SYNTHESIS OF CONDENSED NITROGEN HETEROCYCLES DERIVED FROM INDAN-1,3-DIONE

P.V. Padmanabhan, K.J. Jagannadha Rao, D.V. Ramana and
S.R. Ramadas[+]
Department of Chemistry
Indian Institute of Technology
Madras-600 036
India

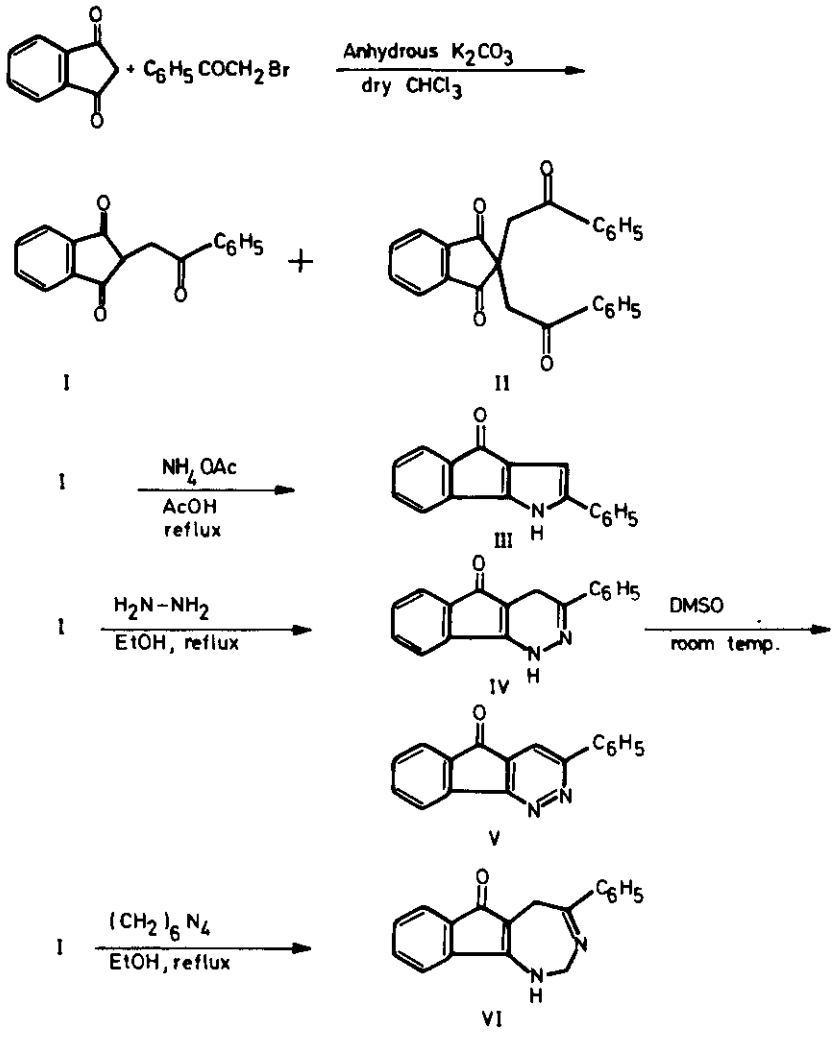
ABSTRACT: Convenient procedures have been evolved out for the synthesis of condensed nitrogen heterocycles such as indenopyrrole, indenopyridazine, indenodiazepine and a few spiroheterocycles from indan-1,3-dione.

A few indenopyrrole and pyridazine heterocycles are claimed to possess hypoglycemic and antibacterial activities[1,2]. This observation prompts us to report here simple procedures for the preparation of newer types of indenopyrrole, indenopyridazine, indenodiazepine derivatives along with a few spiroheterocycles starting with the easily available indan-1,3-dione as detailed below.

Indan-1,3-dione[3] on treatment with phenacylbromide in dry chloroform containing anhydrous potassium carbonate at room temperature afforded 2-phenacylindan-1,3-dione(I) as a pale yellow crystalline solid, mp 160°C, in 75% yield along with 2,2-bisphenacylindan-1,3-dione(II) as white needless, mp 172°C, in 20% yield; ir($CHCl_3$) 3030, 1735, 1680, 1590, 1440 and 1335 cm^{-1}; δ($CDCl_3$) 3.78(4H, s), 7.2-7.8(14H, m). 2-Phenacylindan-1,3-dione(I) on treatment with solid ammonium acetate in refluxing glacial acetic acid furnished 2-phenyl-4-oxo-indeno[1,2-b]pyrrole(III) as an amorphous red solid, mp 280°C, in 90% yield; ir(KBr) 3030, 1650, 1600, 1560, 1375 and 1265 cm^{-1}; δ(D_6-DMSO) 7.3-8.3(11H, m), $M^{+\cdot}$ at m/z 245(30%) and m/z 244(100%).

