

Anti-inflammatory and Anti-osteoporosis Flavonoids from the Rhizomes of
Helminthostachys zeylanica

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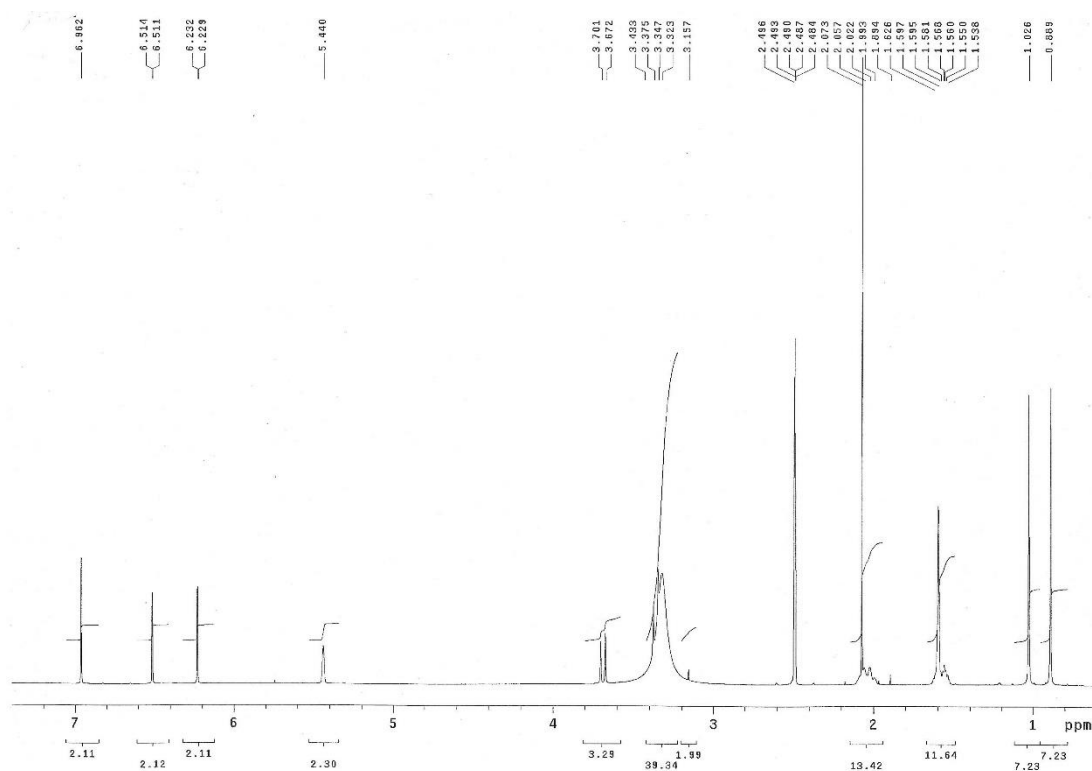
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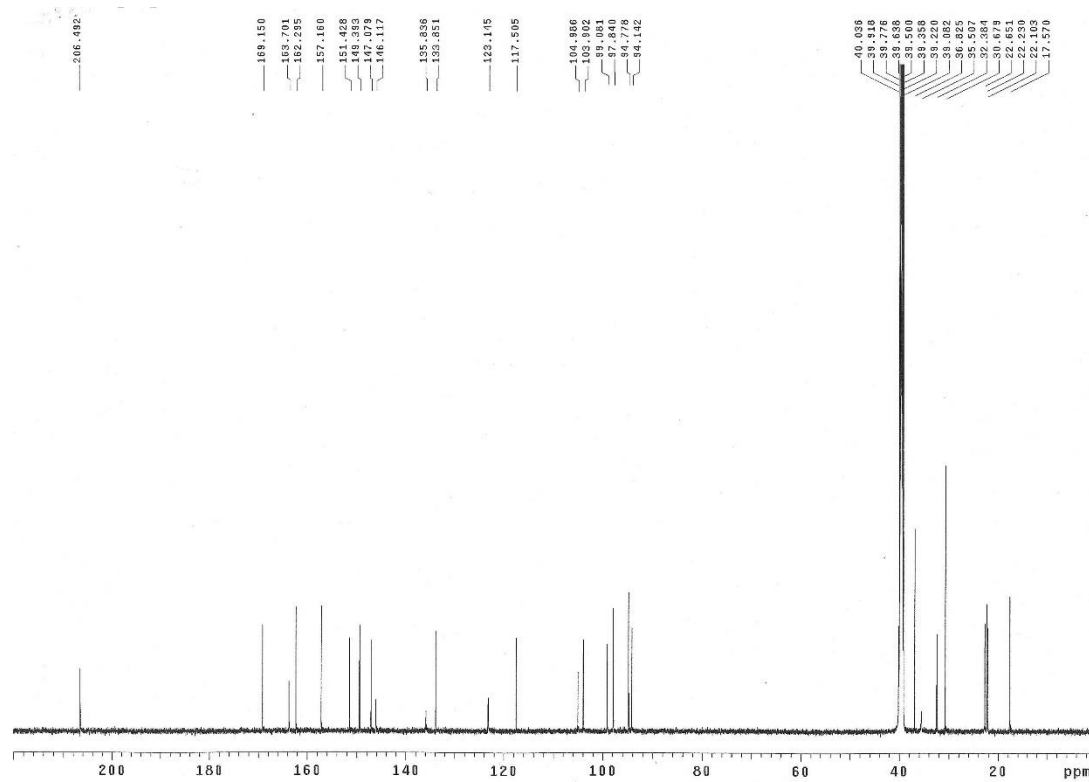
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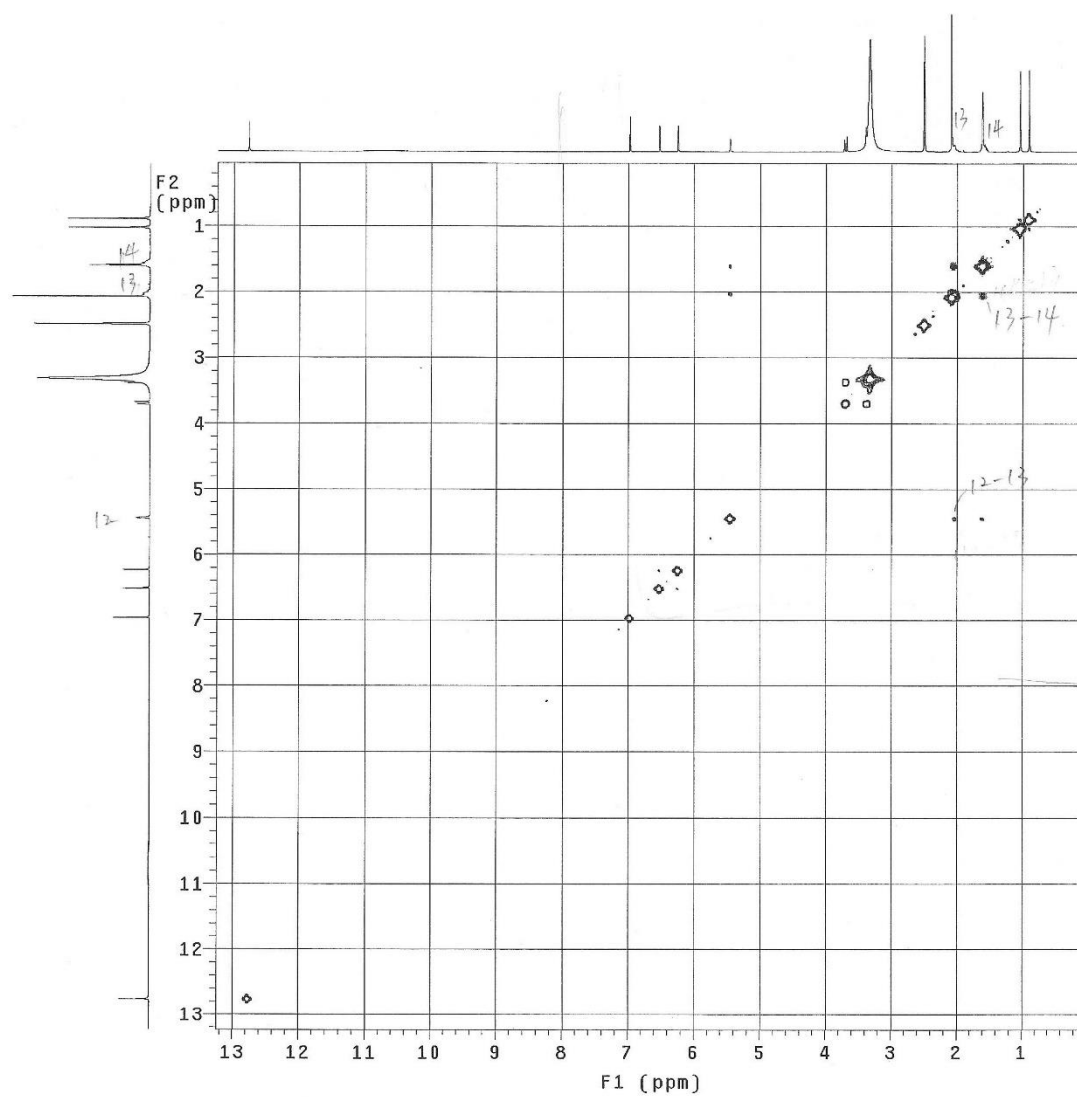
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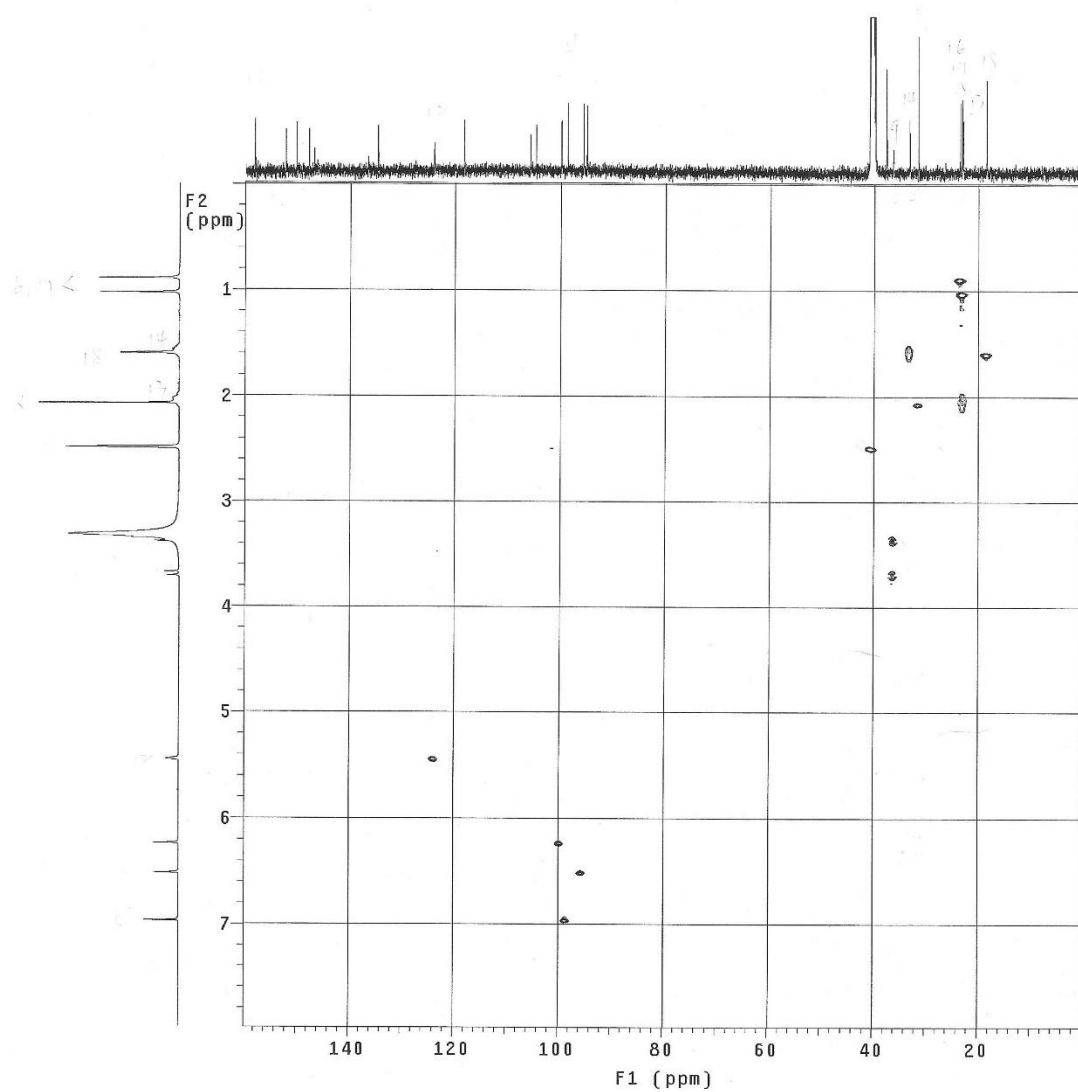
S1. ¹H NMR (600 MHz, DMSO-*d*₆) spectrum of ugonin V (**1**)



