

## **APPENDIXES**

# APPENDIX

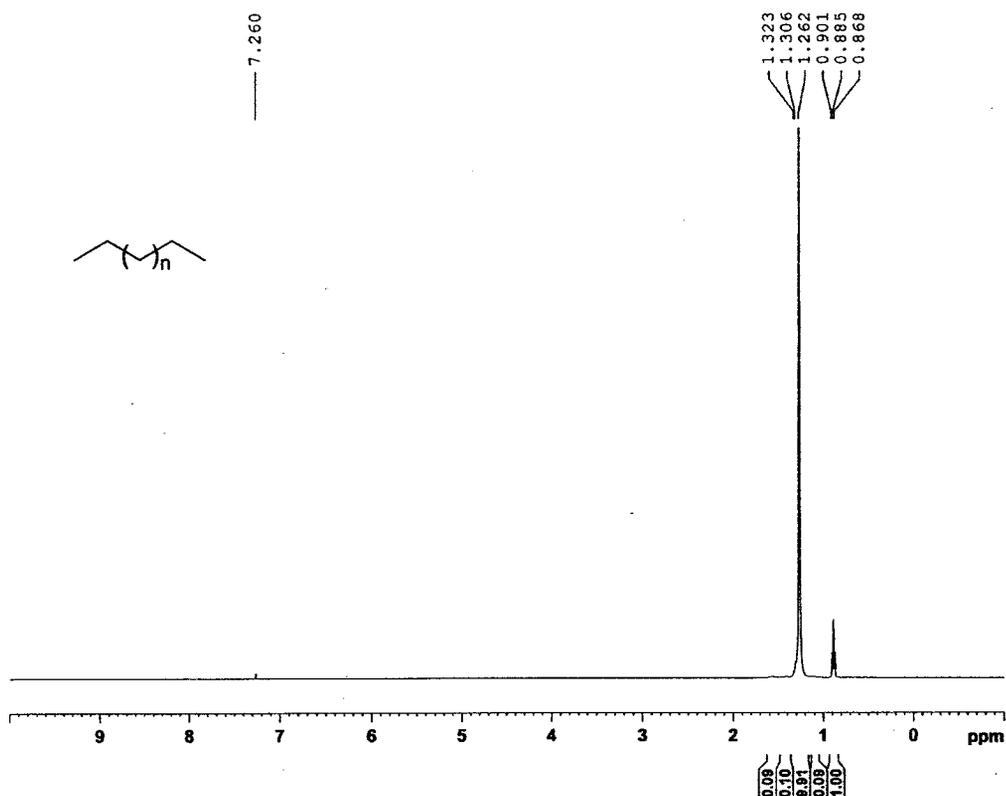


Figure 7  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ) spectrum of saturated hydrocarbons (LFD-H1)

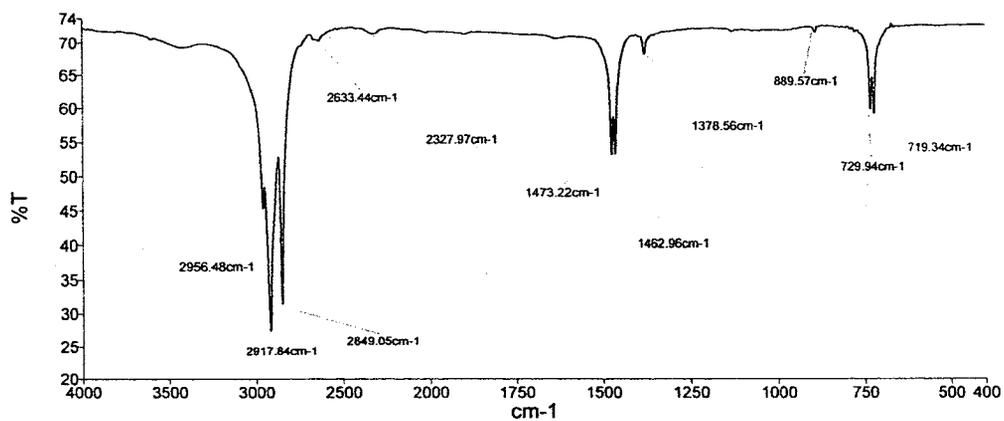
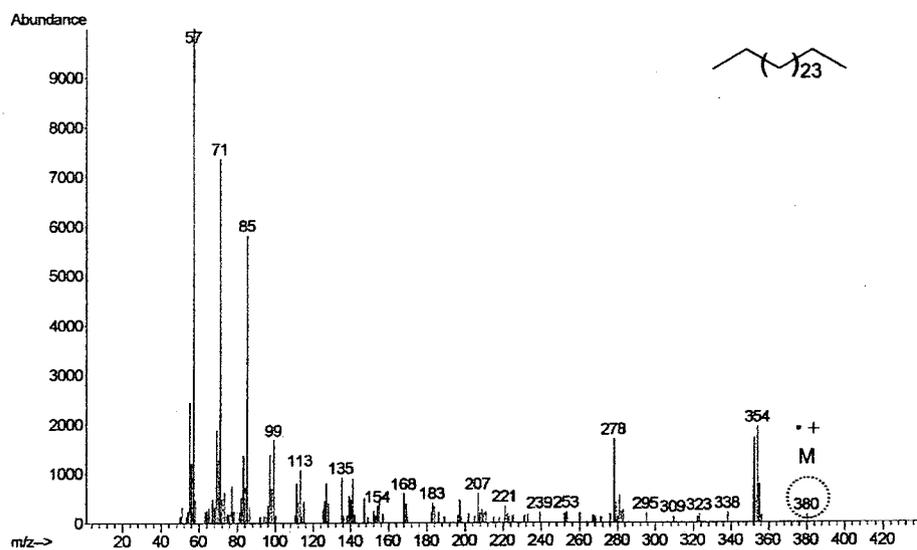
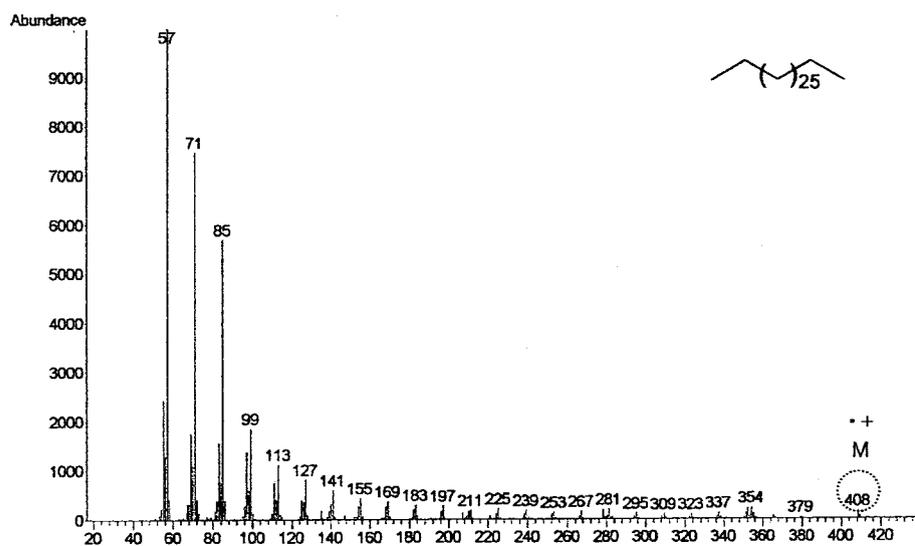


Figure 8 IR (KBr) spectrum of saturated hydrocarbons (LFD-H1)



**Figure 9 GC-MS spectrum of heptacosane (C<sub>27</sub>H<sub>56</sub>)**



**Figure 10 GC-MS spectrum of nonacosane (C<sub>29</sub>H<sub>60</sub>)**

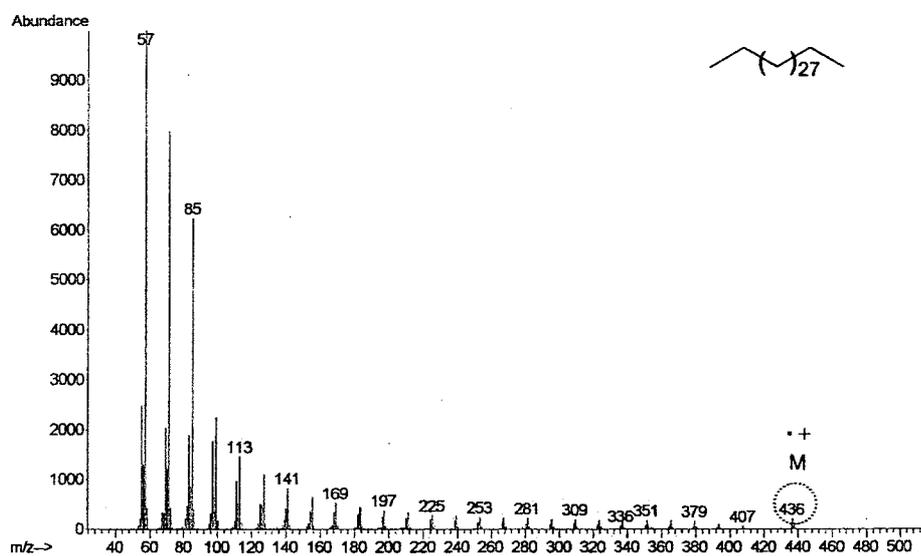


Figure 11 GC-MS spectrum of hentriacotane (C<sub>31</sub>H<sub>64</sub>)

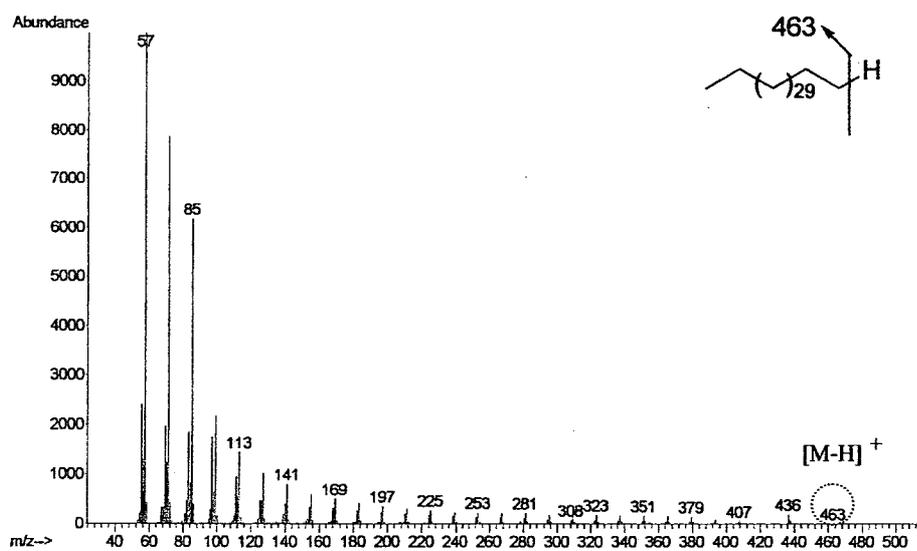


Figure 12 GC-MS spectrum of tritriacotane (C<sub>33</sub>H<sub>68</sub>)

