O_2NS_2$	164	87 %

Biological Testing of compounds.

Heterocyclic thioether compounds IV(a-f) were evaluated for antibacterial against fungi Escherichia coli (EC), pseudomona S. aeruginosa (PA), staphylococcus aureus (SA), Bacillus subtillis (BS), candida albicans (CA), Aspergillus niger (AN).

The result were obtained in the form of clearing zone and were after the period of incubation (37^{0c} for 24 hrs). The zone of inhibition was measured in mm and data is presented in table 2.

CULTURE USED:

Culture abbreviation	Culture name	Culture code
ES	*Escherichia coli*	NCIM 1209
PA	*Pseudomonas aeruginosa*	NCIM 2036
SA	*Staphylococcus aureus*	NCIM 2079
BS	*Bacillus subtilis*	NICM 2250
AN	*Aspergillus niger*	NICM 545

Table-2 Antimicrobial activity of compounds(Zone of inhibition in mm)

Sr. No.	Compound	EC	PA	SA	BS
1	IIa	10.36	11.21	10.14	10.12
2	Iib	10.14	12.21	12.21	11.14
3	IIc	10.22	11.23	10.12	11.12
4	IId	11.89	11.88	10.88	11.45
5	IIe	11.33	11.02	11.14	10.45
6	IIf	10.25	12.23	10.47	10.98
7	IIIa	10.23	10.12	10.23	10.56
8	IIIb	13.11	10.52	10.01	10.89
9	IIIc	12.55	10.41	11.11	10.54
10	IIId	10.10	11.02	10.88	10.87
11	IIIe	10.89	11.08	11.12	11.25
12	IIIf	10.12	10.48	10.78	10.78
13	IVa	-	-	13.66	12.36
14	IVb	-	-	12.97	13.56
15	IVc	-	-	7.47	-
16	IVd	-	-	7.76	8.15
17	IVe	-	-	7.78	9.23
18	IVf	-	-	9.83	10.12
19	Chloramphenicol	28.67	24.44	29.63	26.30
20	Ciprofloxacin	21.11	22.23	22.33	21.34

Media used :

For bacteria : Nutrient agar (Hi-media)

For yeast : MGYP

Inoculum size :

Bacteria : 1 x 10 bacteria per ml.
Yeast : 1 x 10 cells per ml.
❖concentration of compound
(Prepared in ethanol) 100 µ gm 1 disc method used(disc method, disc size 6mm) "__" means no zone of inhibition.

CONCLUSION

In present work we have developed a general method for the synthesis of succinimides with good yield. which can be used for the synthesis of various heterocyclic system. The dicarbaldehydes formed (IIIa-f) are unknown synthones and may be used for the synthesis of various heterocyclic system.

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