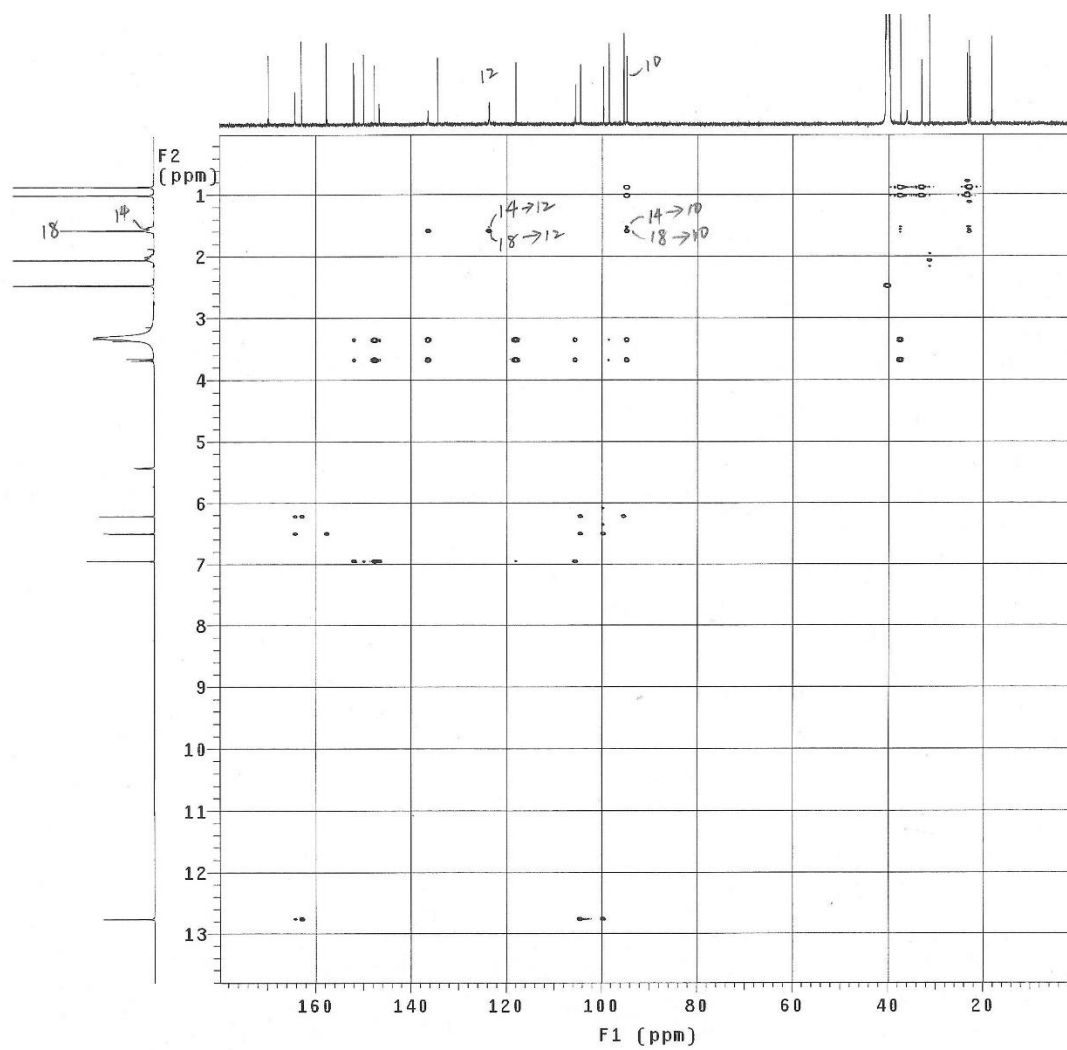
S2. ^{13}C NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of ugonin V (**1**)



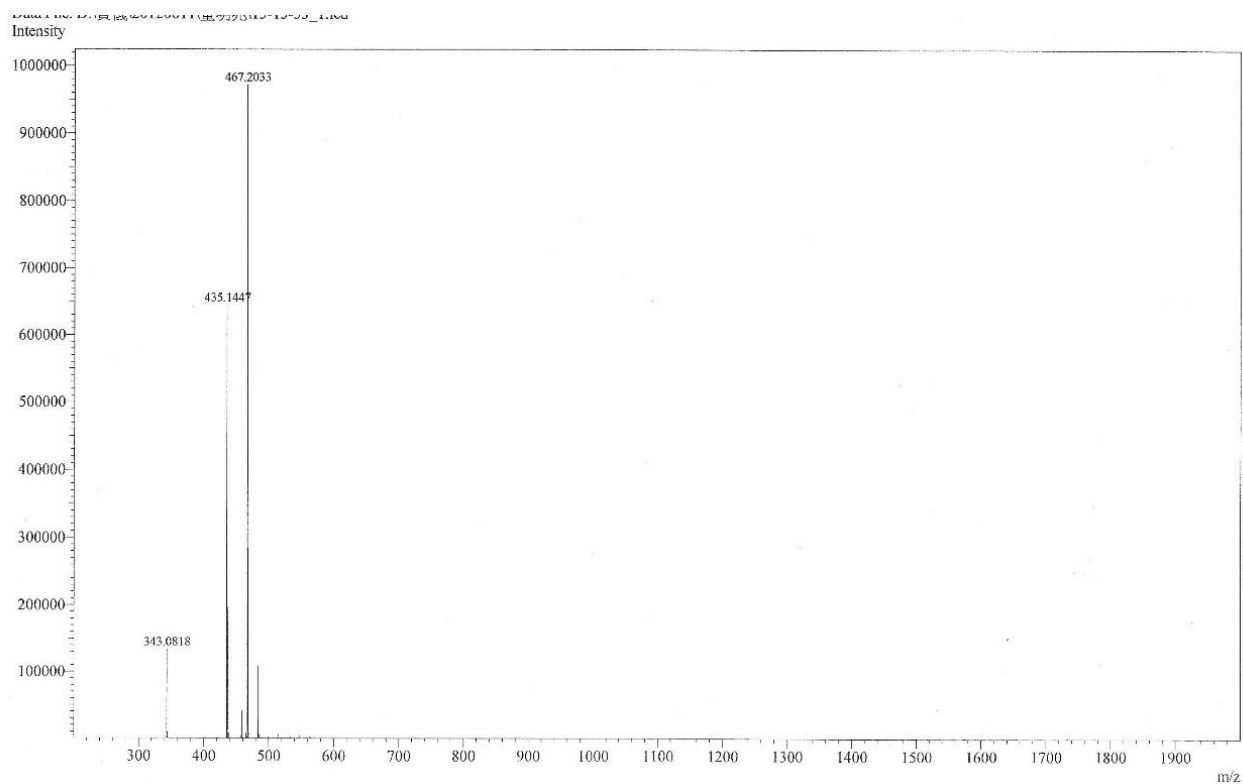
S3. ¹H-¹H COSY NMR (600 MHz, DMSO-*d*₆) spectrum of ugonin V (1)



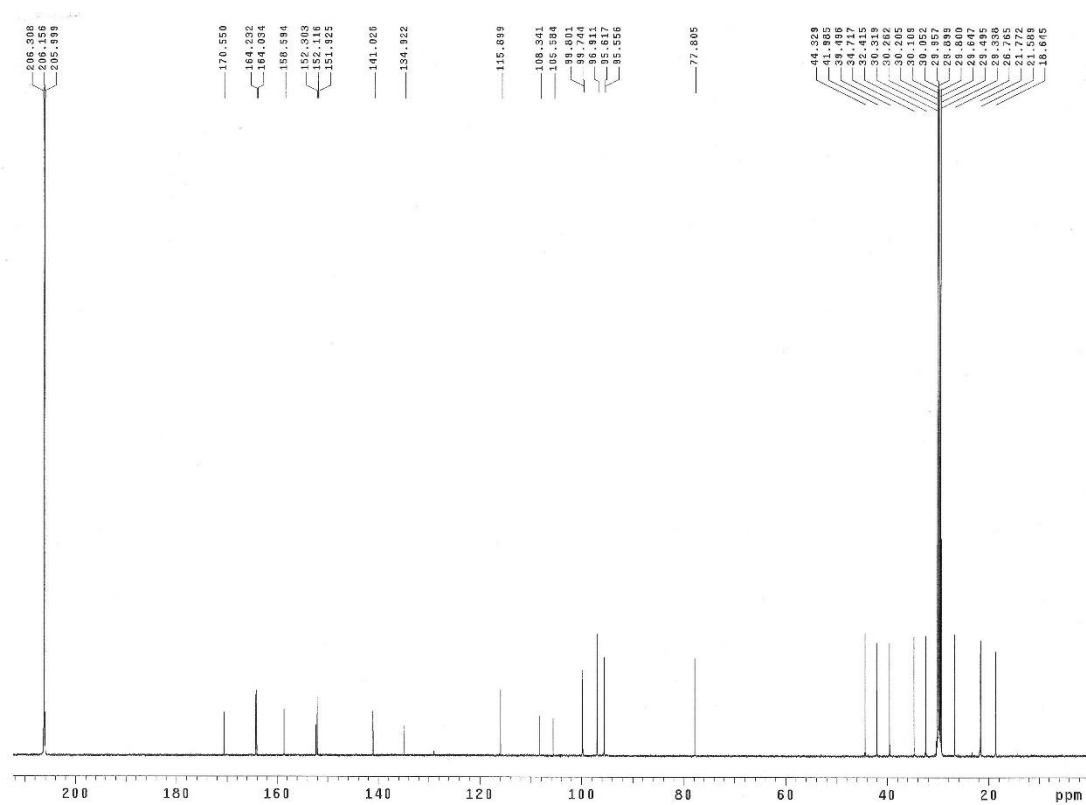
S4. HMQC NMR (600 MHz, DMSO-*d*₆) spectrum of ugonin V (**1**)



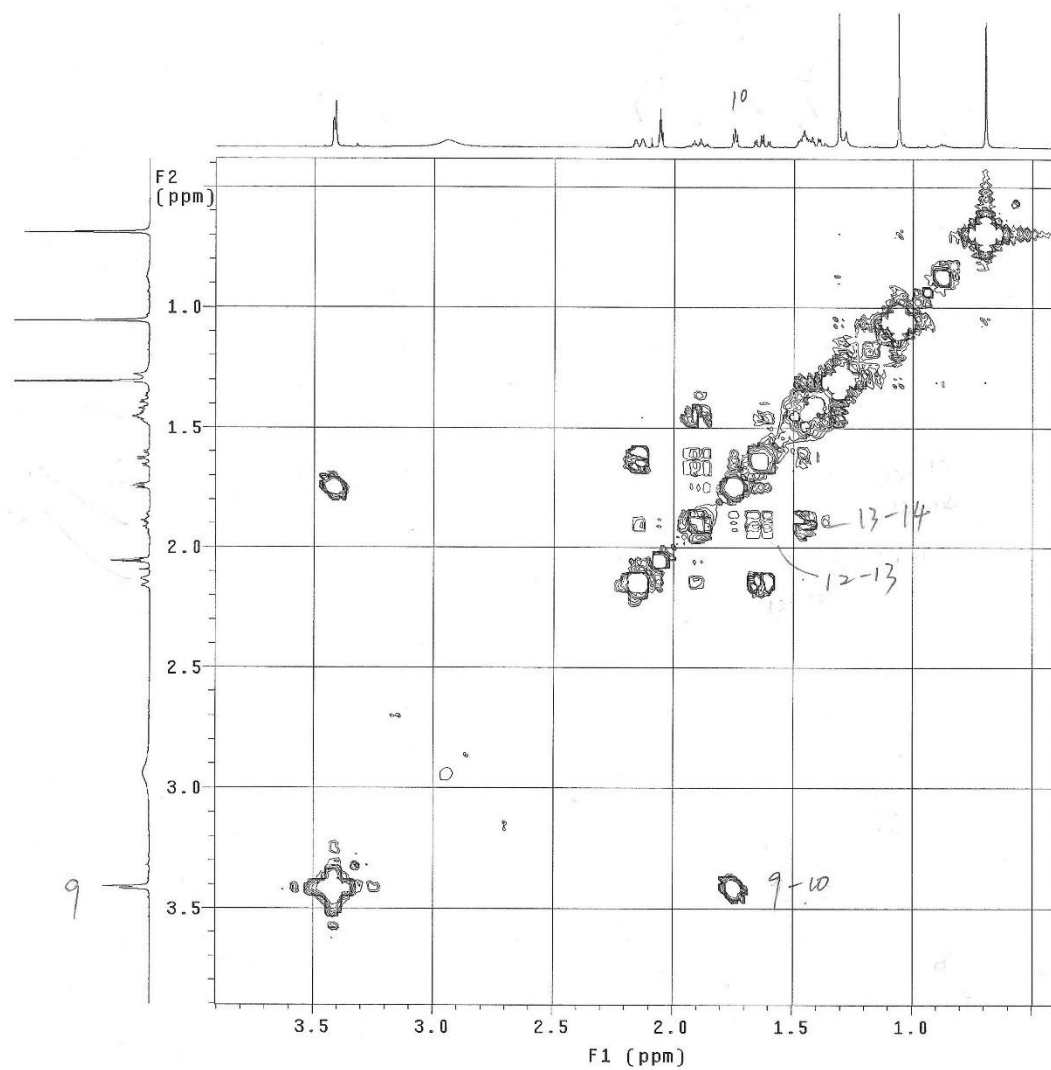
S5. HMBC NMR (600 MHz, DMSO- d_6) spectrum of ugonin V (**1**)