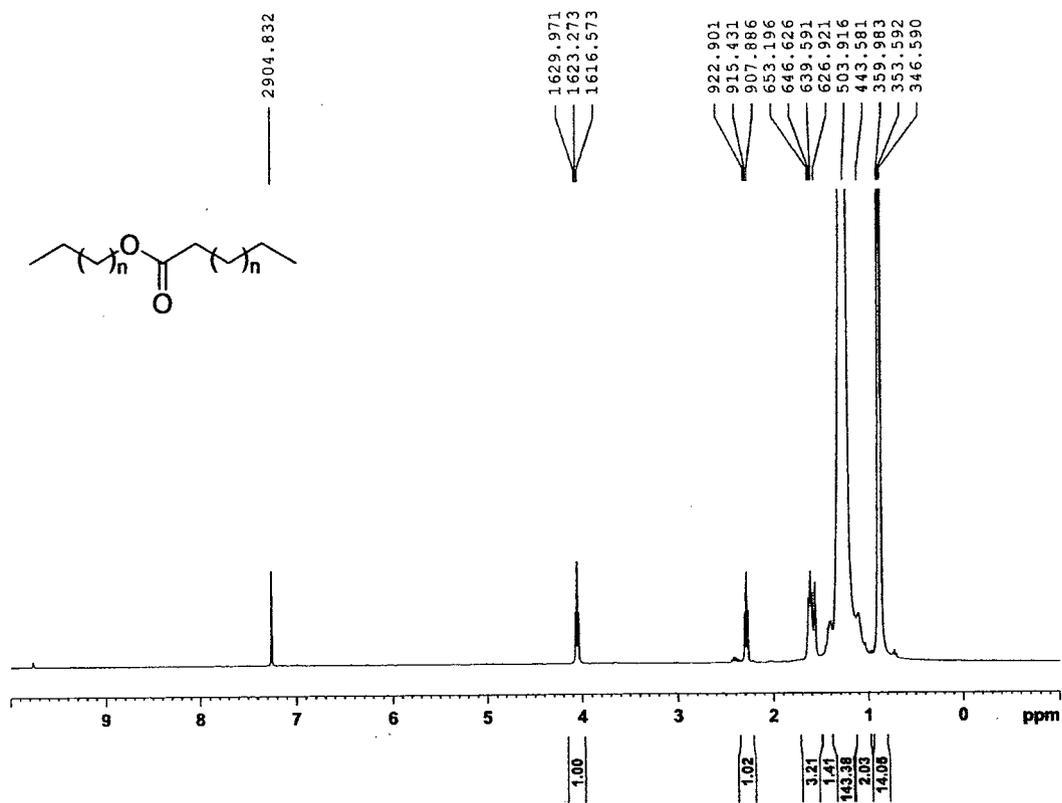


Figure 13 <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) spectrum of wax esters (LFD-H2)

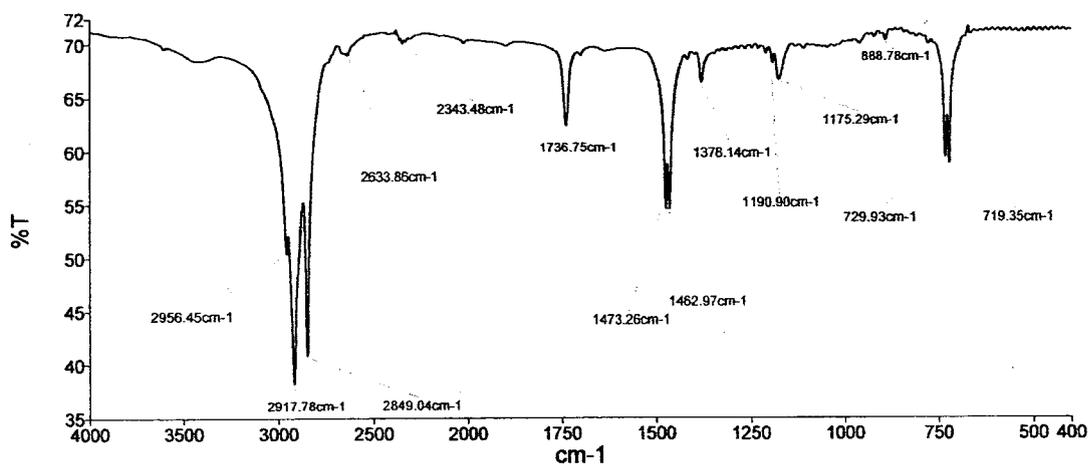


Figure 14 IR (KBr) spectrum of wax esters (LFD-H2)

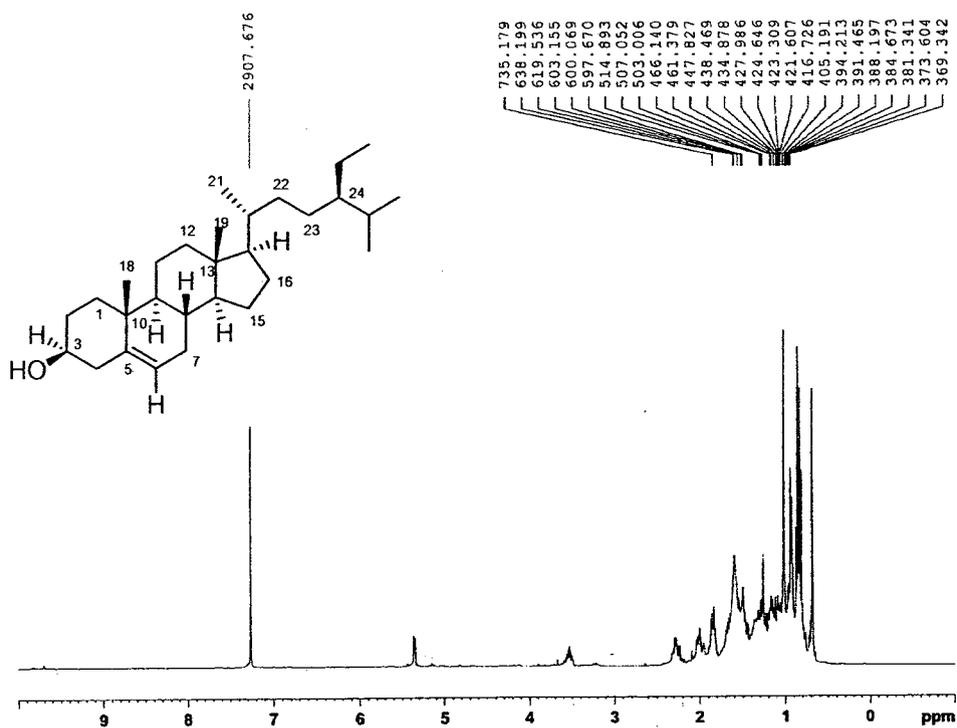


Figure 15  $^1\text{H NMR}$  (400 MHz,  $\text{CDCl}_3$ ) spectrum of  $\beta$ -sitosterol (LFD-H3)

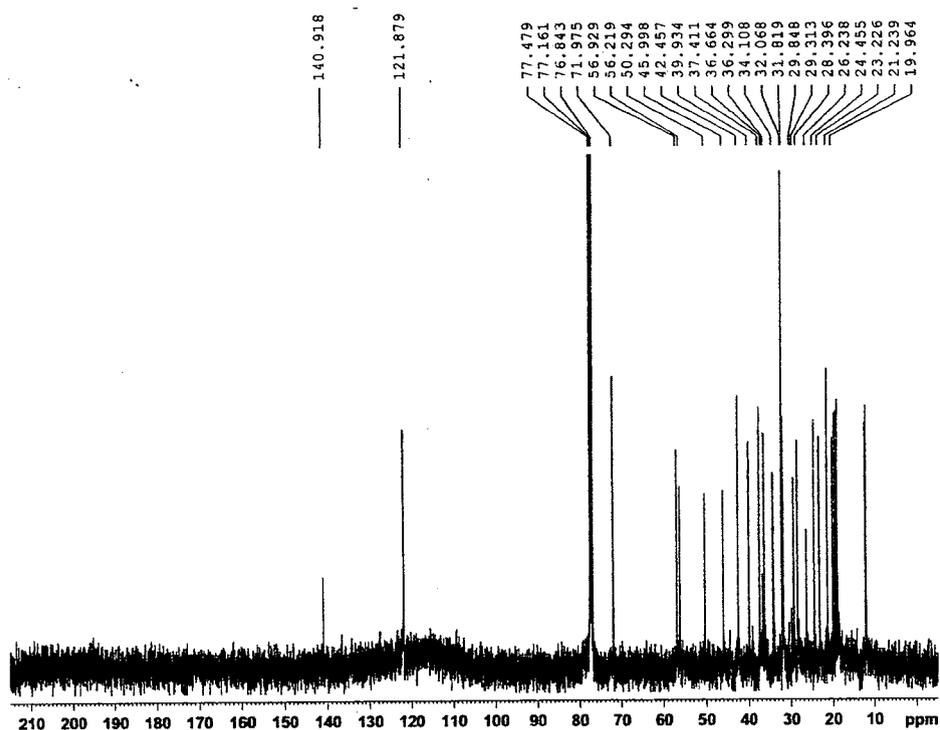


Figure 16  $^{13}\text{C NMR}$  (100 MHz,  $\text{CDCl}_3$ ) spectrum of  $\beta$ -sitosterol (LFD-H3)

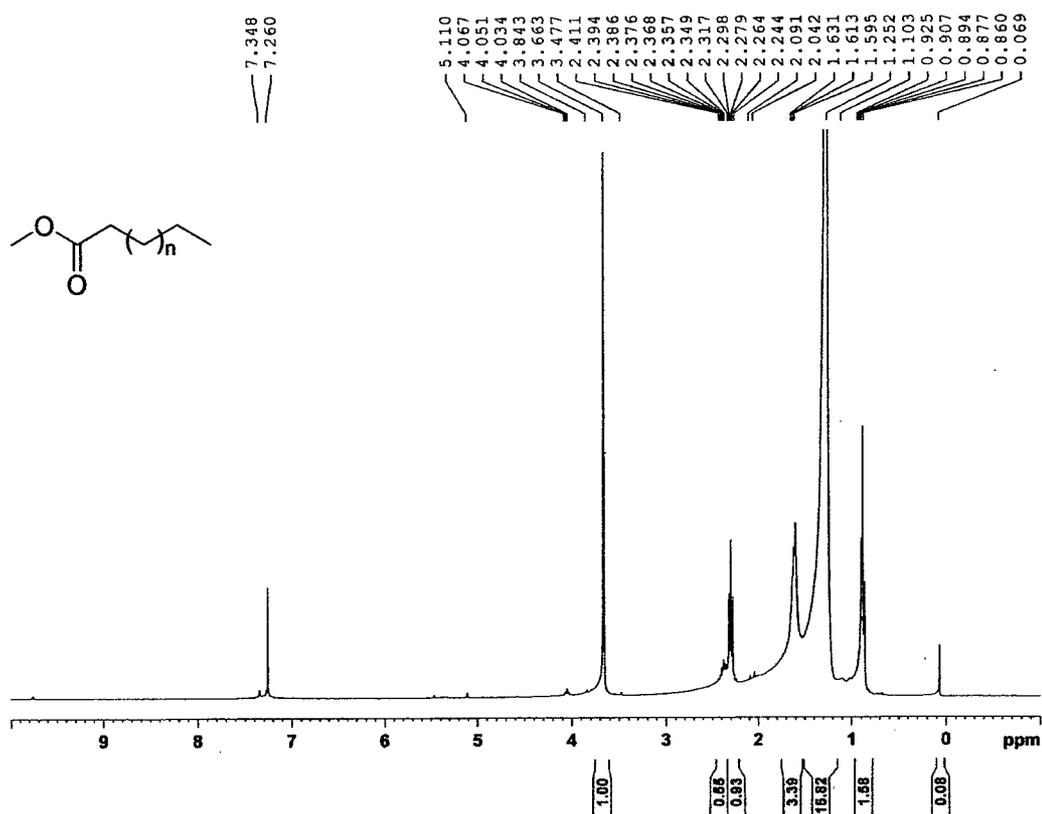


Figure 17 <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) spectrum of saturated fatty acid methyl esters (LFD-H4)

