S U M M A R Y

The work embodied in the present thesis has been divided into four parts.

A. The first part deals with the preparation and circular dichroism studies of 3β-hydroxy 20,29,30-trisnor lupan 28, 19β-lactone (33) and 3β-hydroxy 20,29,30-trisnor lupan 28, 13β-lactone (34).

B. The second part describes the studies of lead (IV) acetate acetoxylation of friedelin (95) and CD studies of 2-acetoxy ketones thus obtained.

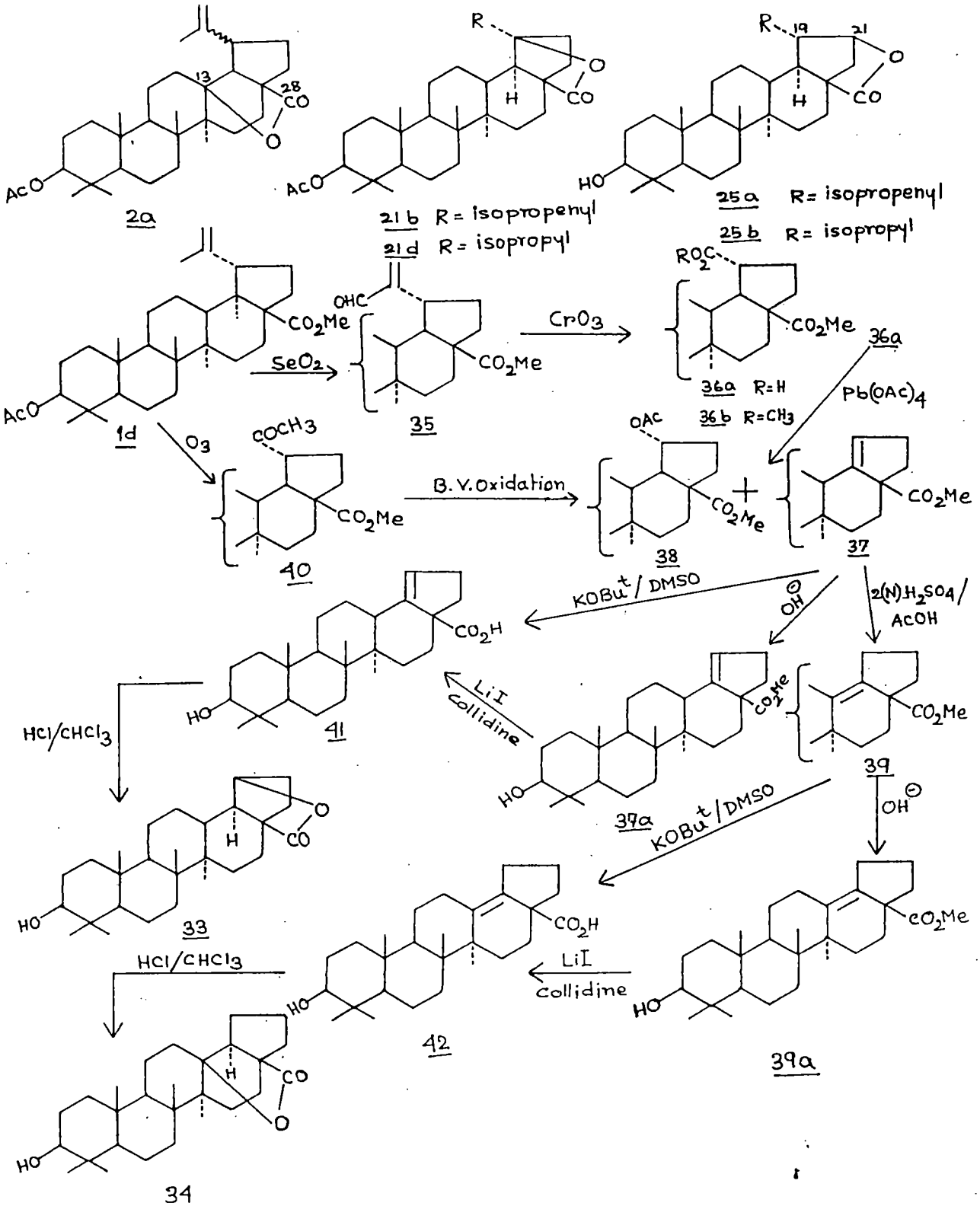
C. The third part describes the partial synthesis of isomeric olean 13(18)en diols — namely the 2β, 3β (35); 2α, 3α (38) and 2α, 3β (110) isomers.