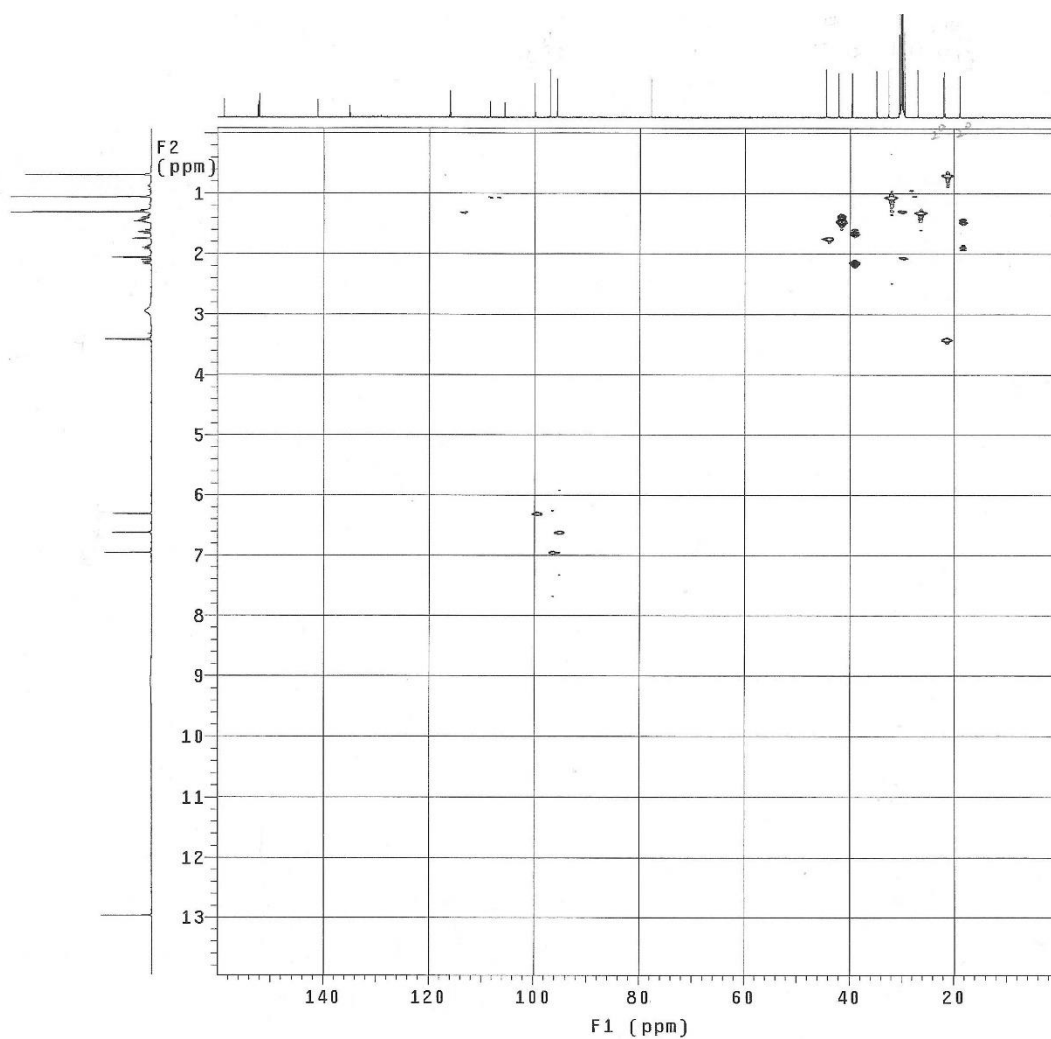
S6. HRESIMS spectrum of ugonin V (**1**)



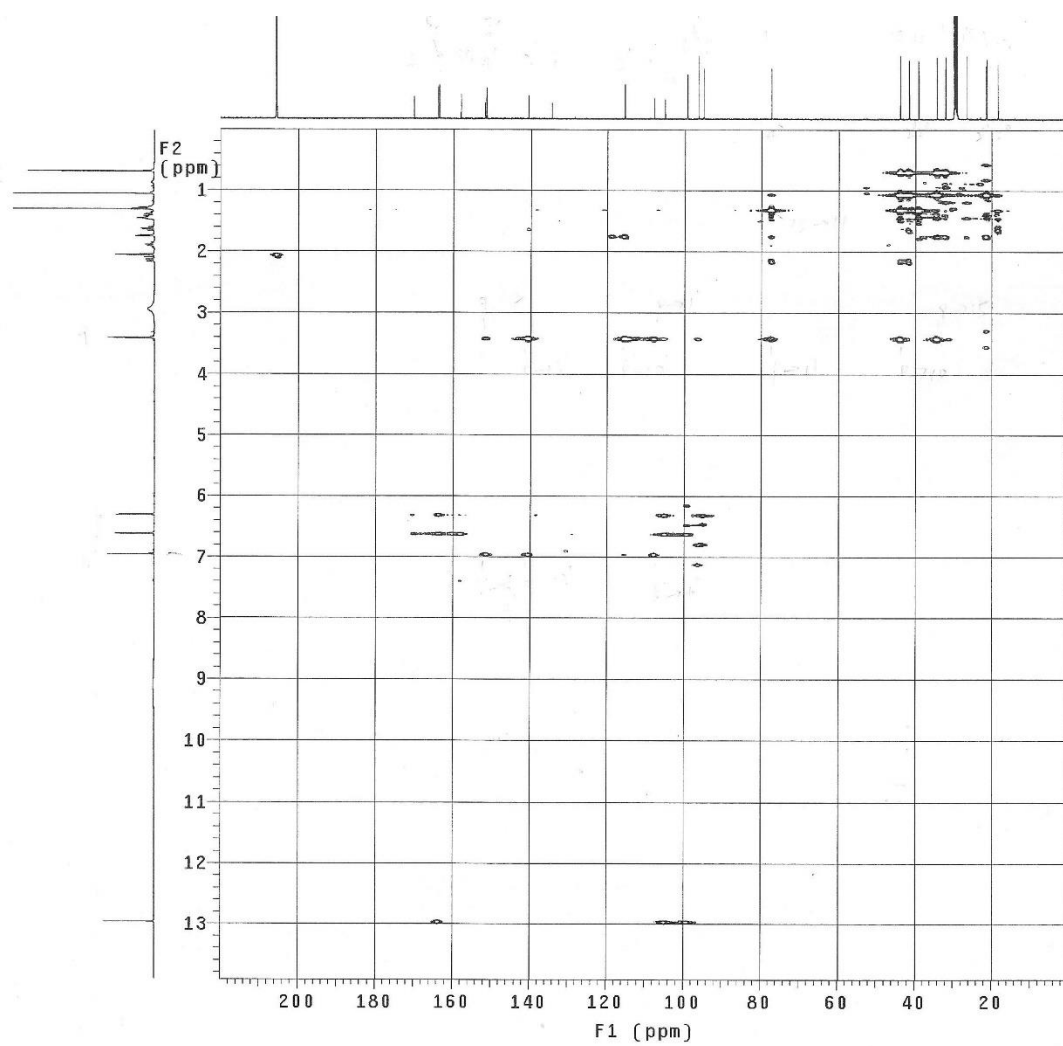
S8. ^{13}C NMR (500 MHz, acetone- d_6) spectrum of ugonin W (2)



S9. ¹H-¹H COSY NMR (500 MHz, acetone-*d*₆) spectrum of ugonin W (2)

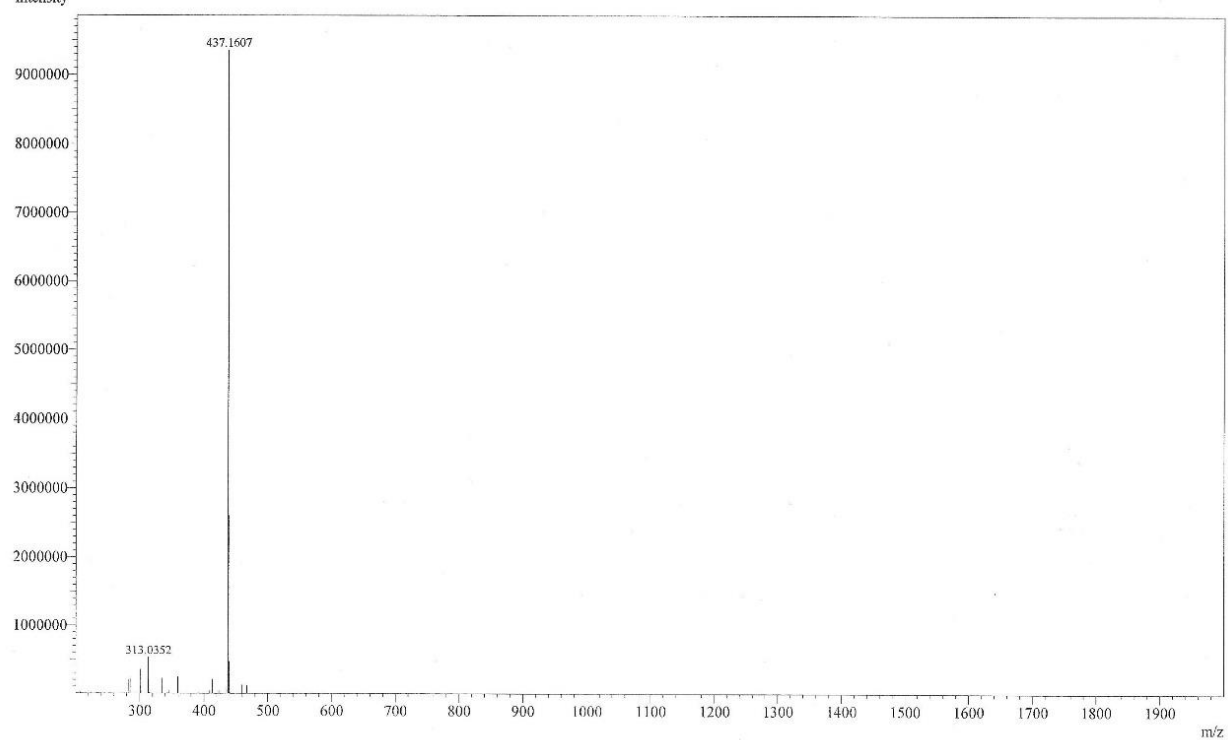


S10. HMQC NMR (500 MHz, acetone- d_6) spectrum of ugonin W (2)

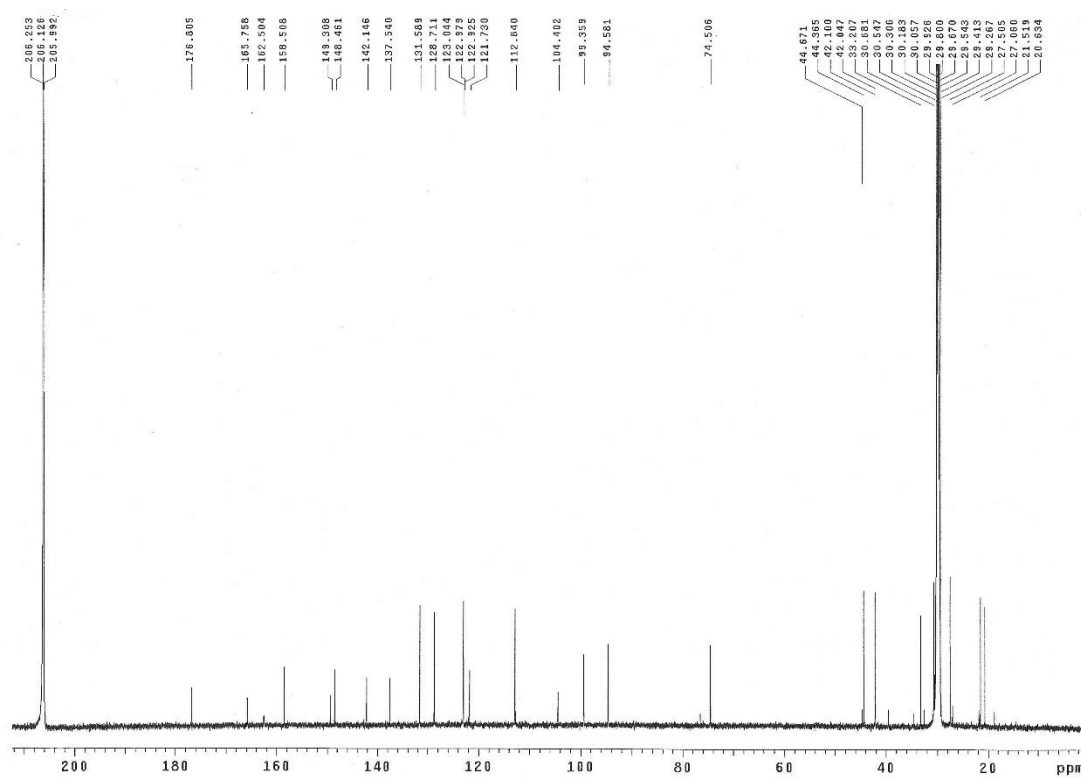


S11. HMBC NMR (500 MHz, acetone- d_6) spectrum of ugonin W (2)