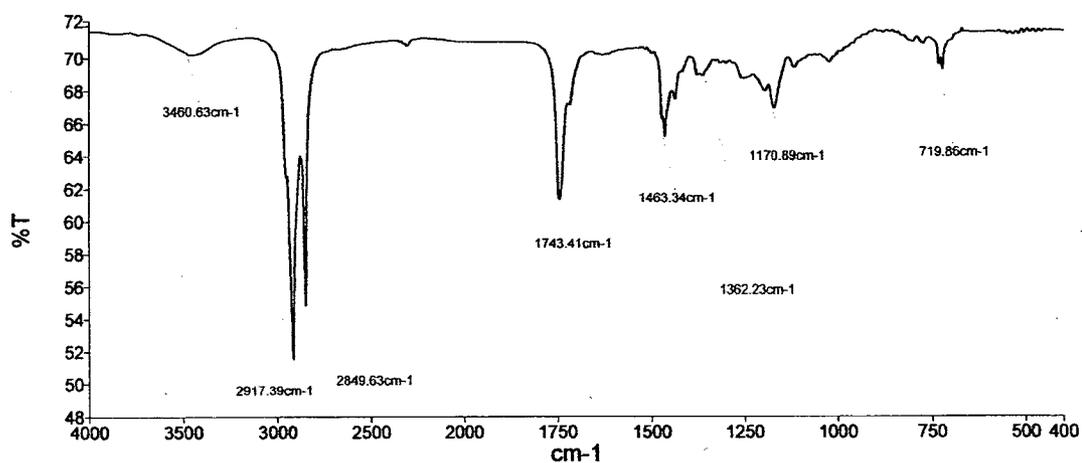
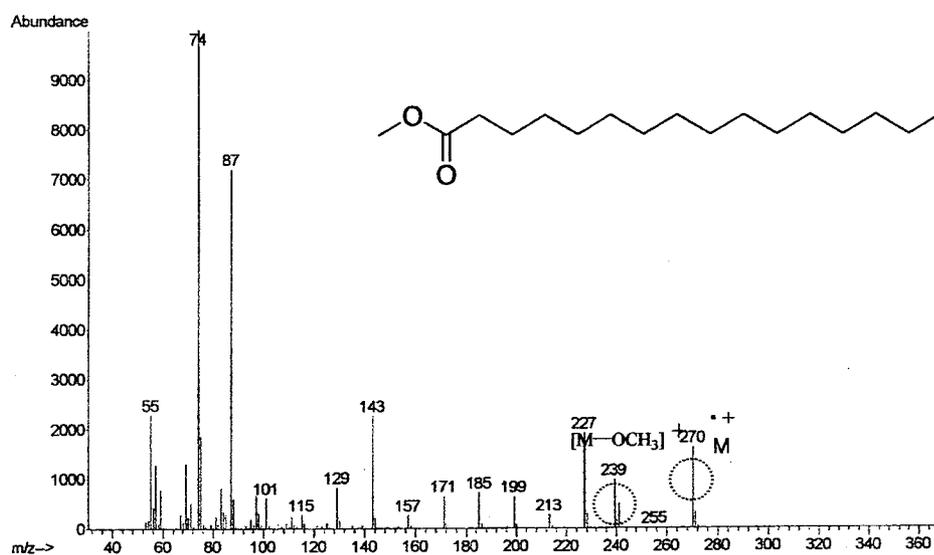
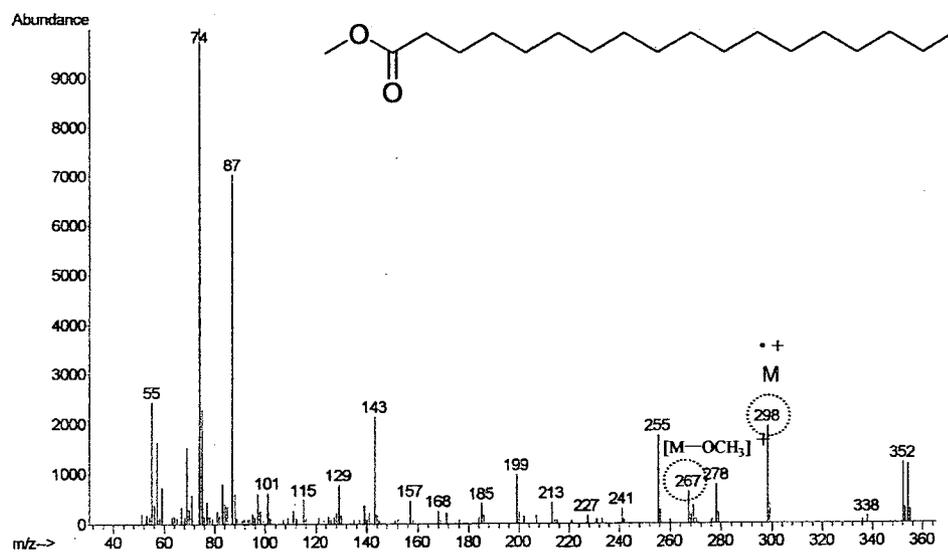


Figure 18 IR (neat) spectrum of saturated fatty acid methyl esters (LFD-H4)



**Figure 19 GC-MS spectrum of hexadecanoic acid methyl ester (methyl palmitate)**  
**(C<sub>17</sub>H<sub>34</sub>O<sub>2</sub>)**



**Figure 20 GC-MS spectrum of octadecanoic acid methyl ester (methyl stearate)**  
**(C<sub>19</sub>H<sub>38</sub>O<sub>2</sub>)**

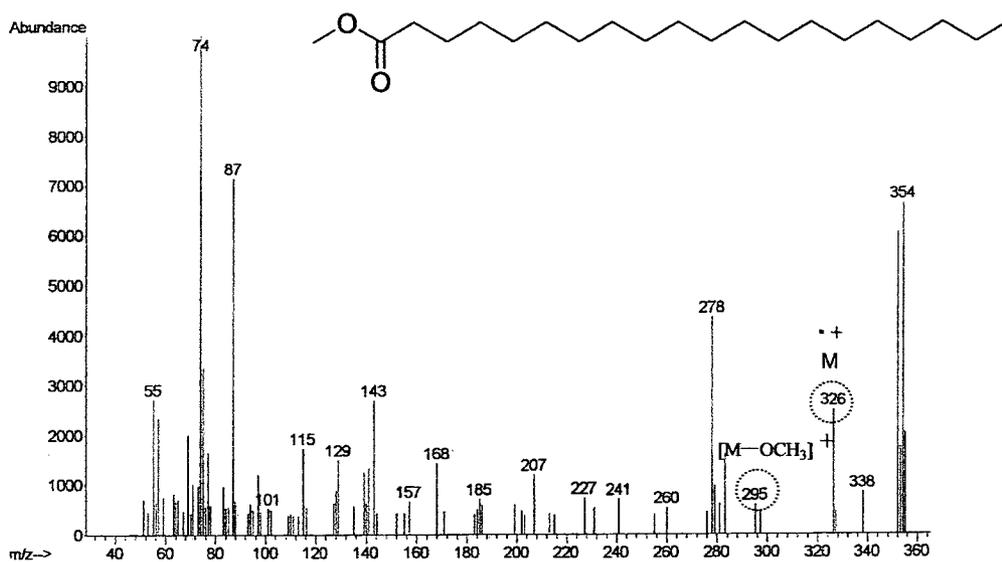


Figure 21 GC-MS spectrum of eicosanoic acid methyl ester (methyl arachidate)  
(C<sub>21</sub>H<sub>42</sub>O<sub>2</sub>)

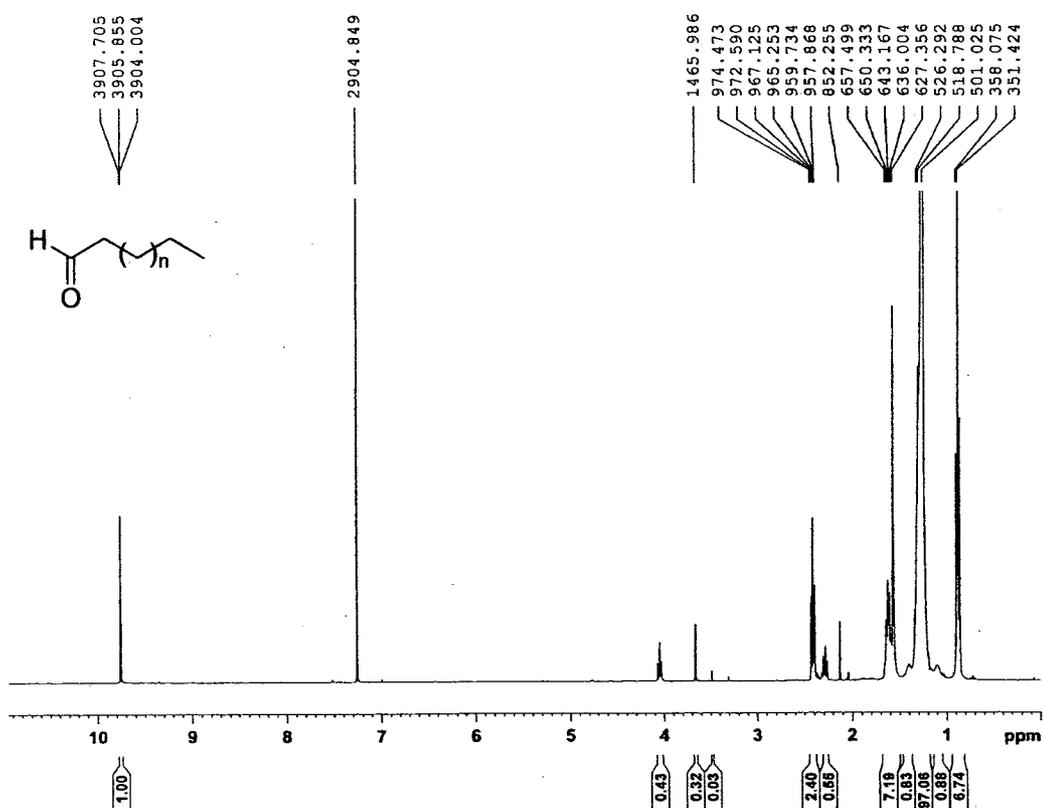


Figure 22 <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) spectrum of fatty aldehyde (LFD-D1)

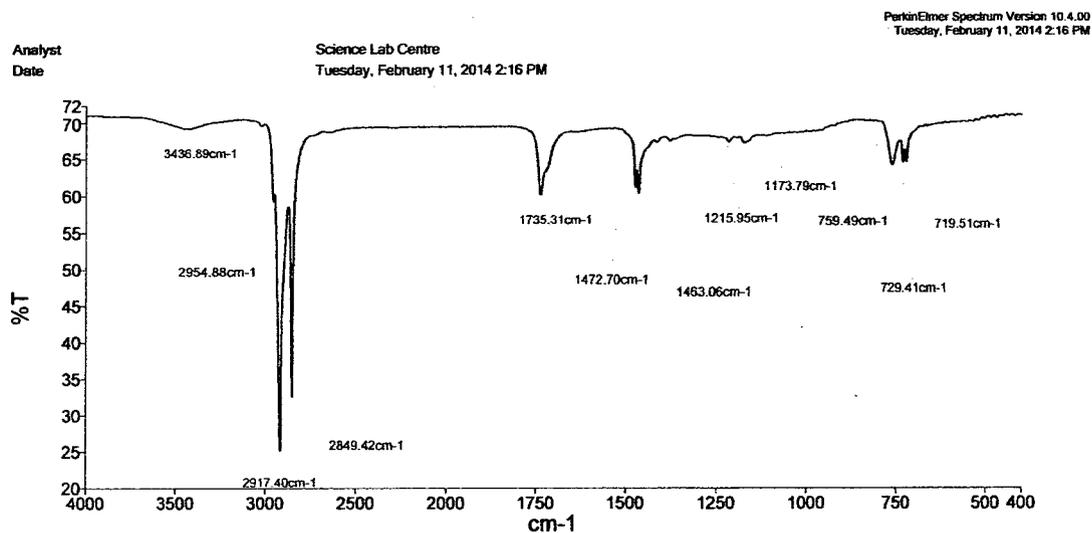


Figure 23 IR (neat) spectrum of fatty aldehyde (LFD-D1)

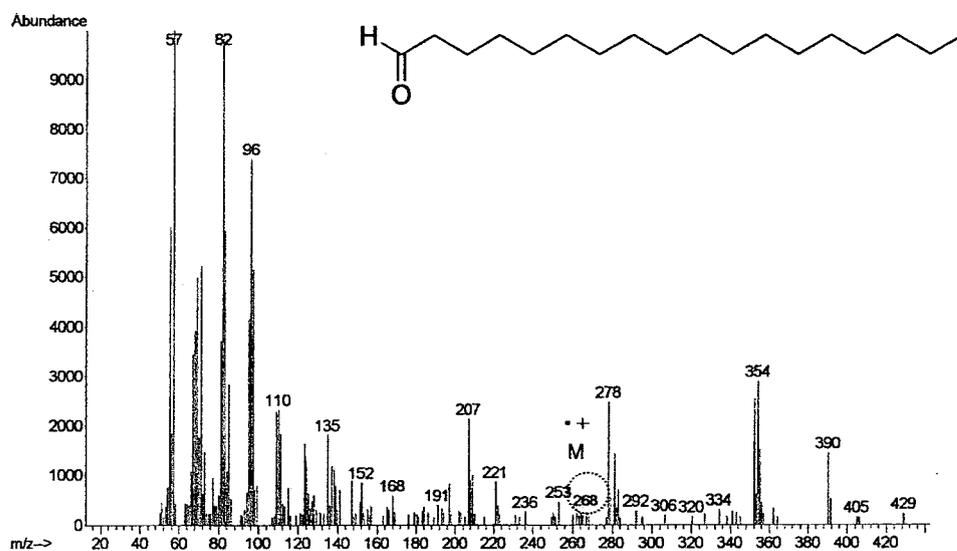


Figure 24 GC-MS spectrum of octadecanal ( $C_{18}H_{36}O$ )