D. The fourth part describes the isolation and characterisation of neutral constituents of two euphorbiaceae species - Antidesma acuminatum and Bridelia retusa.

A. Part I, Chapter II deals with the preparation of lactone 33 and 34 starting from 3β-acetoxy methyl betulinate. 3β-acetoxy methyl betulinate (1d) m.p. 199-200°, $[\alpha]_D$ + 14°, on selenium dioxide oxidation gave an unsaturated aldehyde (35) m.p. 276-8° which, on chromium trioxide oxidation afforded the bisnor acid (36a) m.p. 261-2° — characterised as the dimethyl ester(36b) m.p. 180-1°, $[\alpha]_D$ - 14°. Lead (IV) acetate oxidation of the bisnor acid (36a) in the presence of pyridine and Cu(II) acetate gave the key intermediate, the unsaturated acetoxy methyl

ester (37) m.p. 206-7°, $[\alpha]_D$ + 6° (60%) along with a saturated ester acetate (38) m.p. 190°, $[\alpha]_D$ - 13° (30%). Stereo structure of (38) was deduced by stereospecific Baeyer-Villiger oxidation of the nor keto ester (40)- obtained by ozonolysis of acetyl methyl betulinate (1d) under condition to preclude epimerisation at C-19. Unsaturated acetoxy ester (37) (ν_{max} 845 cm^{-1}; δ 5.4 - trisubstituted double bond) on hydrolysis either by DMSO - ^{t}BuOK or LiI - Collidine followed by dry hydrogen chloride lactonisation gave the 3β-hydroxy 20, 29, 30-trisnor lupan-28, 19β-lactone (33) m.p. 261-2°, $[\alpha]_D$ - 8.4°. The same unsaturated acetoxy ester (37) after 2(N) sulfuric acid - acetic acid isomerisation afforded the isomeric unsaturated ester acetate (39), m.p. 168-70°, $[\alpha]_D$ -43.49° (^{1}H NMR did not show vinyl proton resonance - tetrasubstituted double bond). 39 on similar hydrolysis and followed by lactonisation with dry HCl gas furnished the isomeric hydroxy lactone (34), 3β-hydroxy 20, 29, 30-trisnor lup-28, 13β- lactone m.p. 241-2°, $[\alpha]_D$ + 33.3°. The structures of lactone (33) and (34) were ascertained unequivocally by ^{1}H NMR and ^{13}C NMR analysis. 33 showed NMR peak at δ 4.2 (1H, m) and δ 82.1 (H-$\underset{|}{C}_{19}$-O-; a doublet, carbon atom of secondary lactone termination) while 34 did not show peak around δ4.2 but showed peak at δ80.8 (-$\underset{|}{C}_{13}$-O-; a singlet, carbon atom of tertiary lactone termination) in ^{1}H NMR and ^{13}C NMR respectively.

Acetyl betulinic acid m.p. 288-90°, $[\alpha]_D$ + 18.5°, on mercuric acetate oxidation gave a tertiary γ-lactone which, initially assigned C-28, 13 -lactone structure (2a), has been revised more recently to C-28, 19 -lactone structure (21b).


2a
21b R = isopropenyl
21d R = isopropyl
25a R = isopropenyl
25b R = isopropyl
1d
35
36a R=H
36b R=CH3
36a
Pb(OAc)4
SeO2
CrO3
O3
B.V.Oxidation
40
38
37
KOBut / DMSO
OH⊖
2(N)H2SO4 / AcOH
41
LiI collidine
HCl/CHCl3
33
39
39a
34
42
39a

Subsequently, the naturally occurring lactone thurberogenin, originally allocated a C-28, 19 lactone structure (21b) has been modified to C-28, 21 lactone (25a).