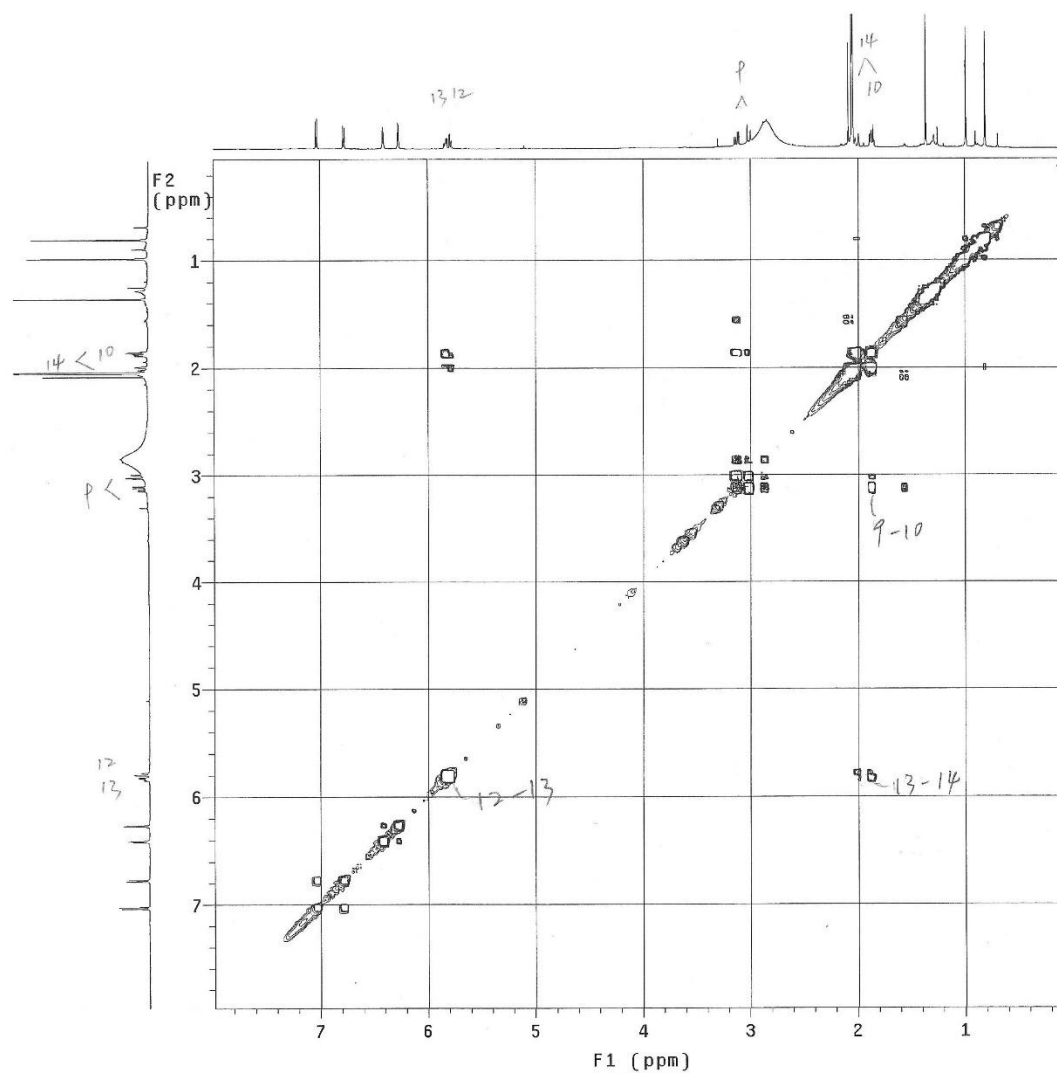
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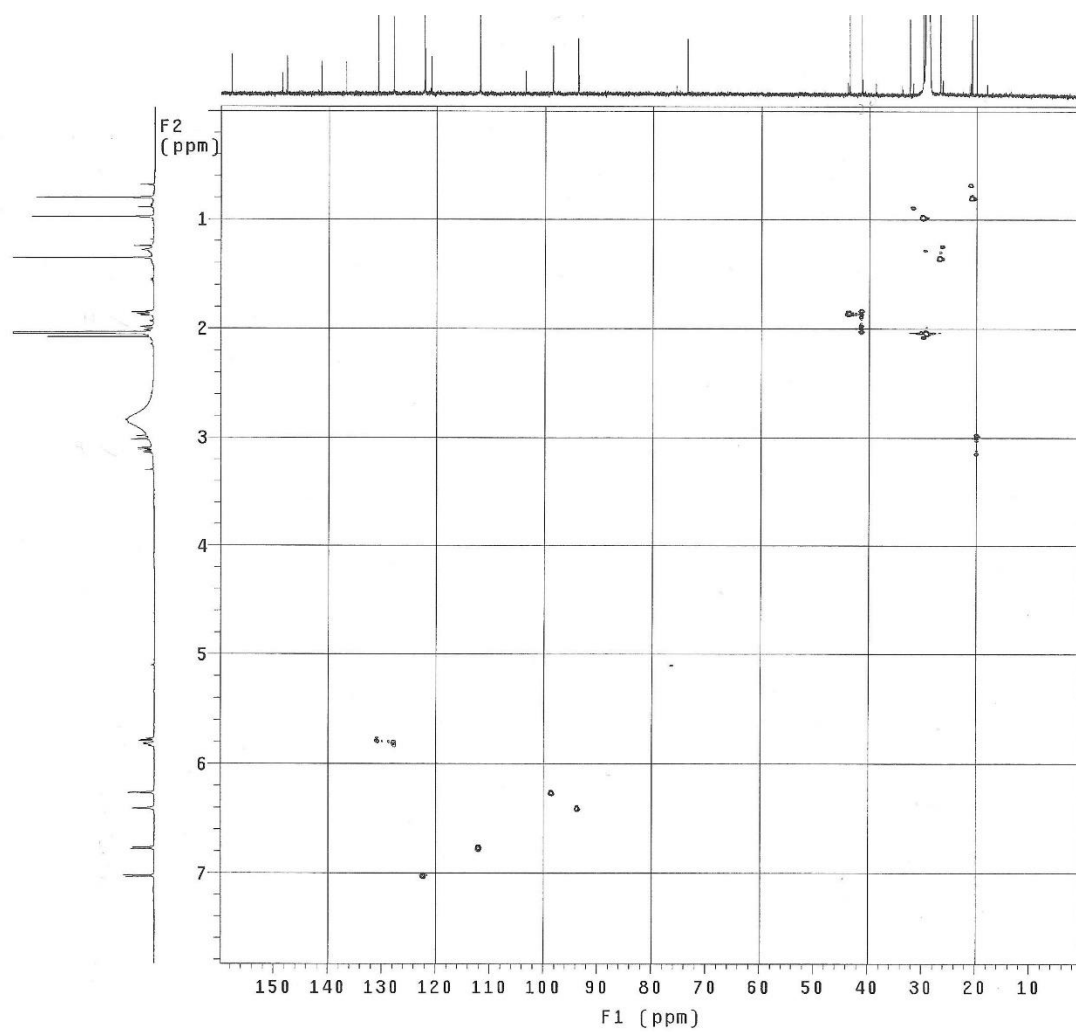
S12. HRESIMS spectrum of ugonin W (2)



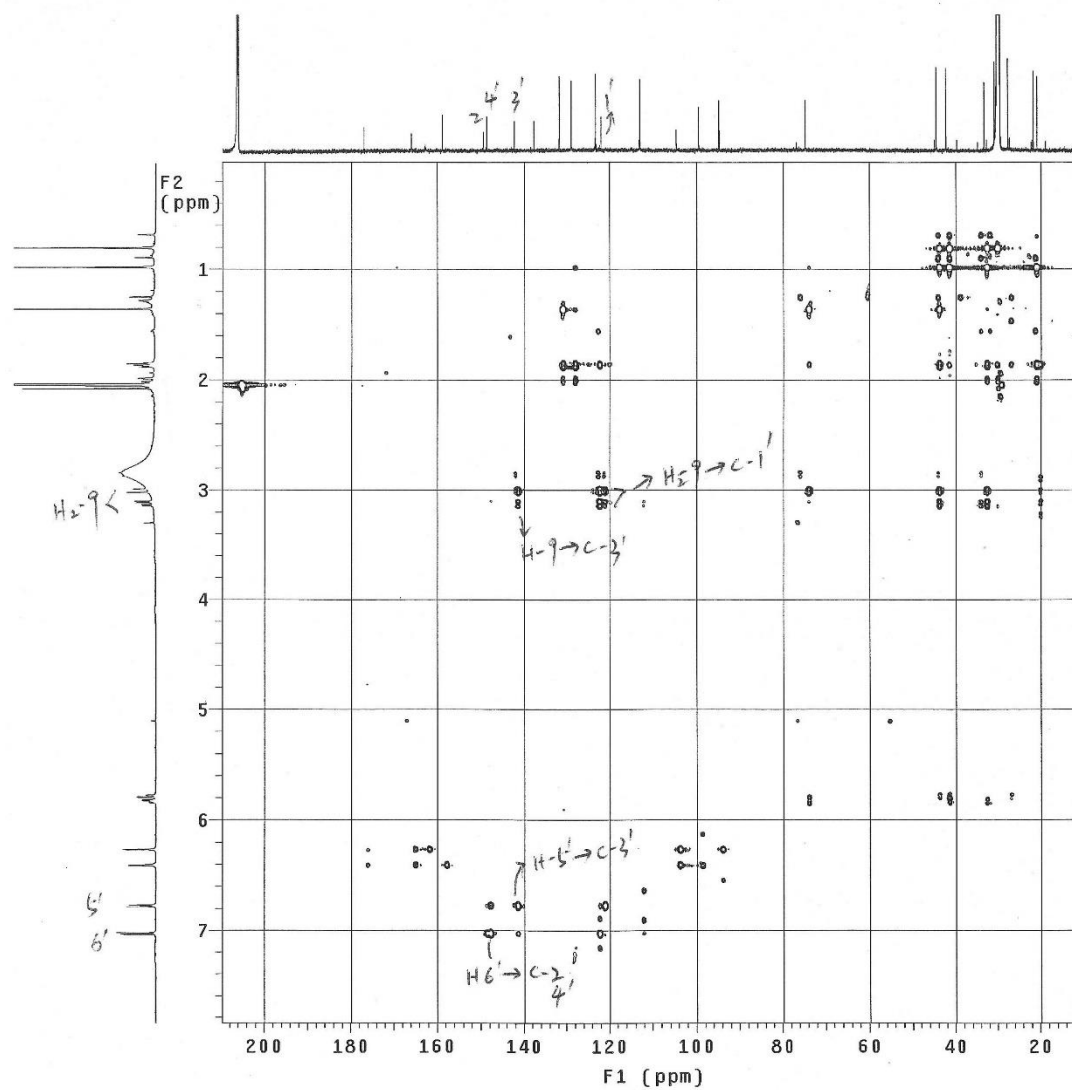
S14. ^{13}C NMR (600 MHz, acetone- d_6) spectrum of ugonin X (**3**)



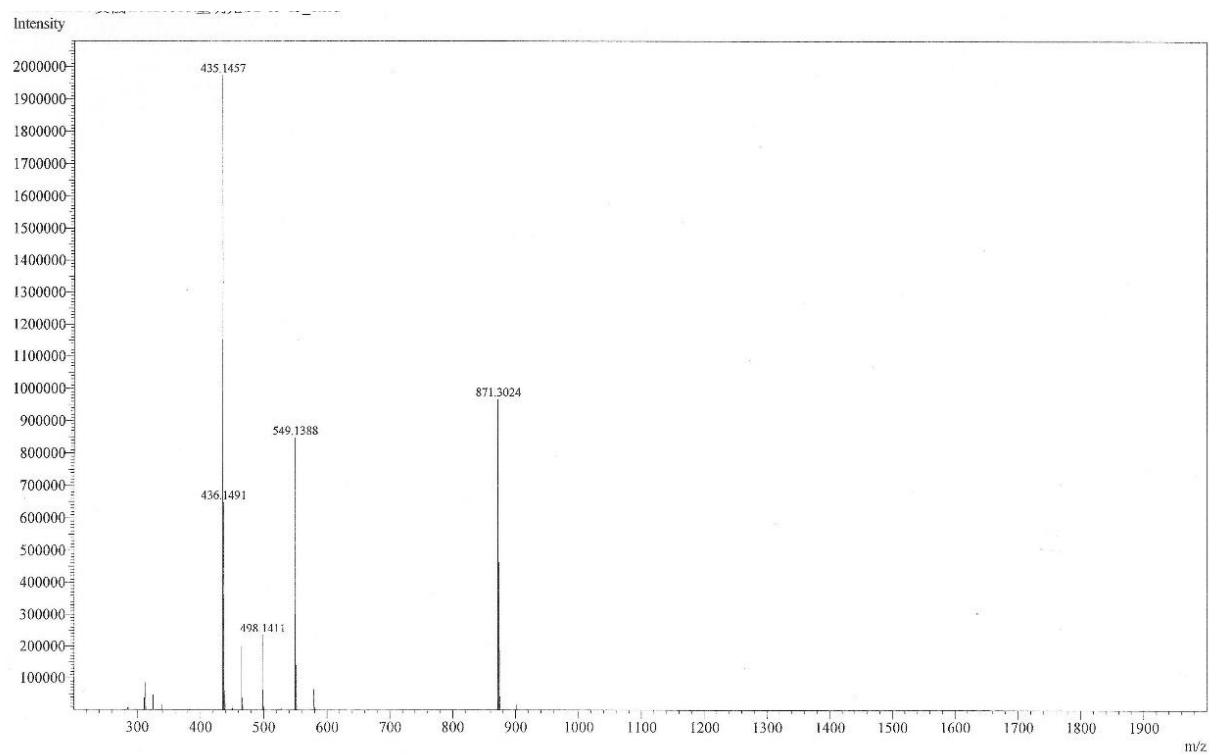
S15. ^1H - ^1H COSY NMR (600 MHz, acetone- d_6) spectrum of ugonin X (3)