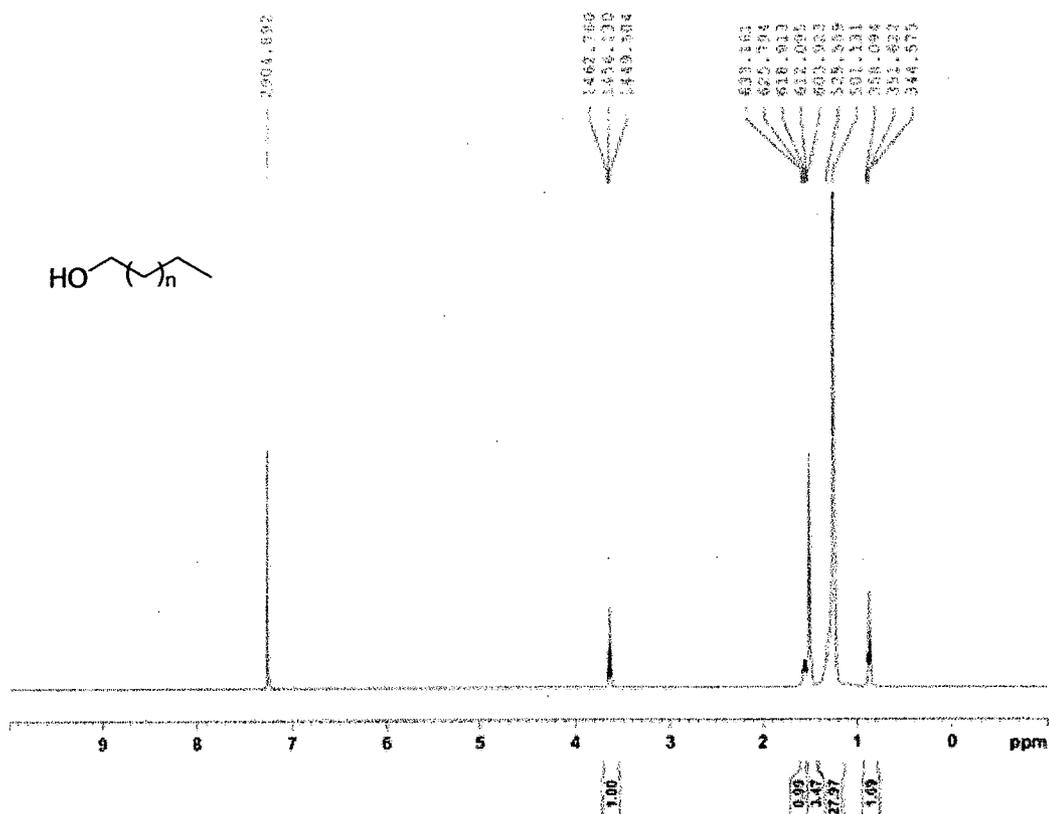


Figure 25 <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) spectrum of fatty alcohols (LFD-D2)

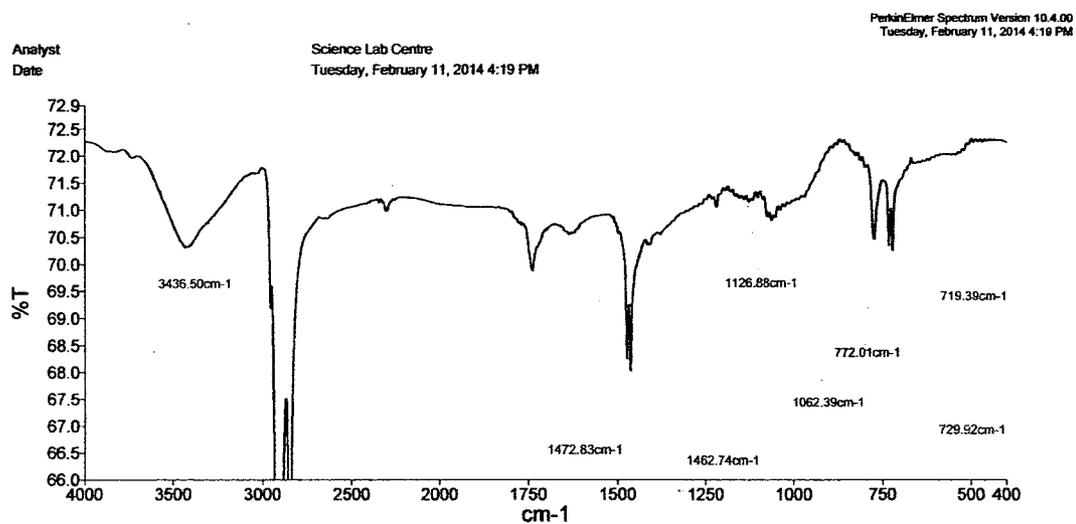


Figure 26 IR (neat) spectrum of fatty alcohols (LFD-D2)

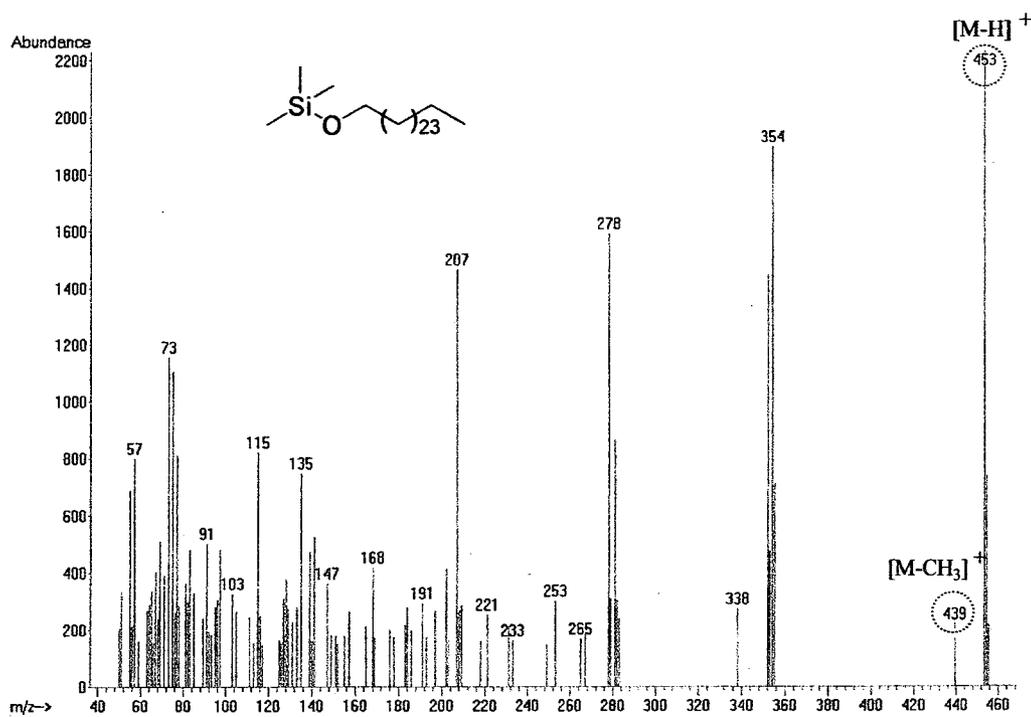


Figure 27 GC-MS spectrum of hexacosanol trimethylsilyl ether ( $C_{29}H_{62}SiO$ )

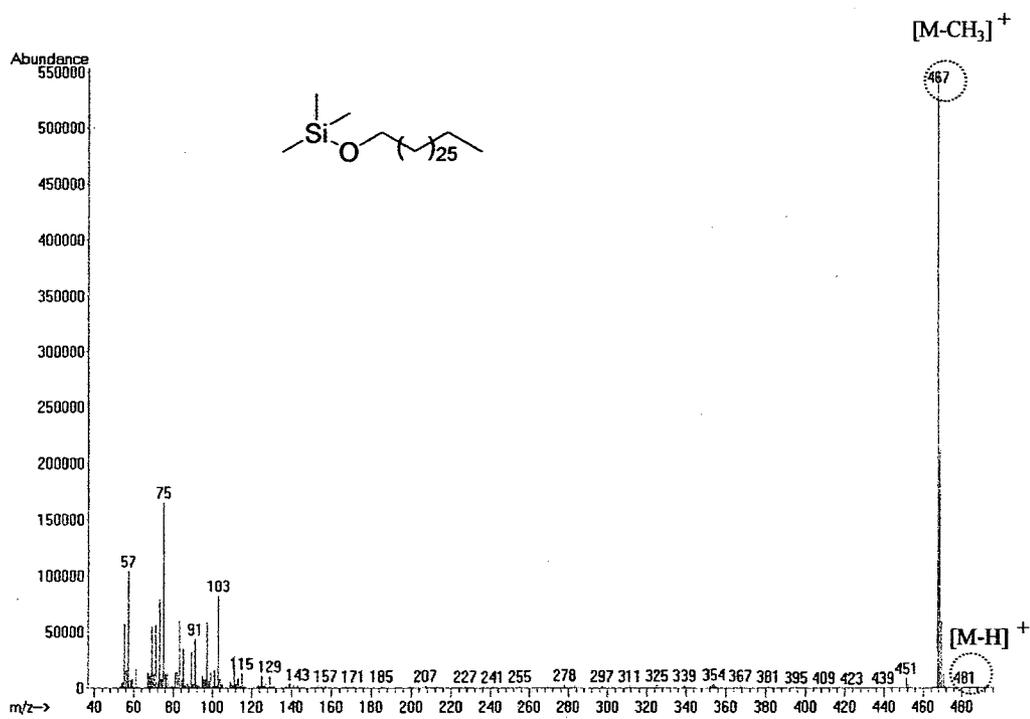


Figure 28 GC-MS spectrum of octacosanol trimethylsilyl ether ( $C_{31}H_{66}SiO$ )

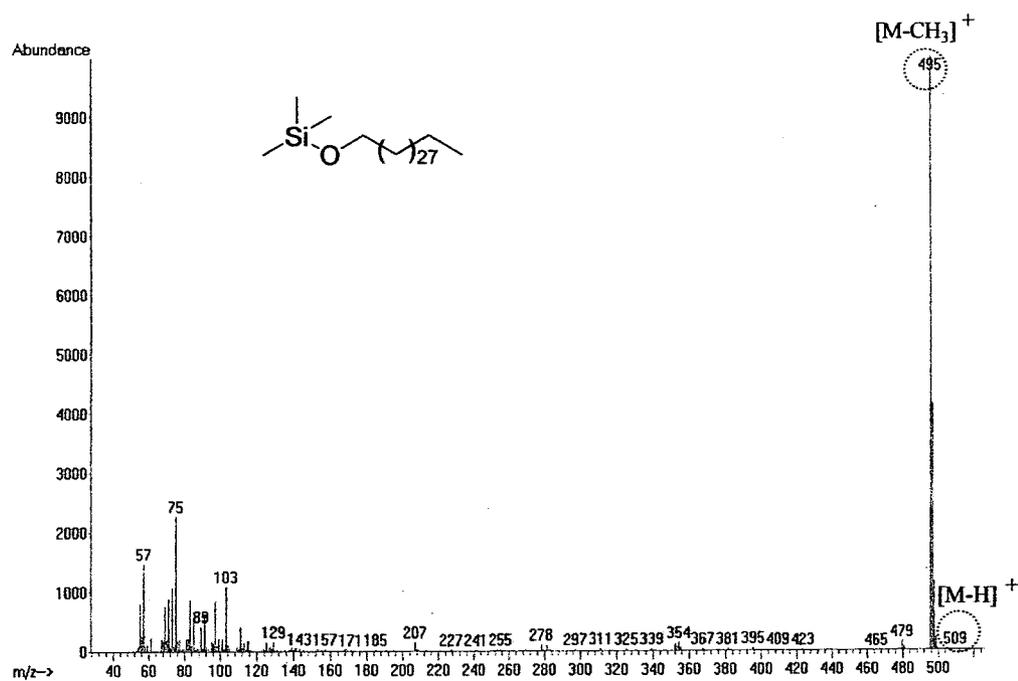


Figure 29 GC-MS spectrum of triacotanol trimethylsilyl ether ( $C_{33}H_{70}SiO$ )