2-Phenacylindan-1,3-dione(I) on condensation with hydrazine hydrate (98-99%) in refluxing ethanol(95%) for 1h gave a dark pink solid, mp 310°C, characterised as (IV) in 95% yield; ir(KBr) 3030, 2950, 1650, 1550, 1465, 1375, and 1200 cm^{-1} and it was soon realised that this compound underwent

SCHEME - I

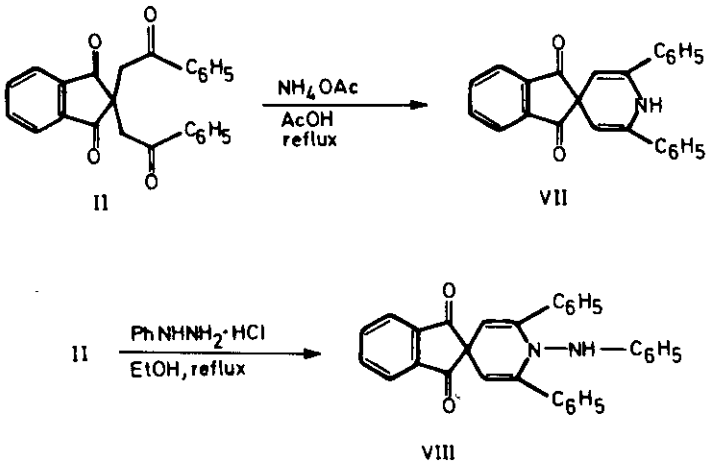

+ C6H5COCH2Br
Anhydrous K2CO3
dry CHCl3
C6H5
C6H5
C6H5
I
II
NH4OAc
AcOH
reflux
III
H2N-NH2
EtOH, reflux
IV
DMSO
room temp.
V
(CH2)6N4
EtOH, reflux
VI

areal oxidation in presence of DMSO at room temperature furnishing the indeno-pyridazine derivative, 3-phenyl-5-oxo-indeno[1,2-c]pyridazine(V) as an yellow crystalline solid, mp 216°C, in 92% yield; ir(KBr) 3165, 3030, 1640, 1590 and 1500 cm^{-1}; δ(D_6-DMSO) 7.6-8.5 (10H, m); $M^{+\cdot}$ at m/z 258(100%); m/z 230(23%); m/z 202(55%); m/z 200(31%).

2-Phenacylindan-1,3-dione(I) was allowed to react with hexamethylene-tetramine in refluxing ethanol(95%) for 4h. Concentration of the resulting reaction mixture to half of the original volume furnished on cooling a dark brown crystalline solid which on repeated recrystallization from ethanol (95%) gave 4-phenyl-6-oxo-indeno[1,2-d]-2(H), 5(H)-1,3-diazepine(VI) as a white crystalline solid, mp 222°C, in 80% yield; ir($CHCl_3$) 3350, 3030, 2950, 2900, 2820, 1735, 1695, 1625 and 1590 cm^{-1}. δ($CDCl_3$) 1.88(1H, s) 3.4(2H, s), 4.3(2H, s), 7.2-8.0(9H, m). The signal at δ 1.88 disappeared on D_2O exchange; $M^{+\cdot}$ at m/z 274(95%), m/z 172 (73%), m/z 144(39%) and m/z 117(100%).

2,2-Bisphenacylindan-1,3-dione on condensation with ammonium acetate in refluxing glacial acetic acid furnished the expected spiroheterocycle(VII) as a brownish solid, mp 272°C, in 70% yield. Repeated recrystallization from acetone gave an analytical sample of spiro[2,6-diphenyl-1(H)-pyridine-4,2'-indan-1',3'-dione](VII) as an yellow crystalline solid, mp 280°C; ir(KBr) 3030, 1650, 1550, 1325, 1270, 1260, 910, 810 and 750 cm^{-1}; $M^{+\cdot}$ at m/z 363(100%), m/z 362(88%), m/z 181(15.5%). Insolubility in the usual NMR solvents prevented the study of the NMR spectral characteristics for this compound. Similarly 2,2-bisphenacylindan-1,3-dione(II) on condensation with phenylhydrazine hydrochloride in refluxing ethanol as expected gave the spiroheterocycle(VIII) as pale brown crystals, mp 215°C, in 86% yield. Recrystallization from ethanol gave the analytical sample of spiro[N-anilino-2,6-diphenylpyridine-4,2'-indan-1',3'-dione](VIII) as a pale red crystalline solid, mp 227°C; ir($CHCl_3$) 3330, 3030, 1680, 1570, 1470, 1450, 1370, 1150, 970 and 935 cm^{-1}. δ($CDCl_3$) 7.3-8.3 (22H, m); $M^{+\cdot}$ at m/z 454(100%) and m/z 218(23%).

SCHEME - II



ACKNOWLEDGEMENT: Two of us (P.V.P. and K.J.J.) are thankful to the CSIR (India) for junior research fellowships.

REFERENCES:

1. S.C.Lahiri and B.Pathak, J. Med. Chem., 1965, 8, 131-3(Eng).
2. K.Takashi, I.Itsuo, T. Chuji, Hakko Kogaku Zasshi, 1973, 5. 66-70(Japan).
3. T.Shriner, J. Am. Chem. Soc., 1973, 55, 3027.

Received, 28th April, 1980