CD Measurements:

The physical techniques IR, NMR and mass are not of much use in distinguishing the tertiary γ-lactones e.g. (2a) and (21b). Since the powerful physical tool CD is increasingly being applied at present to solve structures and stereochemical aspects of the asymmetric environment of the lactone chromophore, we provide here physical evidence from CD-measurements for the structure of the lactones (21b) and (25a). For this purpose authentic C-28, 19 lactone (33) and C-28, 13 lactone (34) have been prepared and CD-curves of these model lactones have been studied along with that of the lactone (2a or 21b) obtained by Hg(II) acetate reaction of acetyl betulinic acid and also thurberogenin (25a). The comparabilities of CD data in the two types of lactones provided convincing physical evidence in support of the revised formulation of Hg(II) acetate oxidation product as well as thurberogenin. [This part of our work has appeared in print "Preparation and Circular Dichroism Studies of Triterpene Lactones of Lupane Series" by G. Dutta and S.N.Bose, Tetrahedron Letters, 29, 5807-5810 (1988). A photo copy of the reprint attached at the end of the thesis.]

B. Part II, Chapter II describes the work on lead (IV) acetate acetoxylation reaction of friedelin (95) in presence of

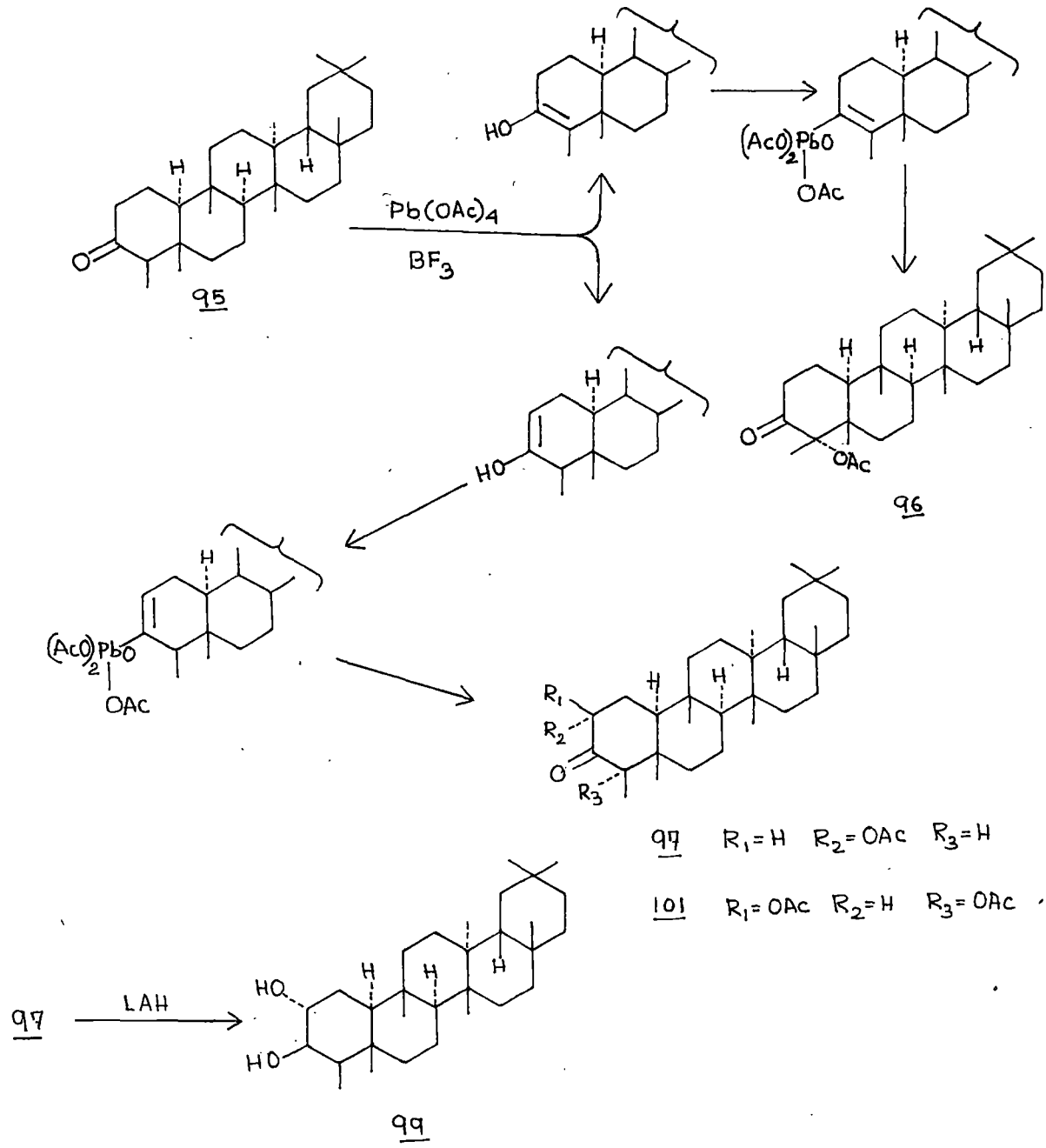
boron trifluoride etherate complex. Four products were isolated from this reaction. Three of them have been characterised as the 2α-acetoxy friedelin (97), m.p. 256-8°, $[\alpha]_D$ - 20°; 4α-acetoxy friedelin (96), m.p. 290°, $[\alpha]_D$ - 45° and 2β, 4α-diacetoxy friedelin (101), m.p. 290°. The stereo-structures of these acetoxy friedelin derivatives have been established by mechanistic consideration of lead (IV) acetate acetoxylation of the ketones, from the known preference of the attack of the acetate of the intermediate organolead salt from the less hindered α-face of the molecule as in case of steroid and triterpenoids ring A, and physical evidence based on ^{1}H NMR, mass and IR spectra.