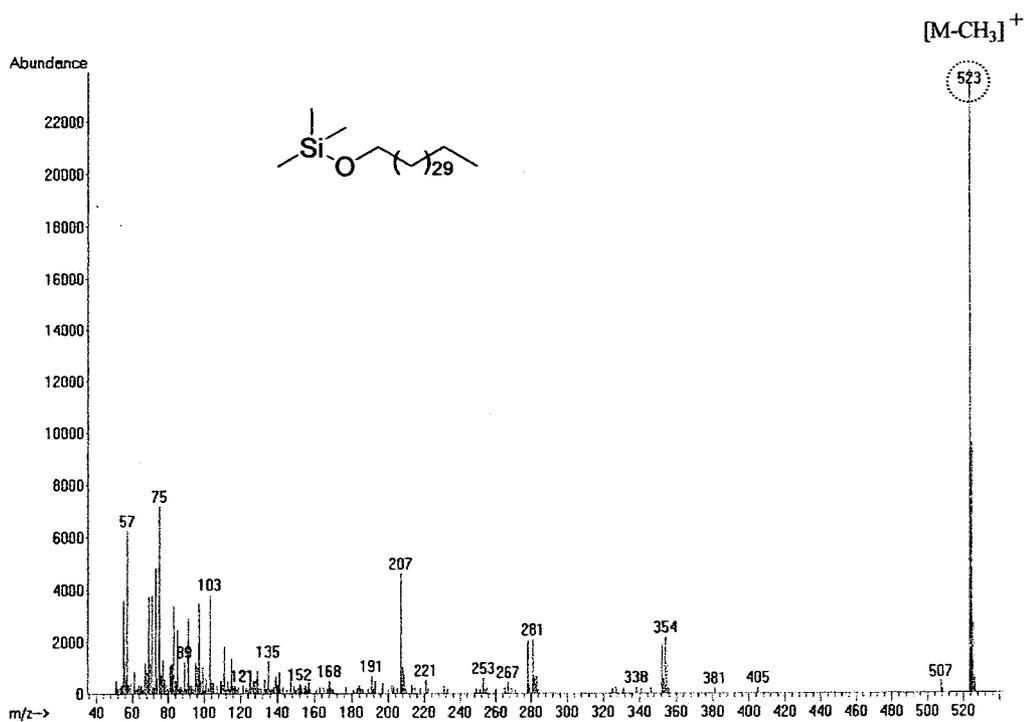


Figure 30 GC-MS spectrum of dotriacotanol trimethylsilyl ether ( $C_{35}H_{74}SiO$ )

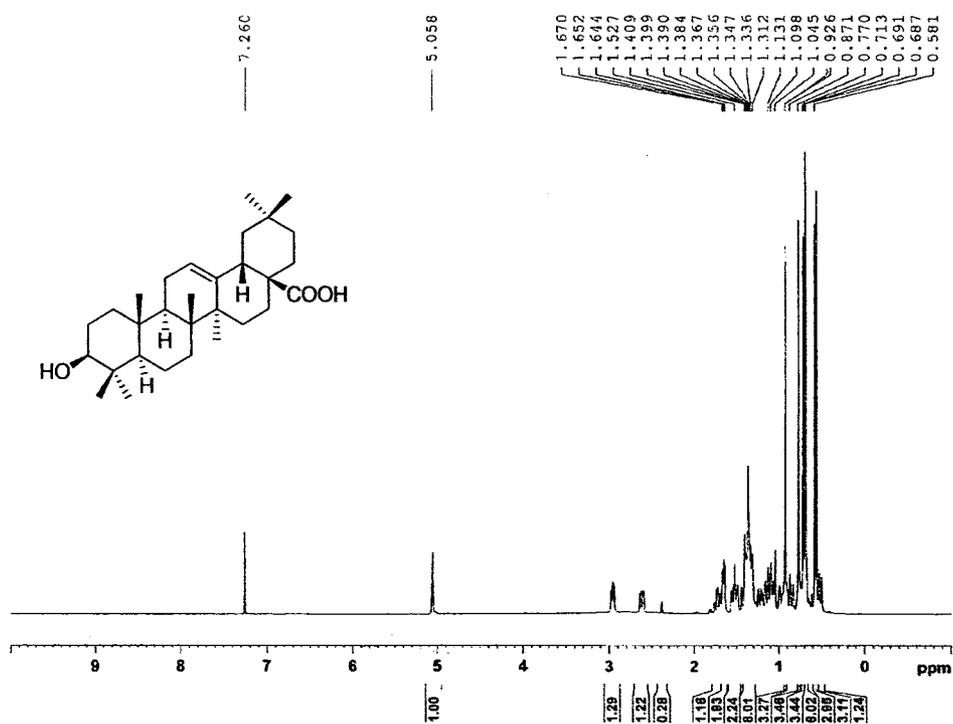


Figure 31  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ) spectrum of oleanolic acid (LFD-E1)

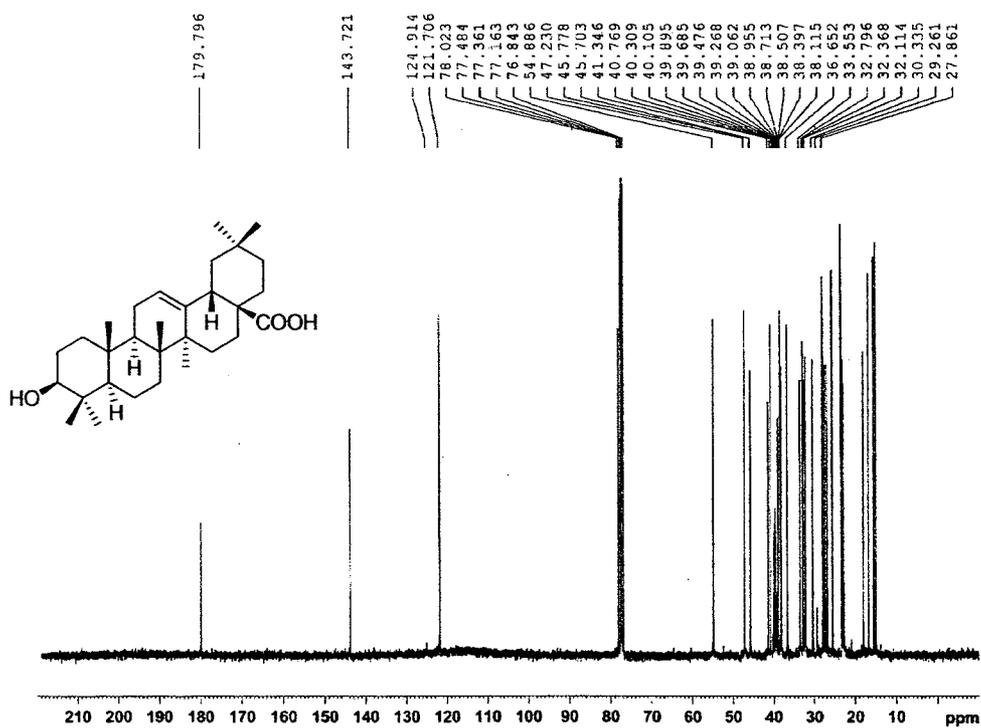


Figure 32  $^{13}\text{C}$  NMR (100 MHz,  $\text{CDCl}_3$ ) spectrum of oleanolic acid (LFD-E1)

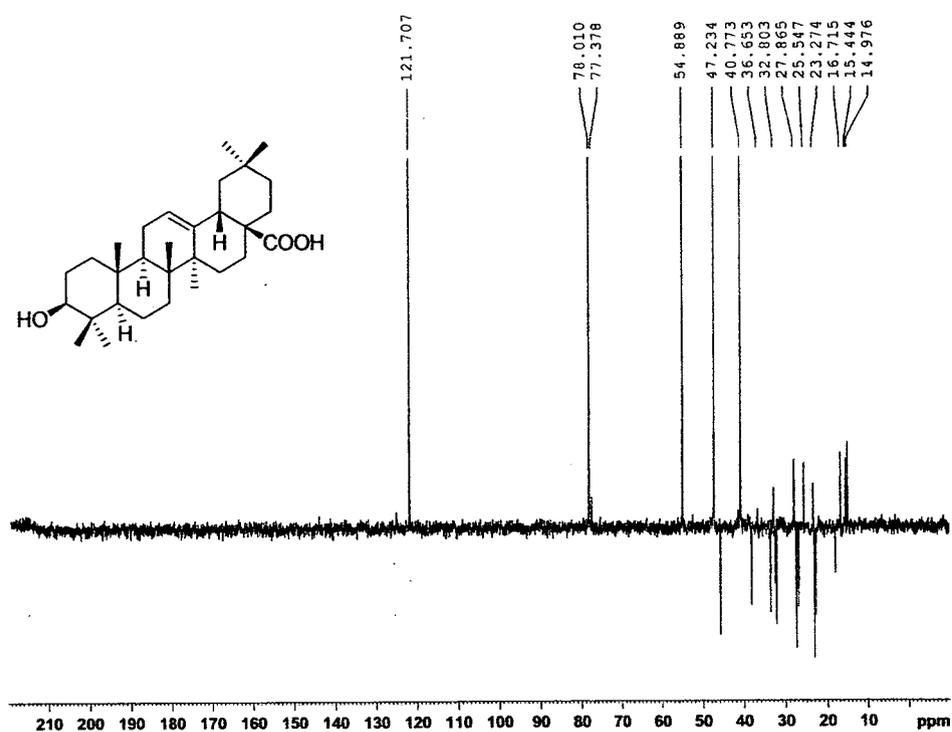


Figure 33  $^{13}\text{C}$  DEPT 135 ( $\text{CDCl}_3$ ) spectrum of oleanolic acid (LFD-E1)

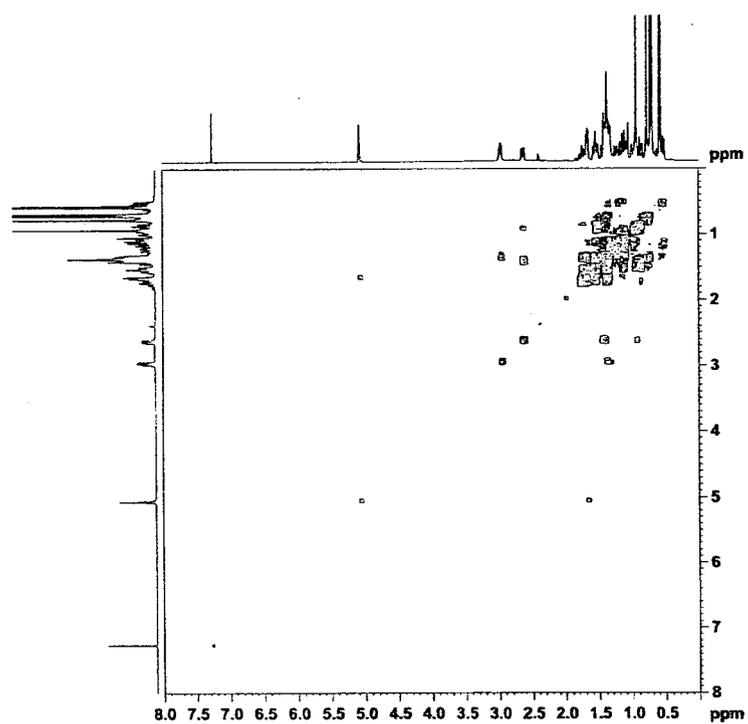


Figure 34  $^1\text{H}$ - $^1\text{H}$  COSY ( $\text{CDCl}_3$ ) spectrum of oleanolic acid (LFD-E1)

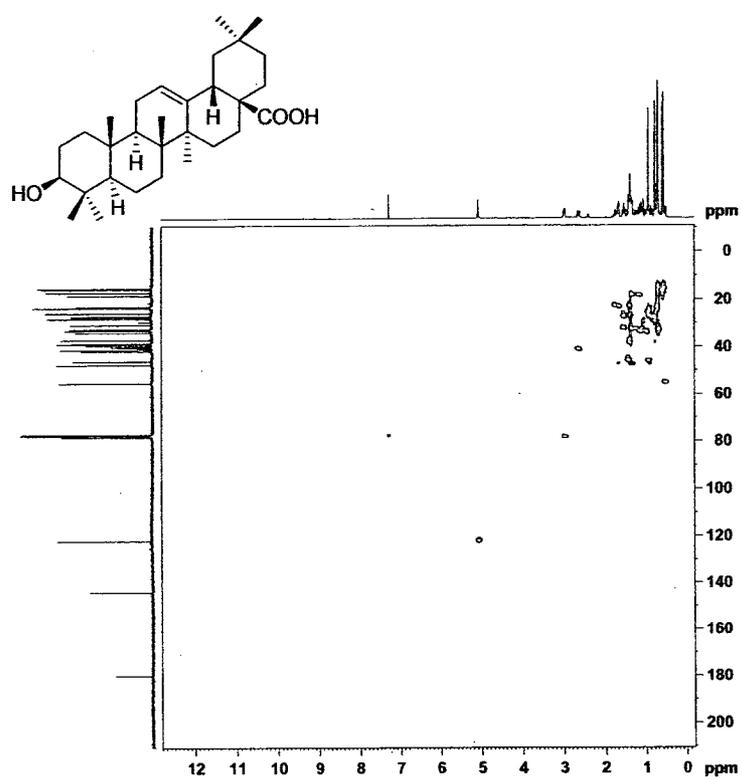


Figure 35 HMQC ( $\text{CDCl}_3$ ) spectrum of oleanolic acid (LFD-E1)