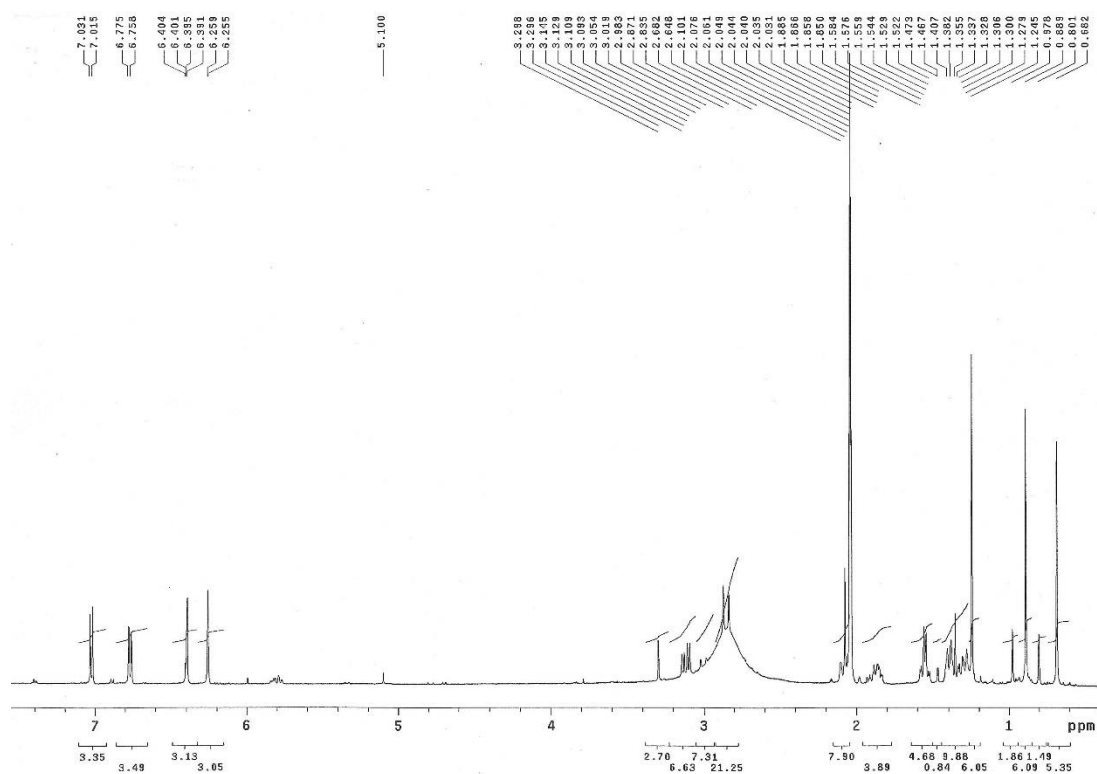
S16. HMQC NMR (600 MHz, acetone-*d*₆) spectrum of ugonin X (**3**)



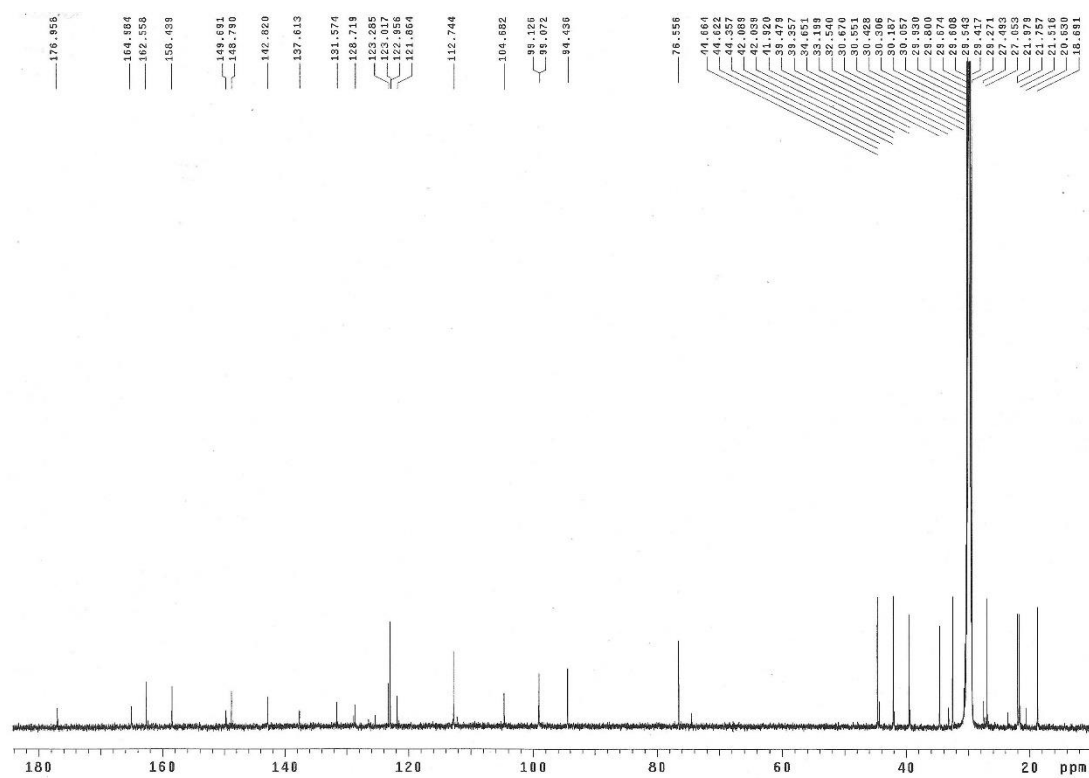
S17. HMBC (600 MHz, acetone-*d*₆) spectrum of ugonin X (3)



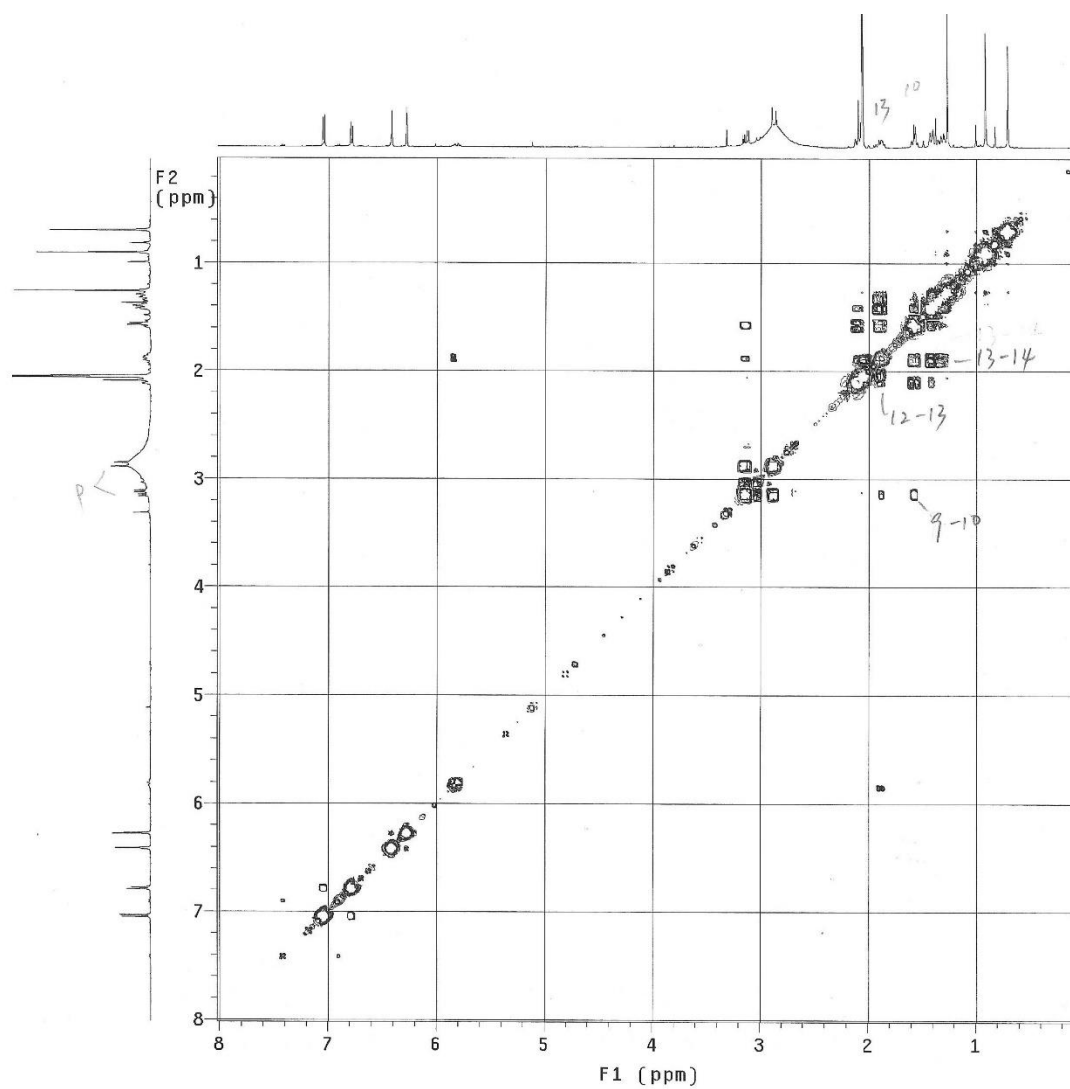
S18. HRESIMS spectrum of ugonin X (3)



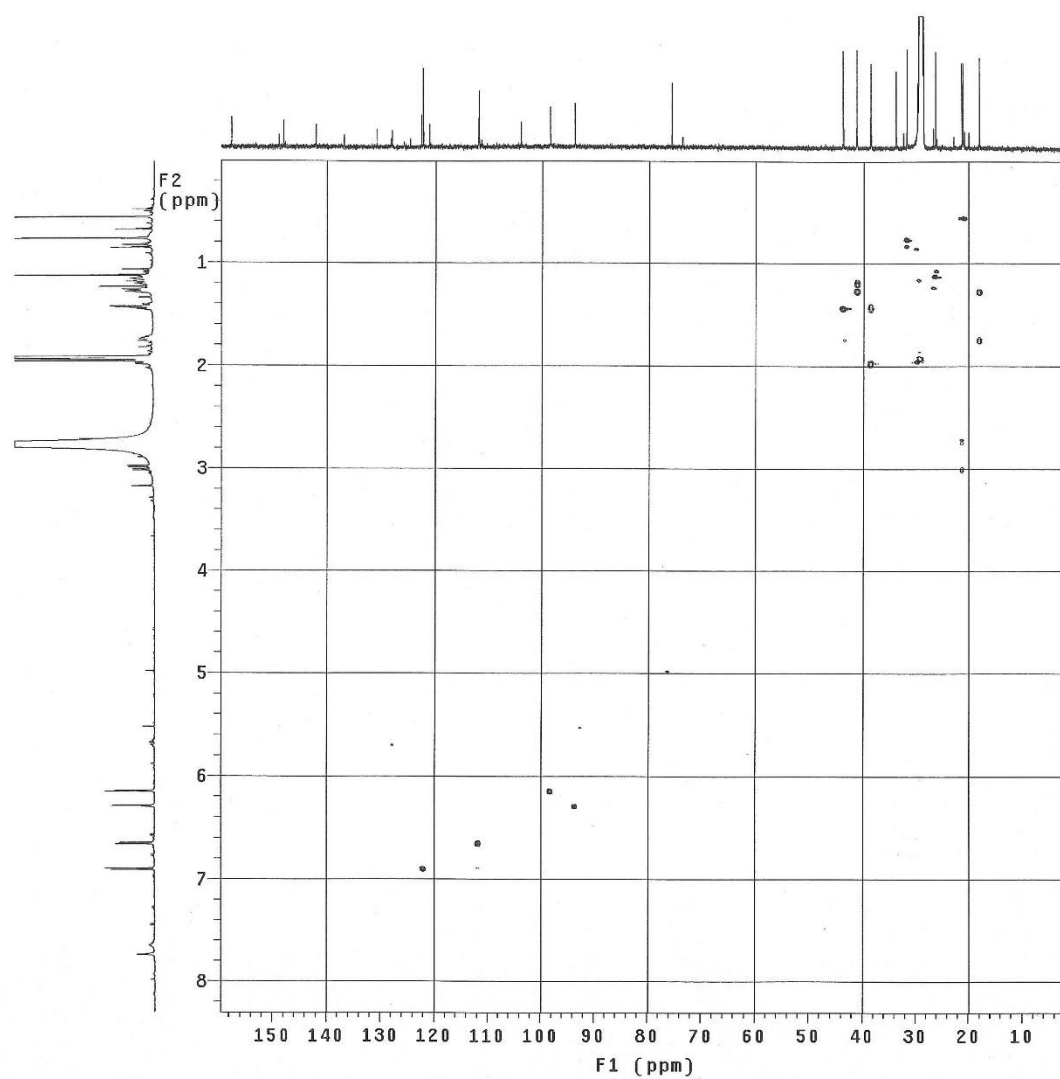
S19. ^1H NMR (500 MHz, acetone- d_6) spectrum of (10*R*, 11*S*)-ugonin N (**4**)