Partial Synthesis of Pachysandiol-A (99):

Pachysandiol-A (99), friedelane 2α, 3β-diol, isolated from Pachysandria terminalis has previously been synthesised by a sequence involving several steps. We have carried out a short convenient synthesis. 2α-acetoxy friedelin (97), one of the major products of lead (IV) acetate acetoxylation of friedelin (95), on lithium aluminium hydride reduction afforded 99 in high yield (76%).

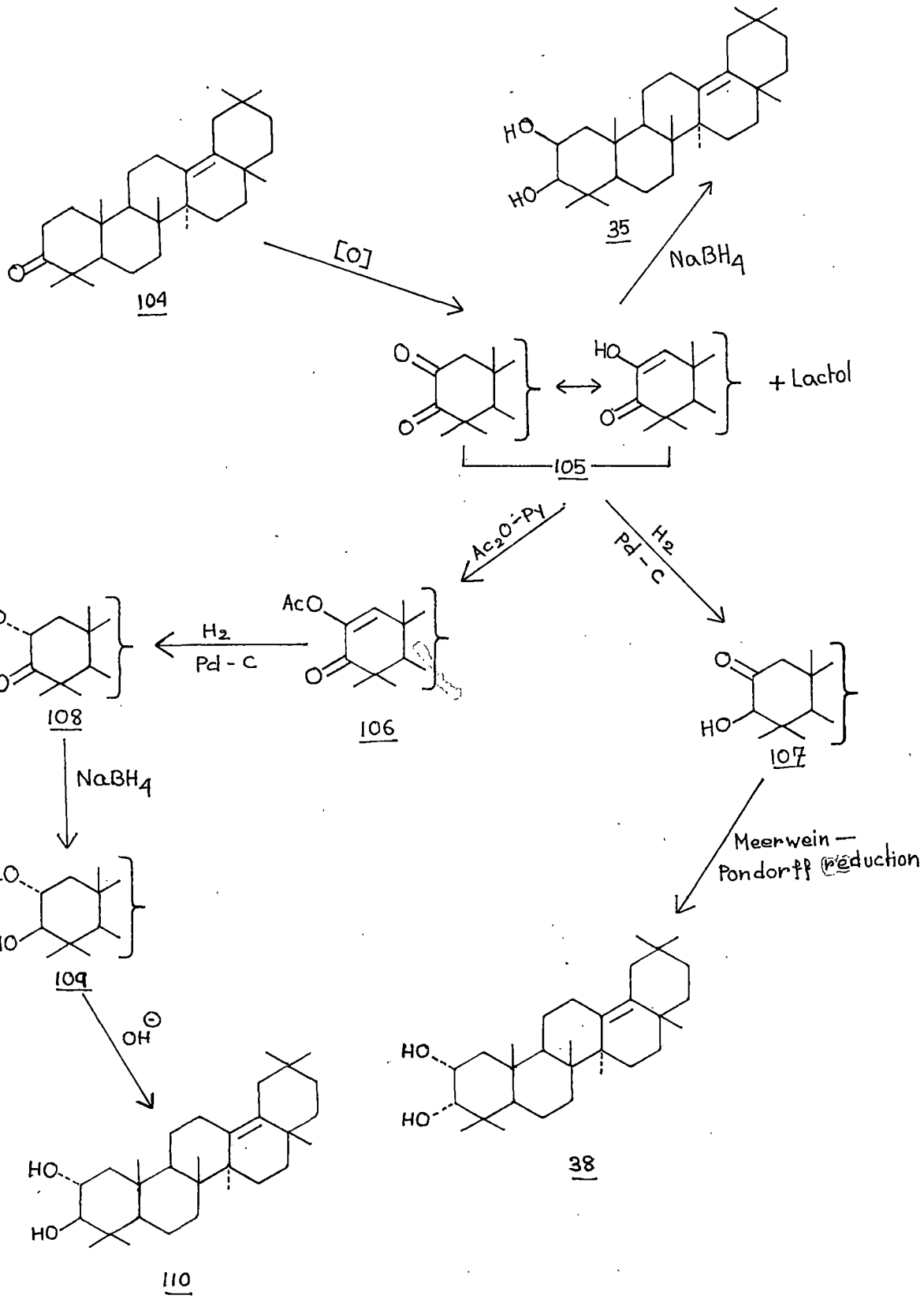
Chiroptical measurements:

CD measurements of friedelin (95), 2α-acetoxy friedelin (97), 2β-acetoxy friedelin (98) and 2β, 4α-diacetoxy friedelin (101) were undertaken with a view to studying antioctant behaviour of 1-acetoxy-2-ketones as have been done in steroids and other fields. 2-acetoxy-3-keto derivatives of friedelan triterpene show


Pb(OAc)4
BF3
95
96
97 R1=H R2=OAc R3=H
101 R1=OAc R2=H R3=OAc
97
LAH
99

significant anti-octant behaviour as reflected in CD measurements. [This part of our work has appeared in print "Acetoxylation of Friedelin by Lead (IV) Acetate and Anti-Octant Behaviour of 2-Acetoxy Ketones" by G. Dutta and S.N.Bose, Indian Journal of Chemistry, Vol. 28B, 975 - 977 (1989). A reprint has been attached at the end of the thesis].

C. Part III, Chapter II deals with the preparation of isomeric olean-13(18)en-2,3-diols starting from the diosphenol of δ-amyrone (105), m.p. 259-61°, $[\alpha]_D$ - 33.7°. δ-amyrone (104) m.p. 200-201°, $[\alpha]_D$ - 12° on autoxidation gave the diosphenol (105), which on sodium borohydride reduction afforded the naturally occurring olean-13(18)en-2β, 3β-diol (35) m.p. 227°, $[\alpha]_D$ - 56.20°. Diosphenol on catalytic hydrogenation afforded the 2-keto-δ-amyrin (107) m.p. 236°, $[\alpha]_D$ - 58.24° which on Meerwin Pondorff reduction gave the naturally occurring olean-13(18)en-2α, 3α-diol (38) m.p. 236°, $[\alpha]_D$ - 20°. The same diosphenol on acetylation gave the corresponding diosphenol acetate (106), m.p. 184°, $[\alpha]_D$ - 42.8°. This on hydrogenation afforded the 2α-acetoxy-δ-amyrone (108), m.p. 187°, $[\alpha]_D$ - 43.72°. Sodium borohydride reduction of 2α-acetoxy-δ-amyrone (108) afforded the 2α-acetoxy-δ-amyrin (109) m.p. 210, $[\alpha]_D$ - 53.19°. This on subsequent alkaline hydrolysis gave the desired synthetic olean-13(18)en-2α, 3β-diol (110), m.p. 212-4°, $[\alpha]_D$ - 62.35°; which has not yet been reported in the literature. The stereochemistry of these isomeric diols have been analysed in the light of NMR spectroscopy reported very recently


104
[O]
35
NaBH4
HO
HO
O
O
HO
+ Lactol
105
Ac2O-Py
H2
Pd - C
AcO
O
108
H2
Pd - C
AcO
O
106
HO
O
107
NaBH4
AcO
HO
109
OH⊖
Meerwein — Pondorff reduction
HO
HO
38
HO
HO
110

[H. Kojima and H. Ogura; Phytochemistry, 28, 1703 (1989)7.

D. Part IV, Chapter - II describes the isolation and characterisation of α-spinosterol from the neutral part of the benzene extract of the bark of Antidesma acuminatum; and friedelin, epi-friedelanol and stigmasterol from the neutral part of the benzene extract of the bark of Bridelia retusa. Identification has been achieved by spectral data, physical constants, m.p., m.m.p. and IR comparison with the authentic samples.