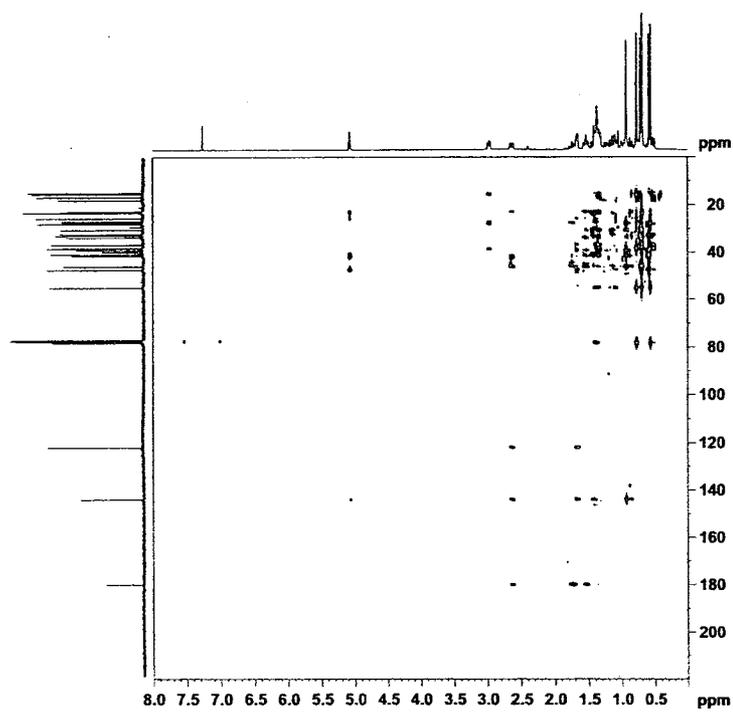
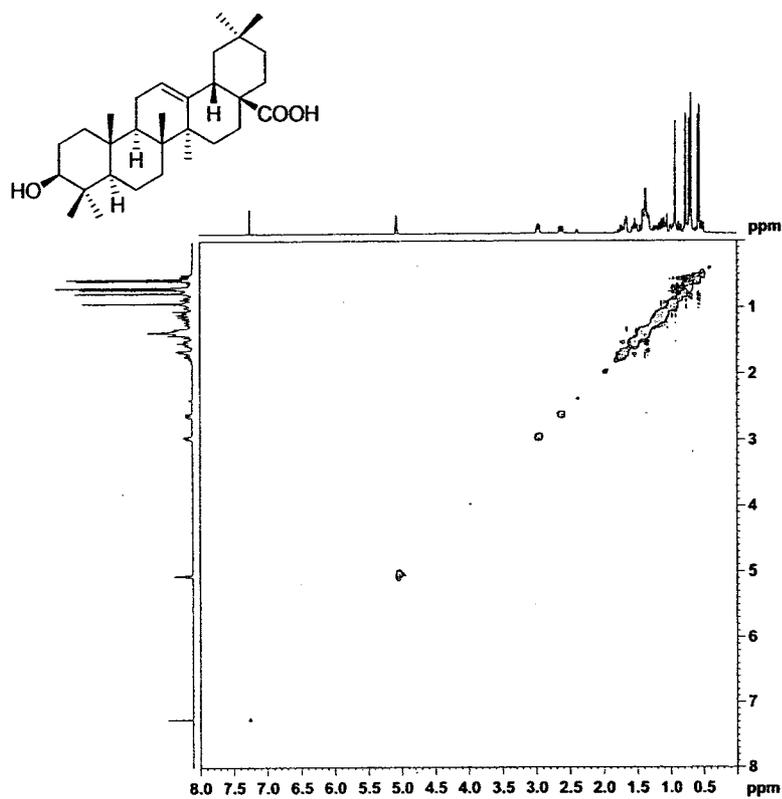
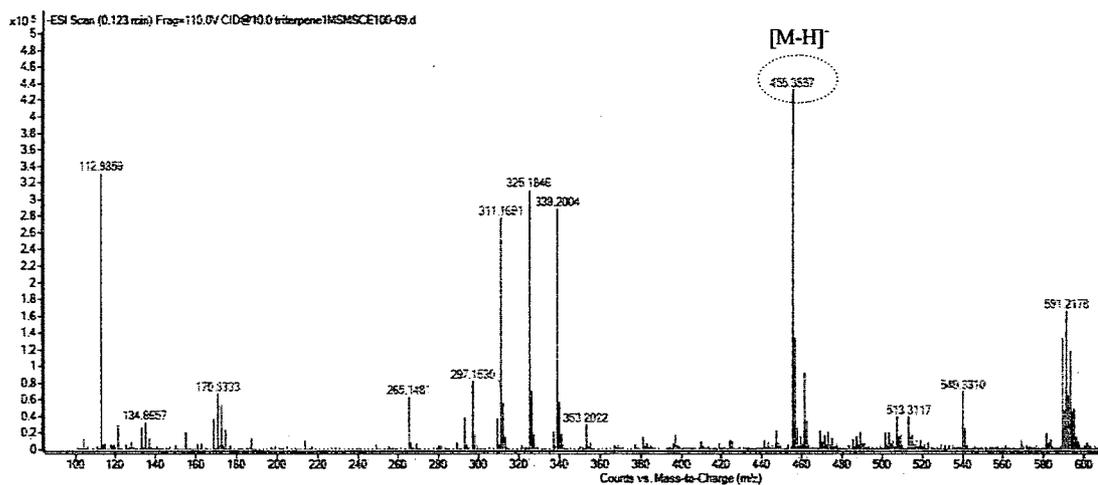


Figure 36 HMBC ( $\text{CDCl}_3$ ) spectrum of oleanolic acid (LFD-E1)

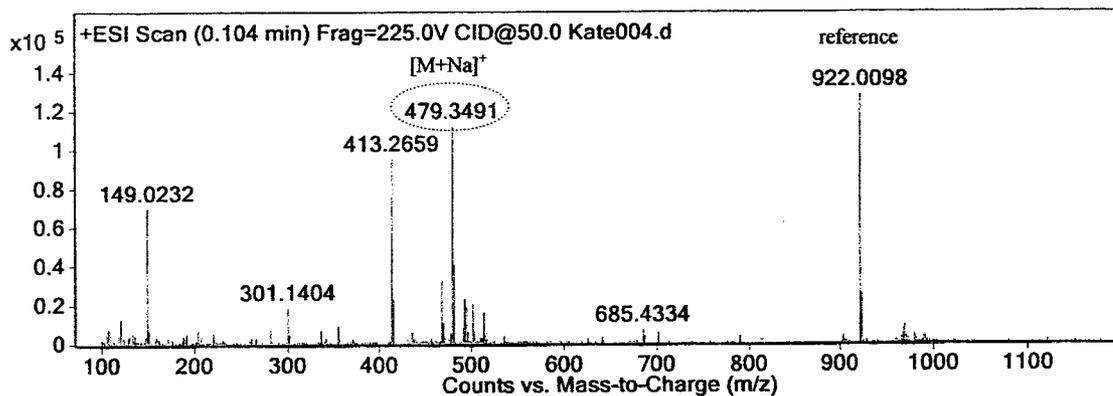


**Figure 37**  $^1\text{H}$ - $^1\text{H}$  NOESY ( $\text{CDCl}_3$ ) spectrum of oleanolic acid (LFD-E1)



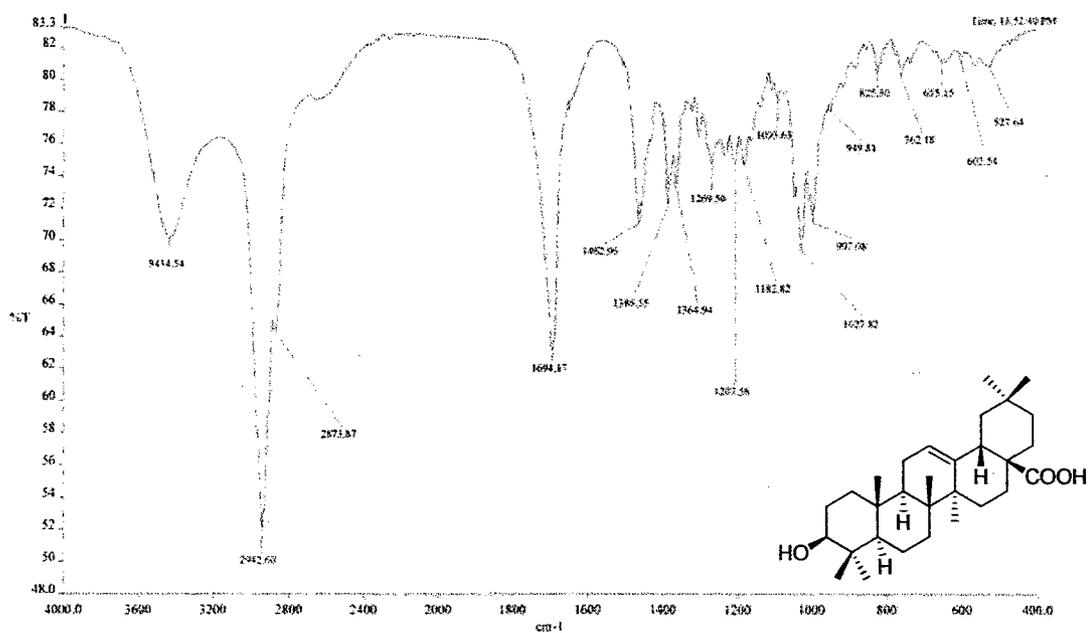
**Figure 38** ESIQ-TOF (negative ion mode) of oleanolic acid (LFD-E1)

$[\text{M}-\text{H}]^-$  for  $\text{C}_{30}\text{H}_{47}\text{O}_3$   $m/z$  455.3537 (Cal. 455.3516)



**Figure 39** ESIQ-TOF (positive ion mode) of oleanolic acid (LFD-E1)

$[M+Na]^+$  for  $C_{30}H_{48}O_3Na$   $m/z = 479.3491$  (Cal. 479.3496)



**Figure 40** IR (KBr) spectrum of oleanolic acid (LFD-E1)

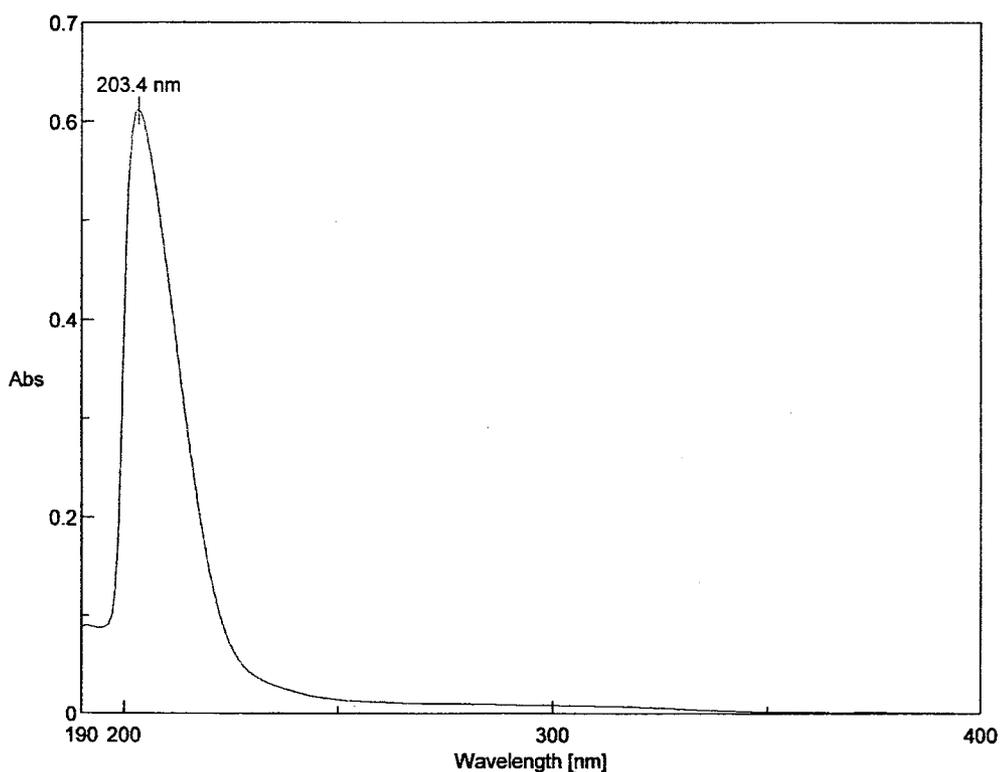


Figure 41 UV (MeOH) spectrum of oleanolic acid (LFD-E1)