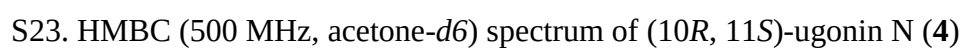
S20. ^{13}C NMR (500 MHz, acetone- d_6) spectrum of (10*R*, 11*S*)-ugonin N (**4**)

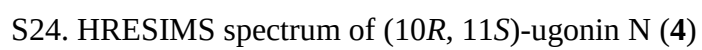


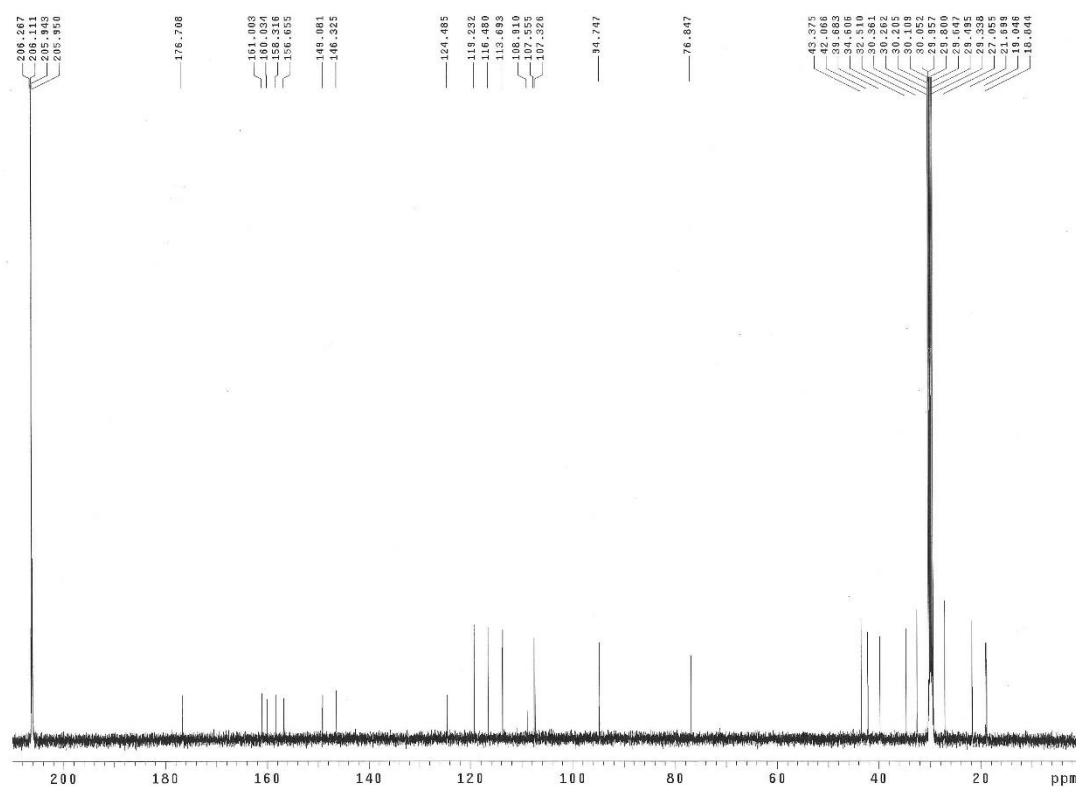
S21. ^1H - ^1H COSY (500 MHz, acetone- d_6) spectrum of (10*R*, 11*S*)-ugonin N (**4**)



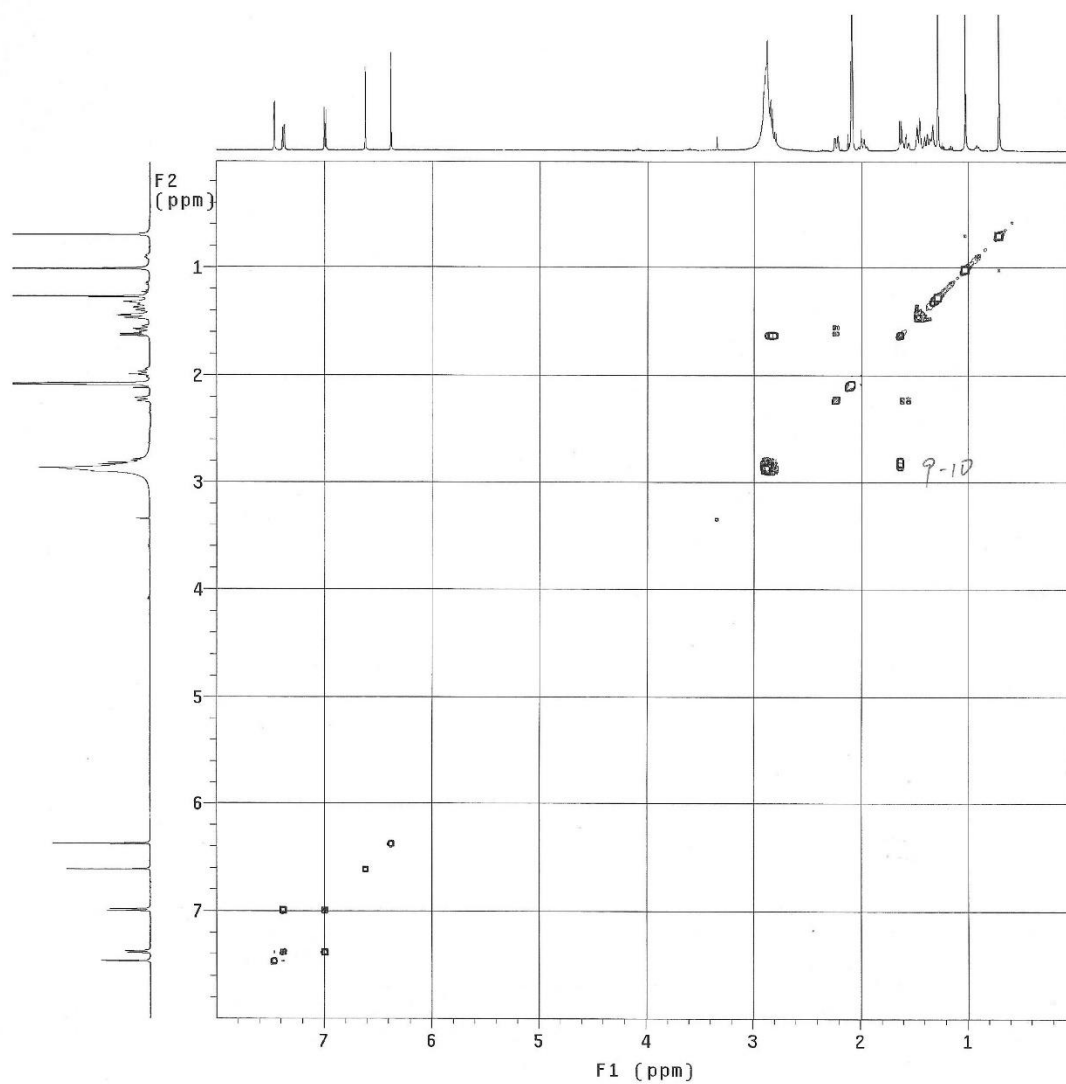
S22. HMQC (500 MHz, acetone-*d*₆) spectrum of (10*R*, 11*S*)-ugonin N (**4**)



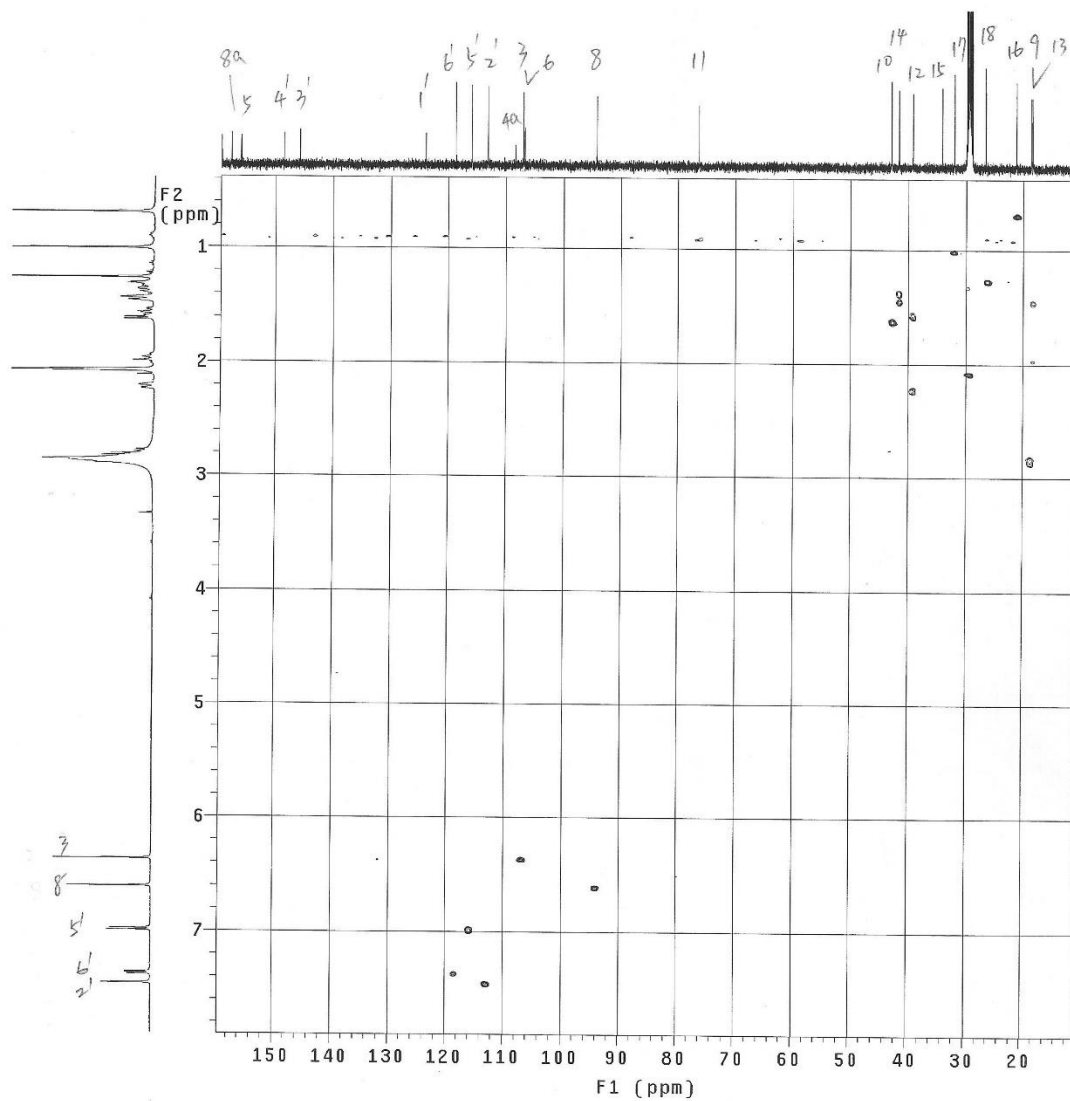




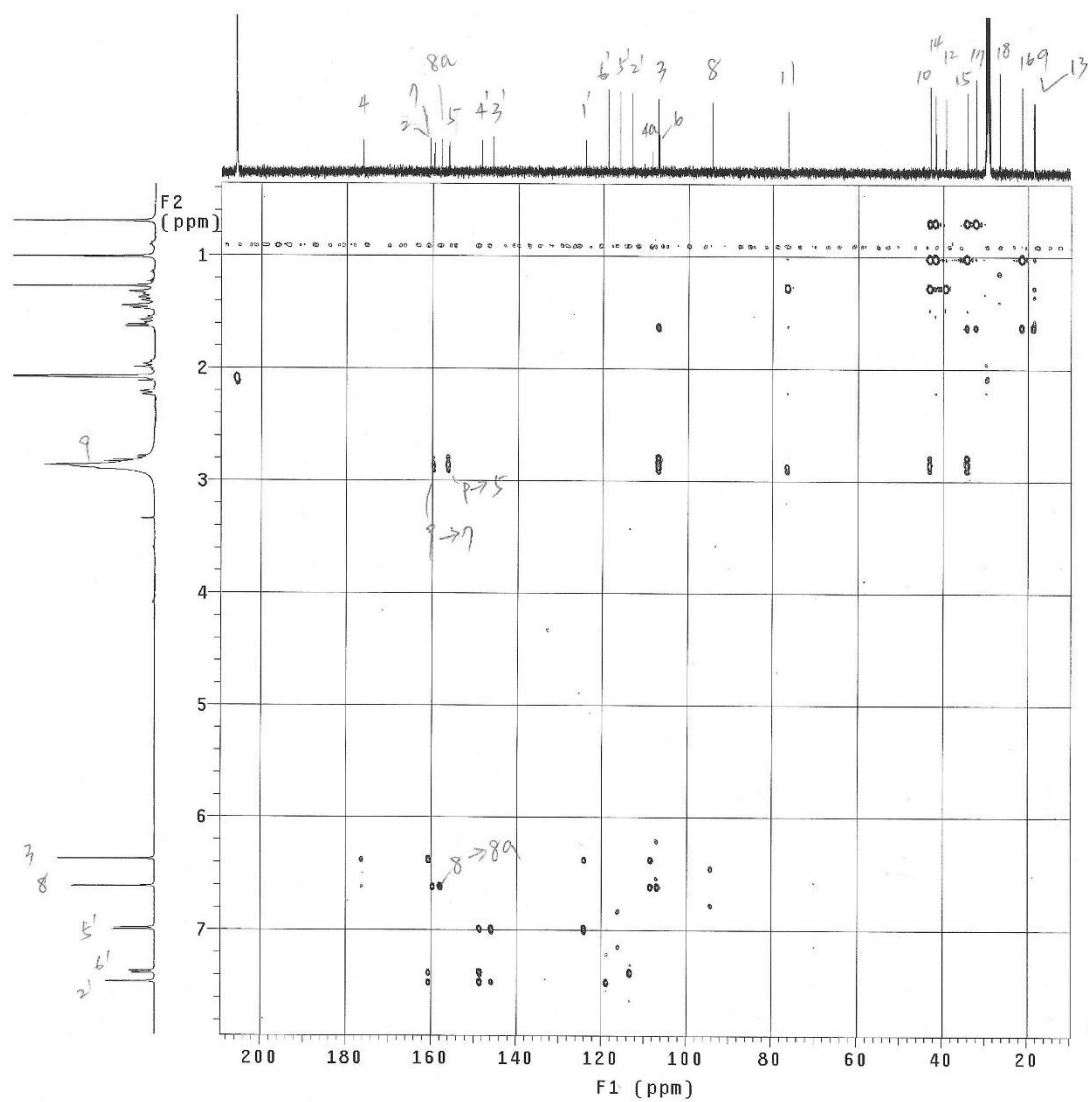
S26. ¹³C NMR (600 MHz, acetone-*d*₆) spectrum of (10*R*, 11*S*)-ugonin S (**5**)