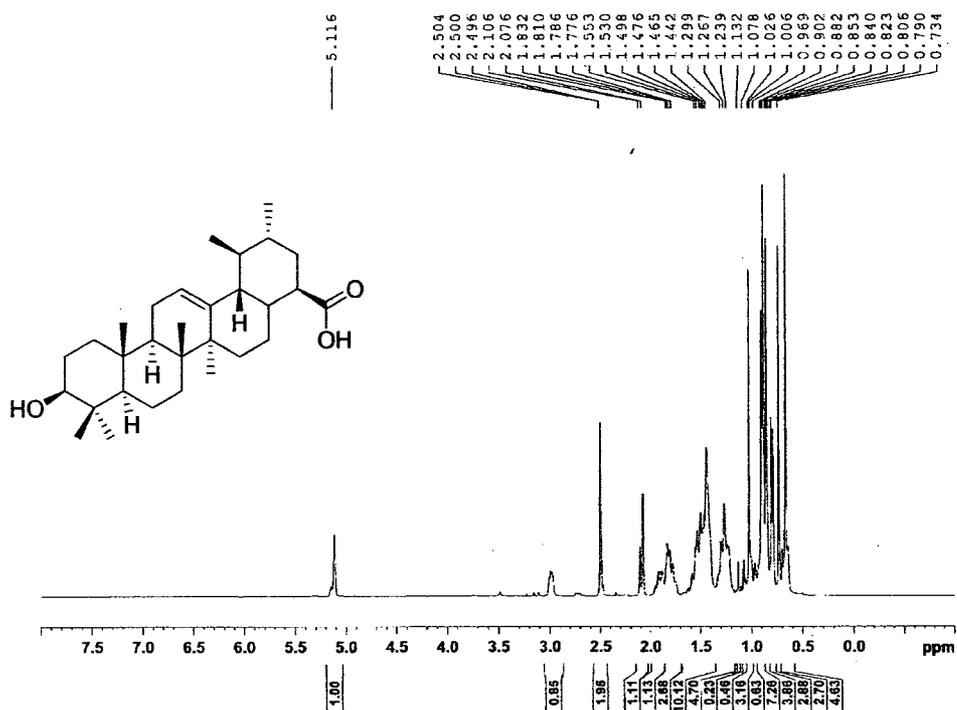


Figure 42 <sup>1</sup>H NMR (400 MHz, DMSO-d<sub>6</sub>) spectrum of ursolic acid (LFD-M1)

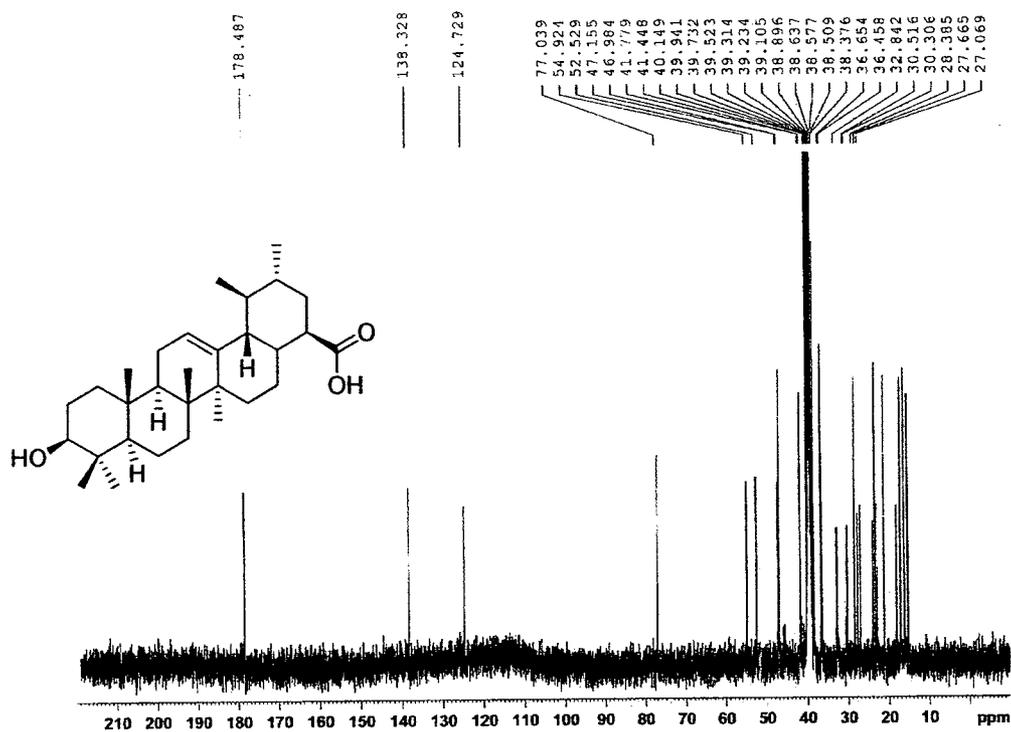


Figure 43  $^{13}\text{C}$  NMR (100 MHz,  $\text{DMSO-}d_6$ ) spectrum of ursolic acid (LFD-M1)

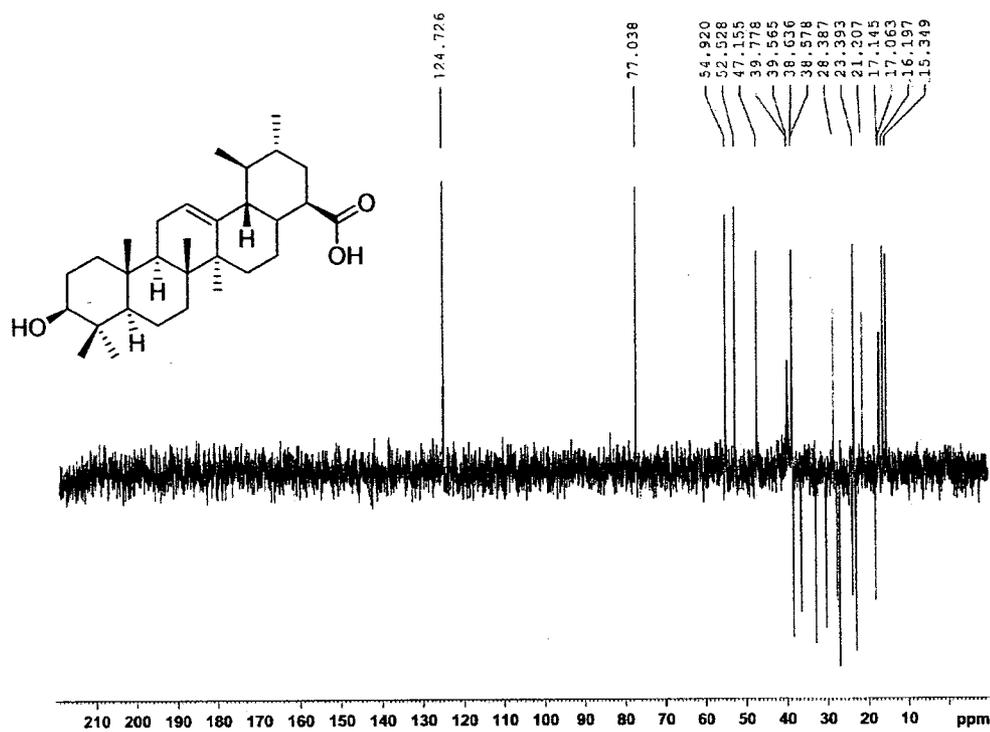


Figure 44  $^{13}\text{C}$  DEPT 135 ( $\text{CDCl}_3$ ) spectrum of ursolic acid (LFD-M1)

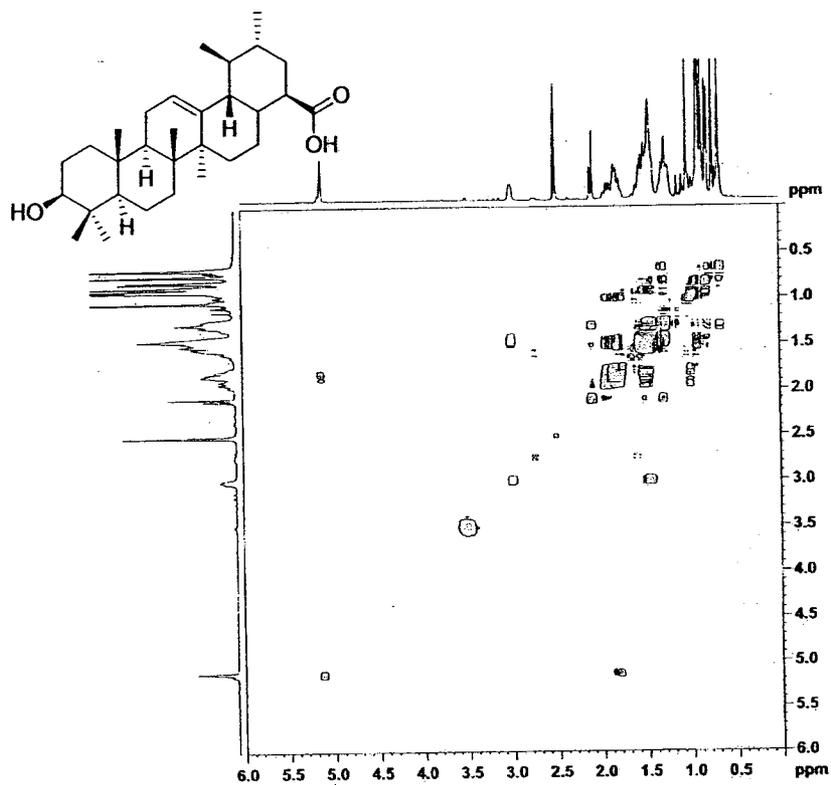


Figure 45  $^1\text{H}$ - $^1\text{H}$  COSY ( $\text{CDCl}_3$ ) spectrum of ursolic acid (LFD-M1)

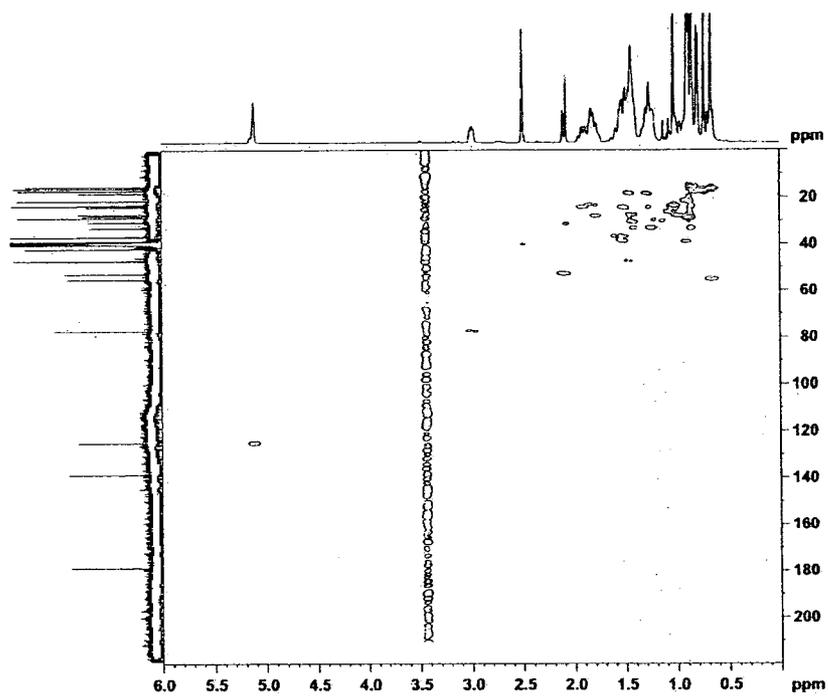


Figure 46 HMQC ( $\text{CDCl}_3$ ) spectrum of ursolic acid (LFD-M1)