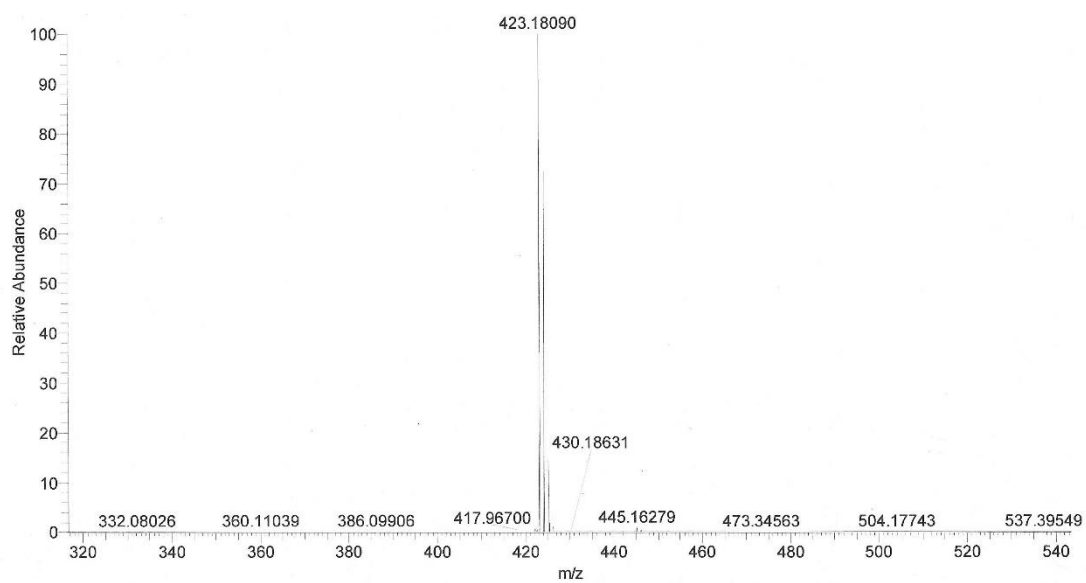
S27. ^1H - ^1H COSY NMR (600 MHz, acetone- d_6) spectrum of (10*R*, 11*S*)-ugonin S (5)



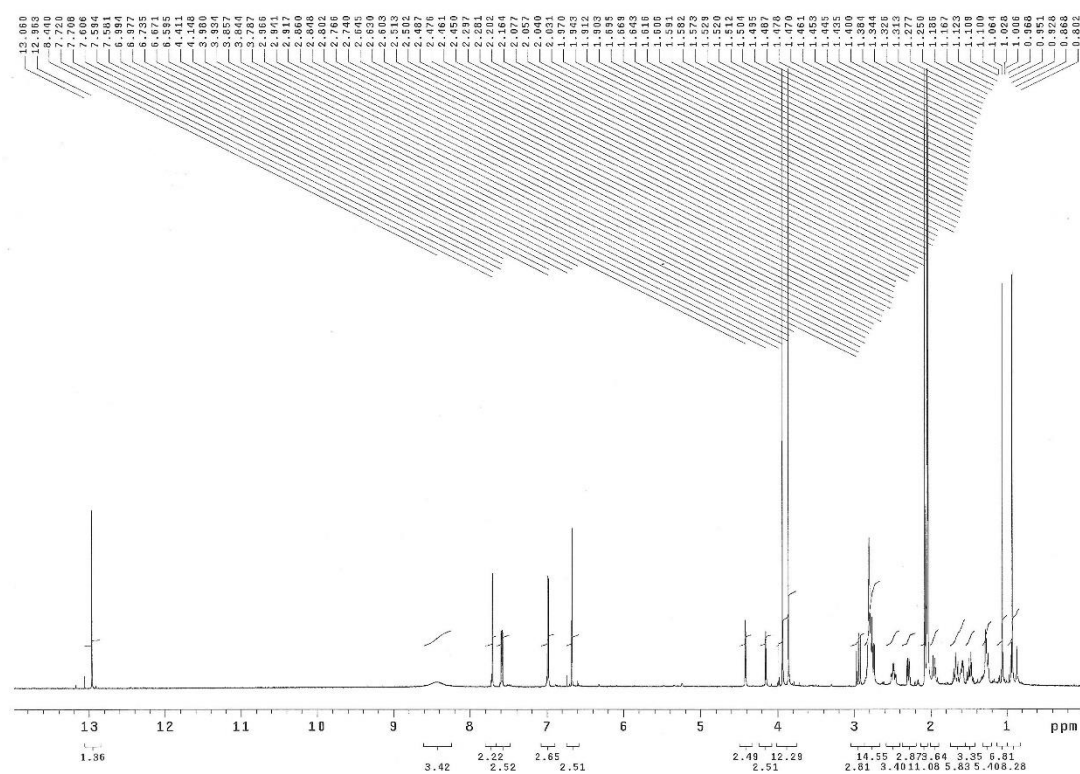
S28. HMQC NMR (600 MHz, acetone-*d*₆) spectrum of (10*R*, 11*S*)-ugonin S (5)



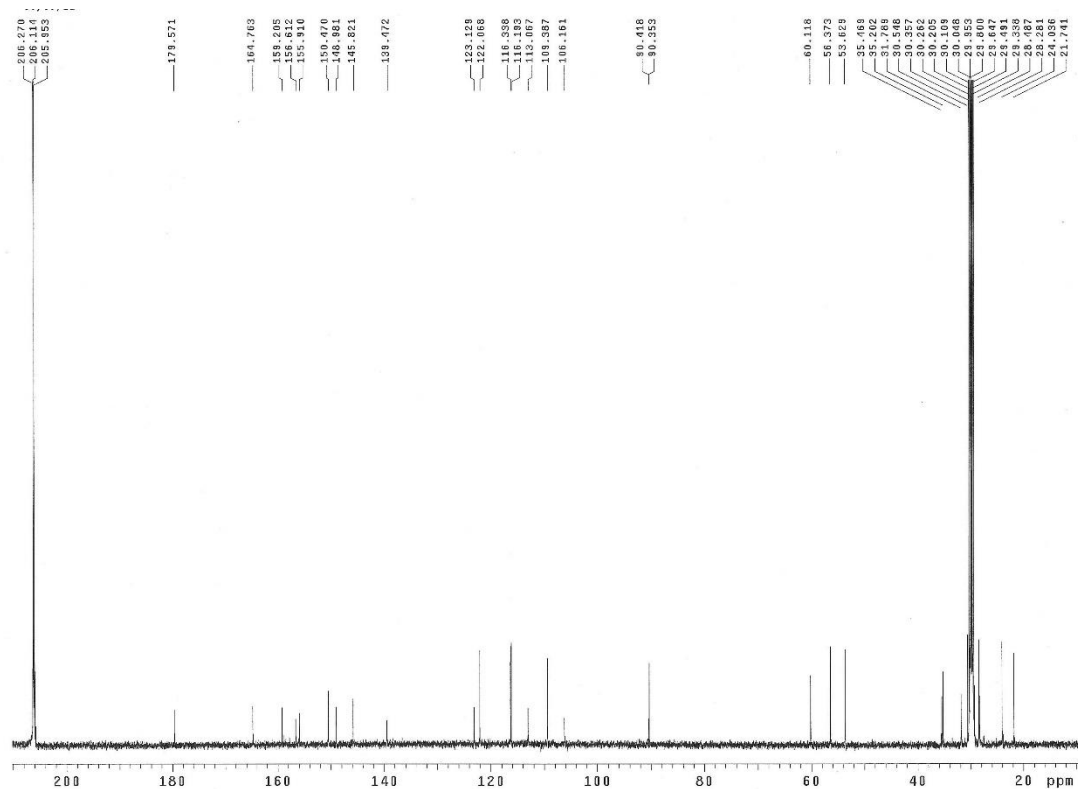
S29. HMBC NMR (600 MHz, acetone-*d*₆) spectrum of (10*R*, 11*S*)-ugonin S (5)



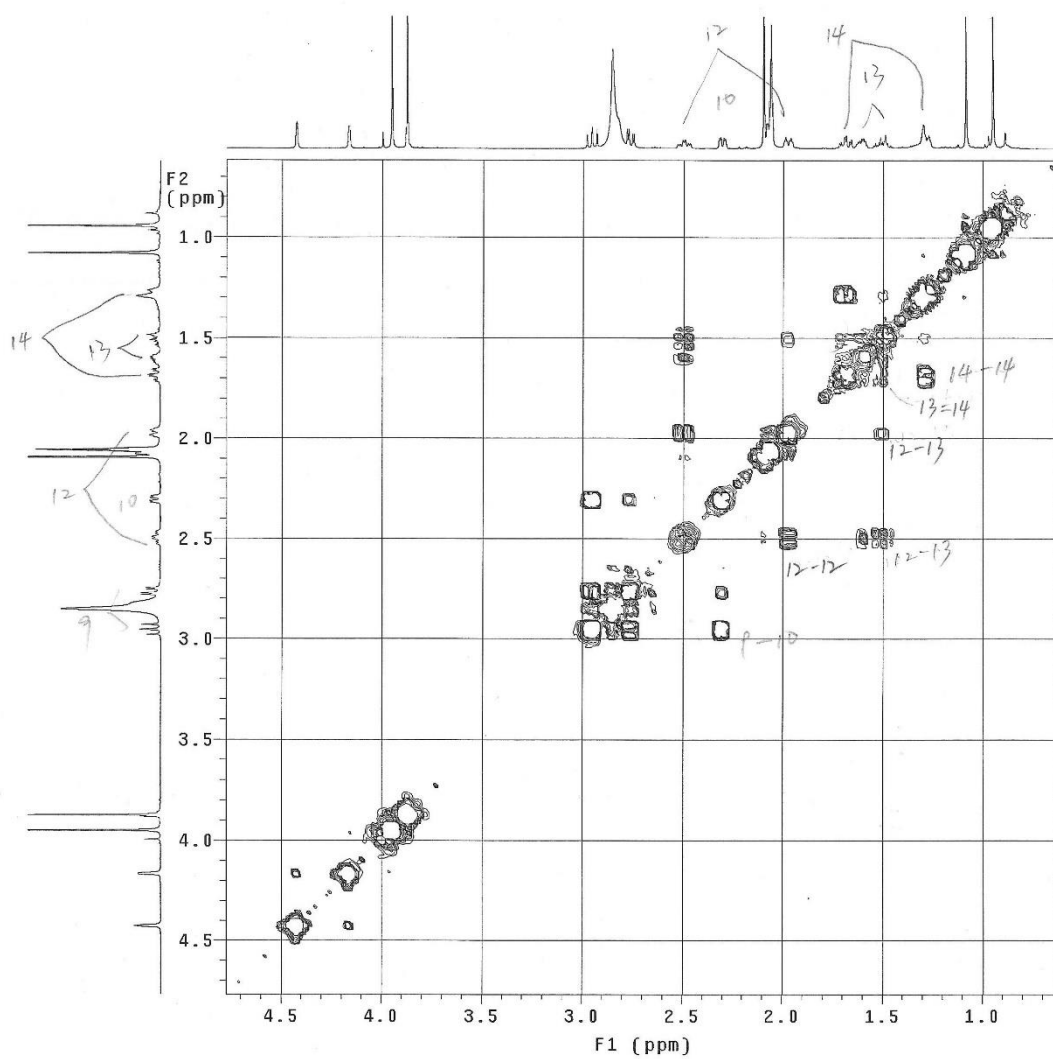
S30. HRESIMS spectrum of (10*R*, 11*S*)-ugonin S (5)