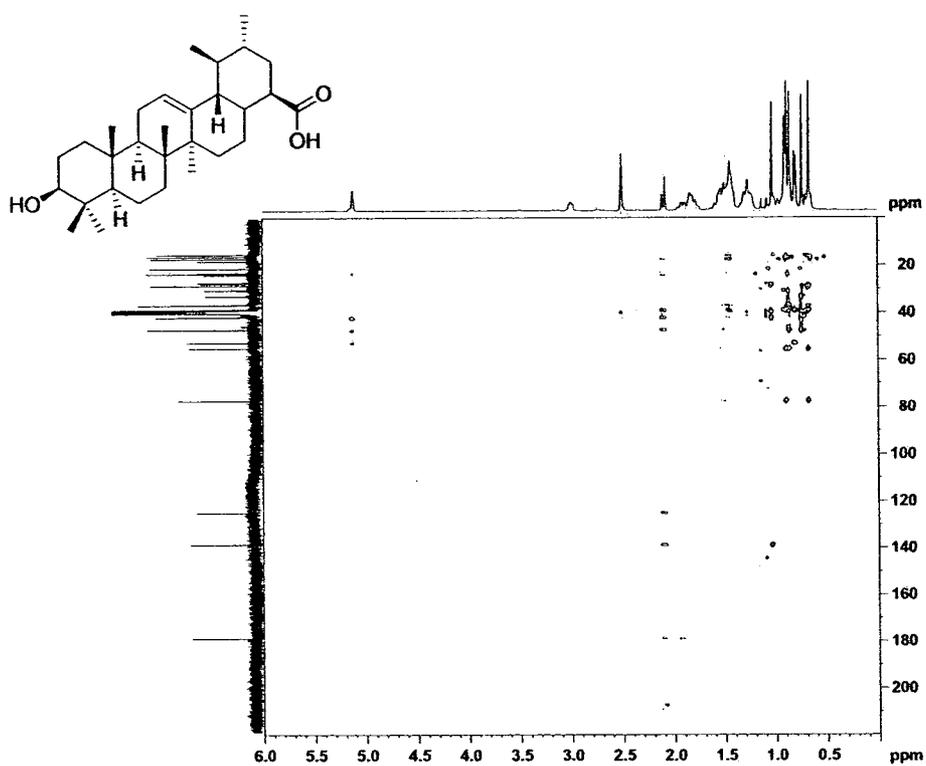


Figure 47 HMBC (CDCl<sub>3</sub>) spectrum of ursolic acid (LFD-M1)

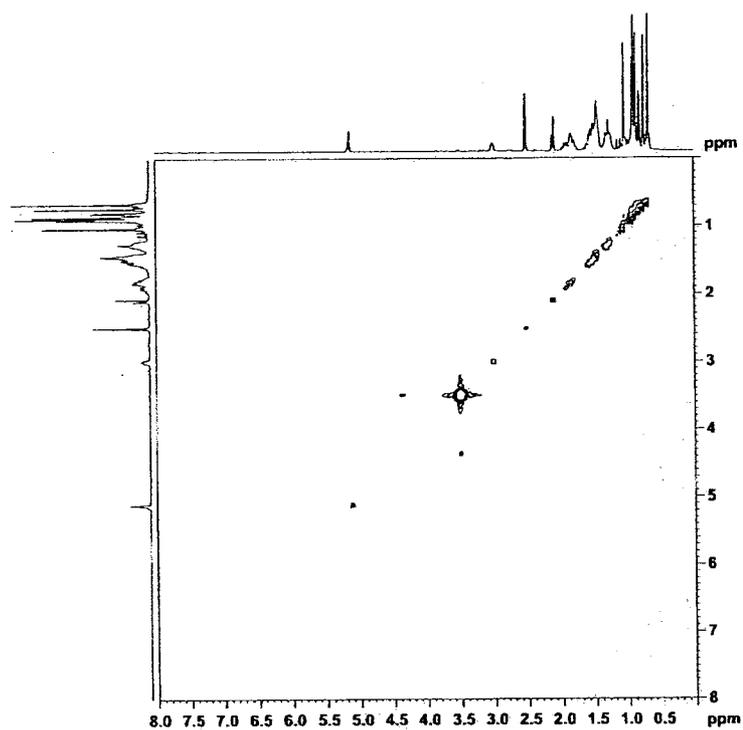
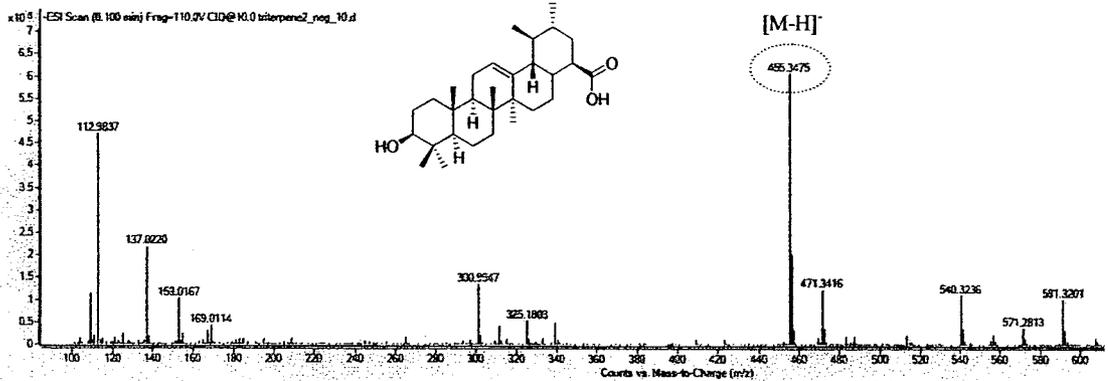
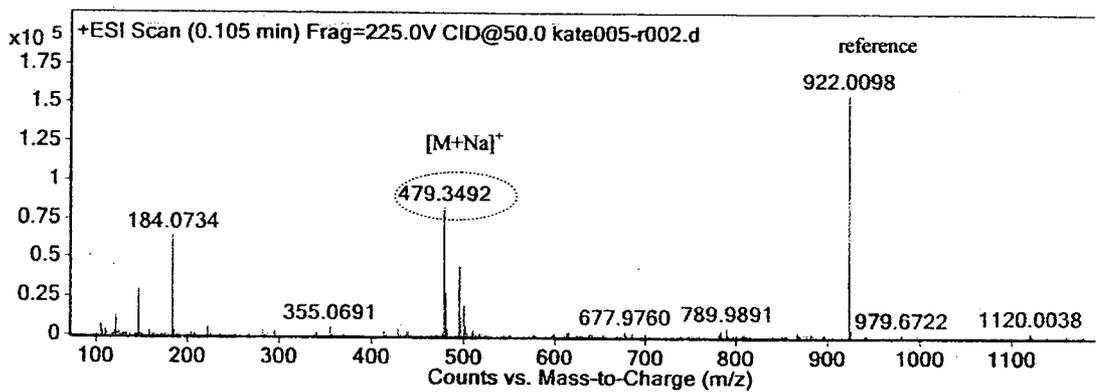


Figure 48 <sup>1</sup>H-<sup>1</sup>H NOESY (CDCl<sub>3</sub>) spectrum of ursolic acid (LFD-M1)



**Figure 49** ESIQ-TOF (negative ion mode) of ursolic acid (LFD-M1)

$[M-H]^-$  for  $C_{30}H_{47}O_3$   $m/z = 455.3475$  (Cal. 455.3516)



**Figure 50** ESIQ-TOF (positive ion mode) of ursolic acid (LFD-M1)

$[M+Na]^+$  for  $C_{30}H_{48}O_3Na$   $m/z = 479.3492$  (Cal. 479.3496)

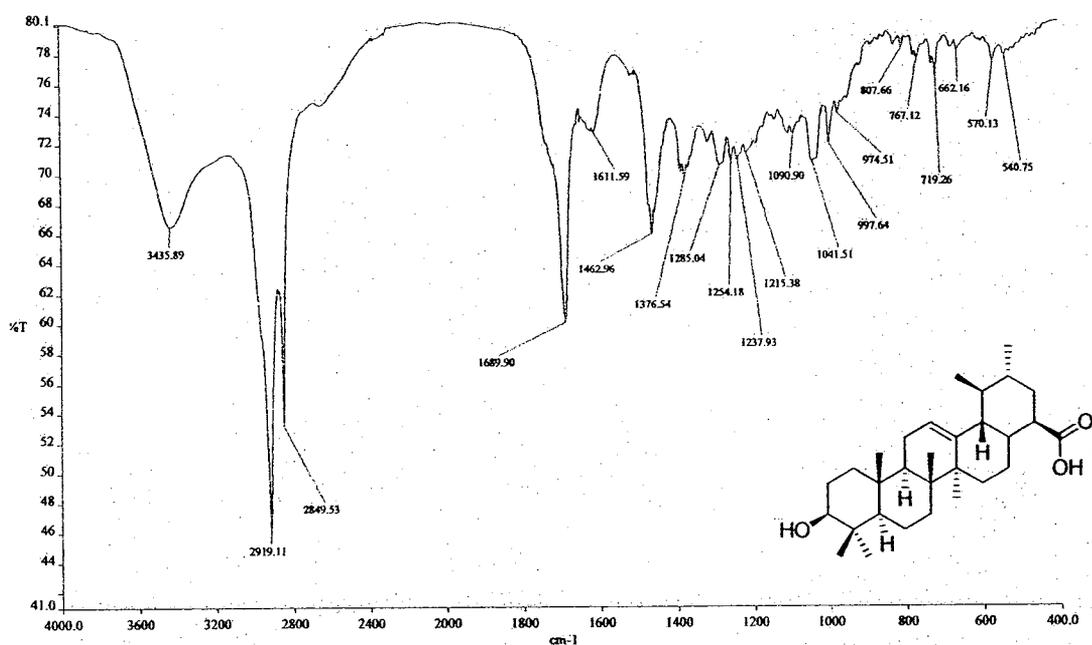


Figure 51 IR (KBr) spectrum of ursolic acid (LFD-M1)

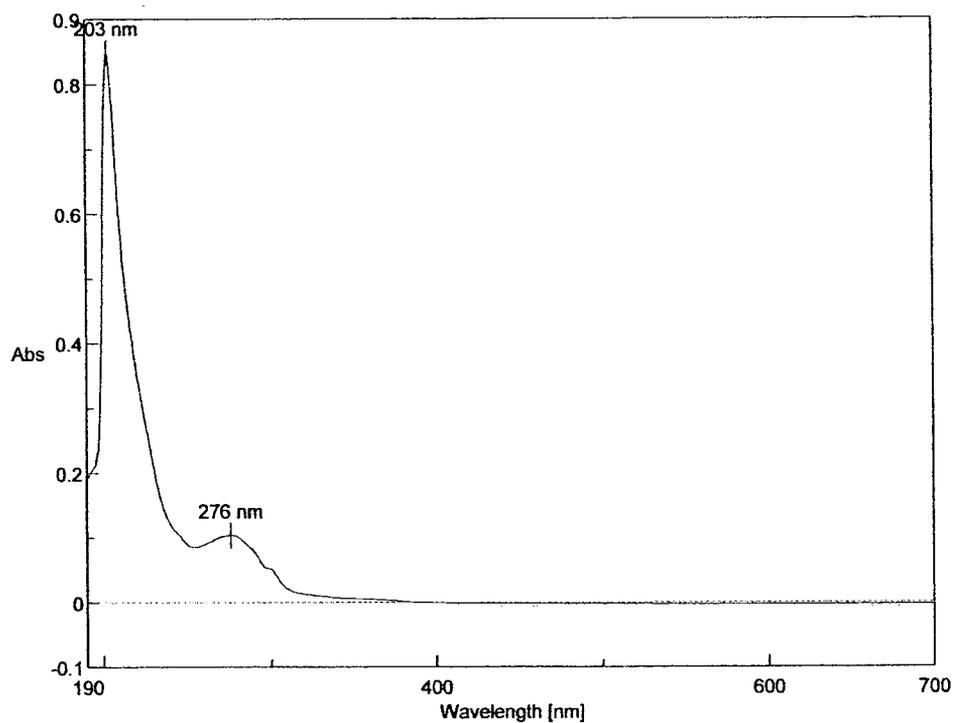


Figure 52 UV (MeOH) spectrum of ursolic acid (LFD-M1)