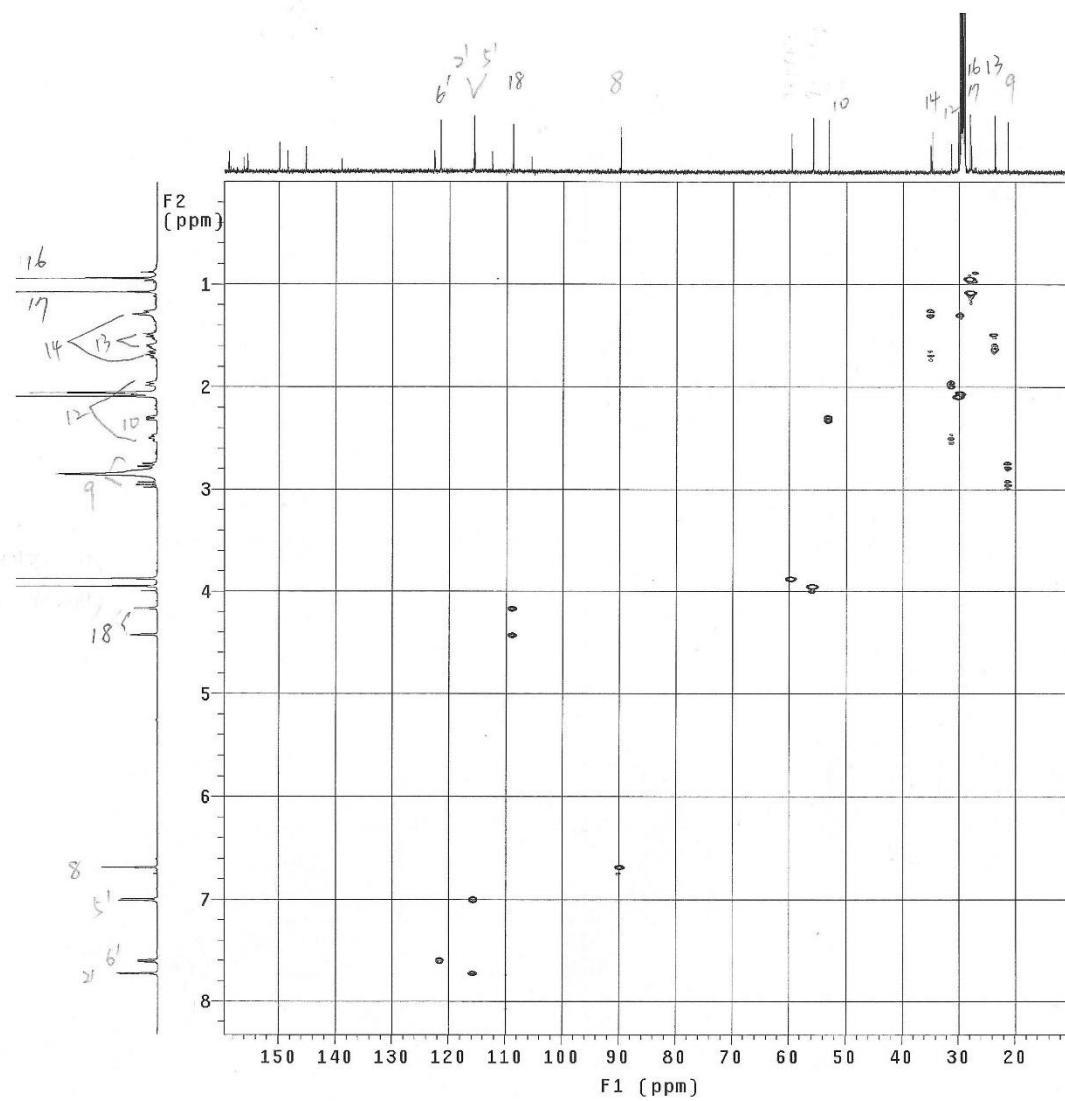
S32. ^1H NMR (500 MHz, acetone- d_6) spectrum of ugonin Y (**6**)



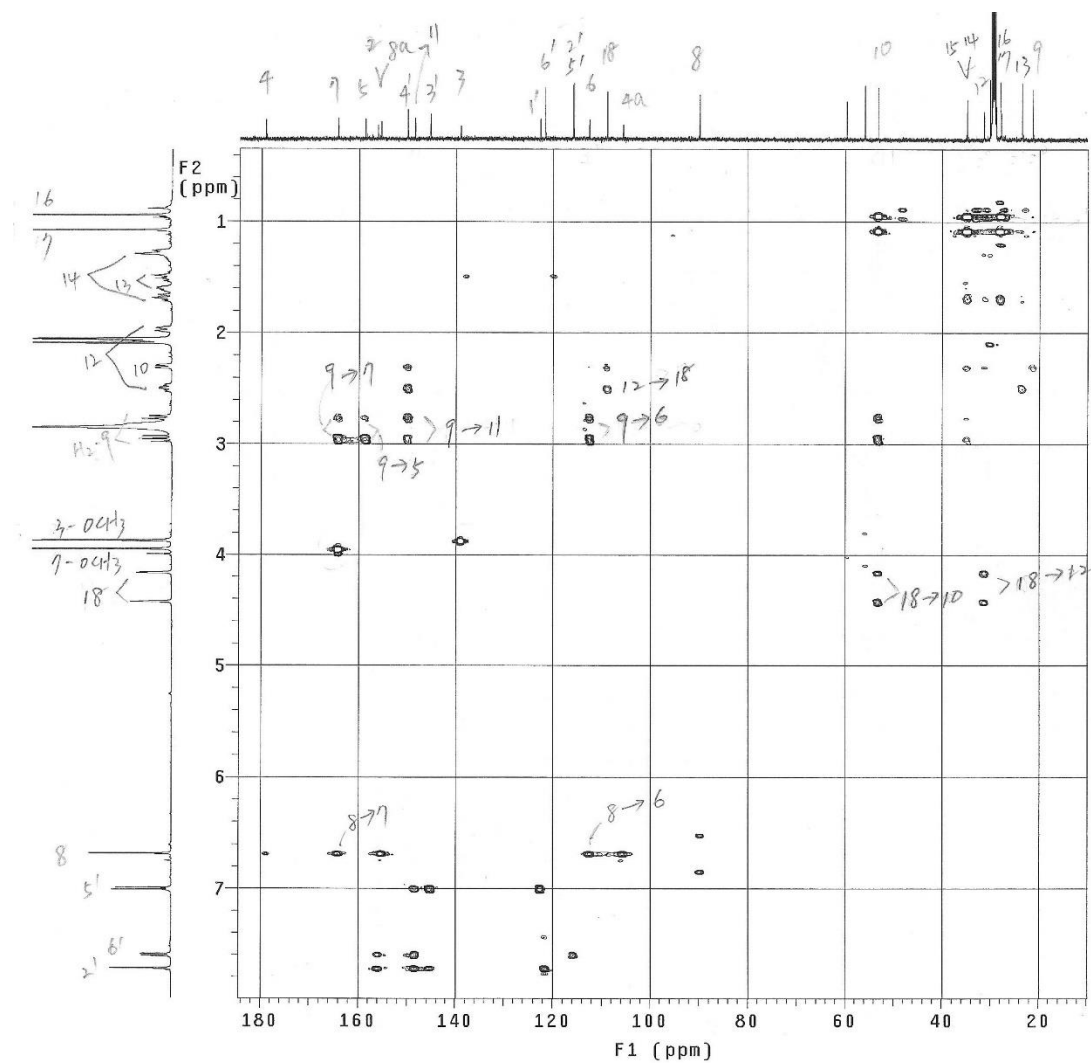
S33. ¹³C NMR (500 MHz, acetone-*d*₆) spectrum of ugonin Y (6)



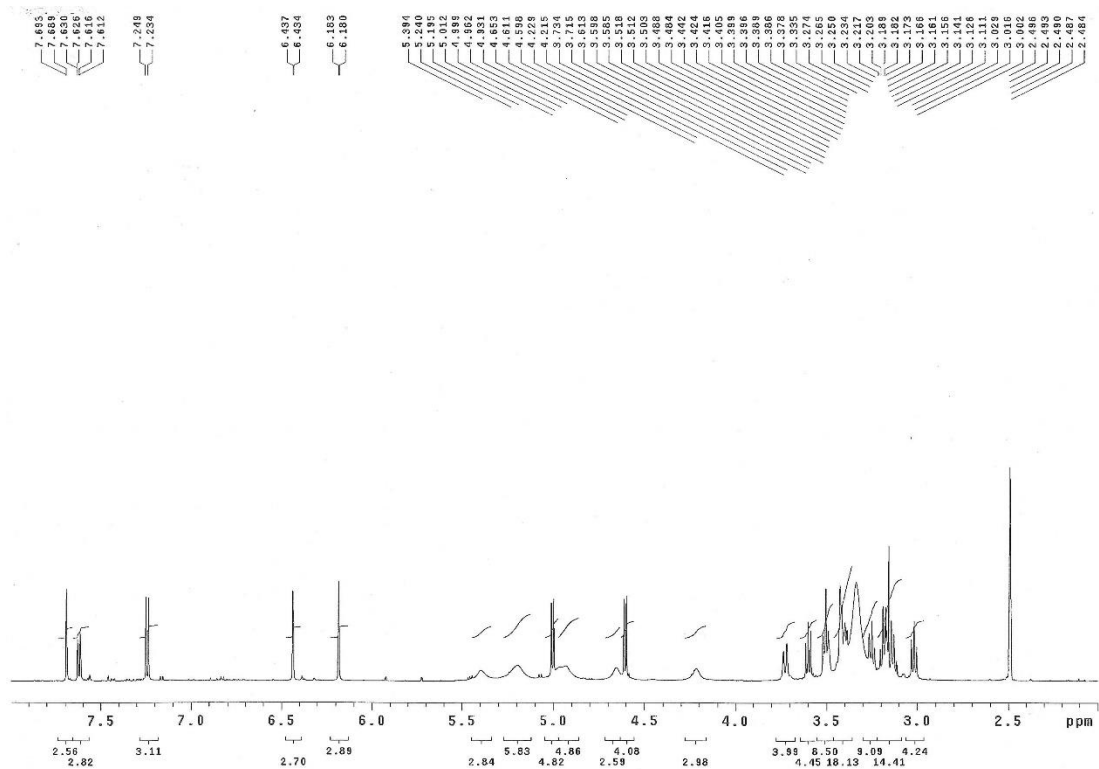
S34. ^1H - ^1H COSY NMR (500 MHz, acetone- d_6) spectrum of ugonin Y (6)



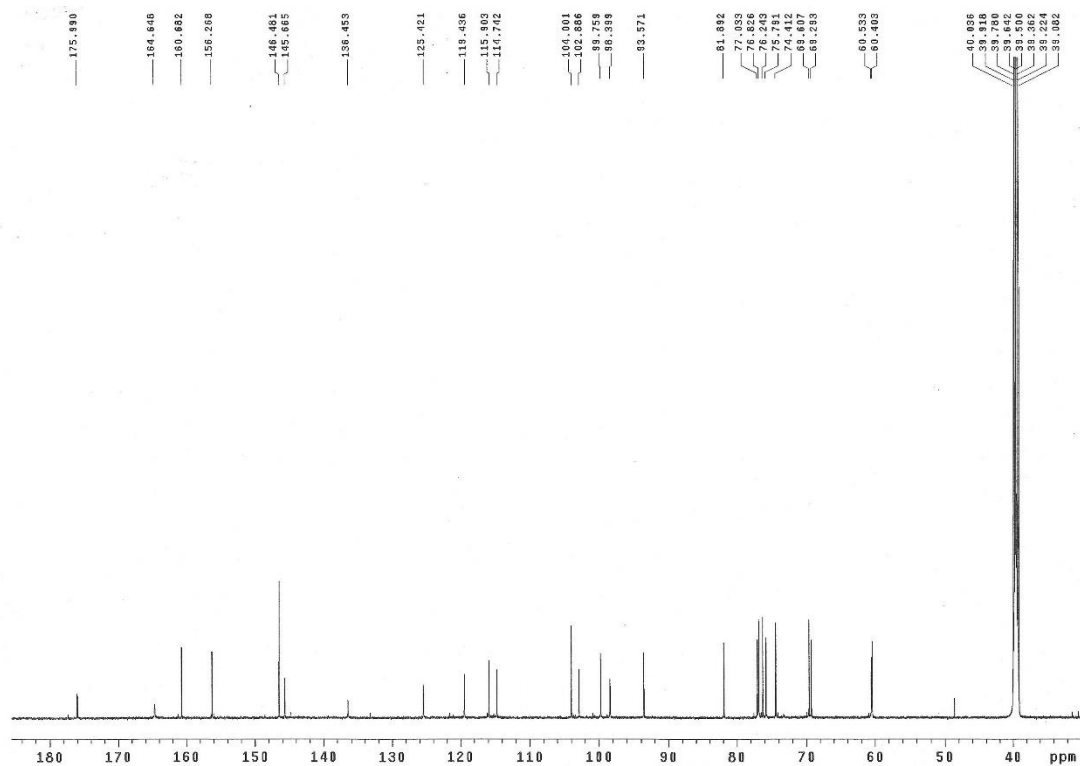
S35. HMQC NMR (500 MHz, acetone-*d*₆) spectrum of ugonin Y (**6**)



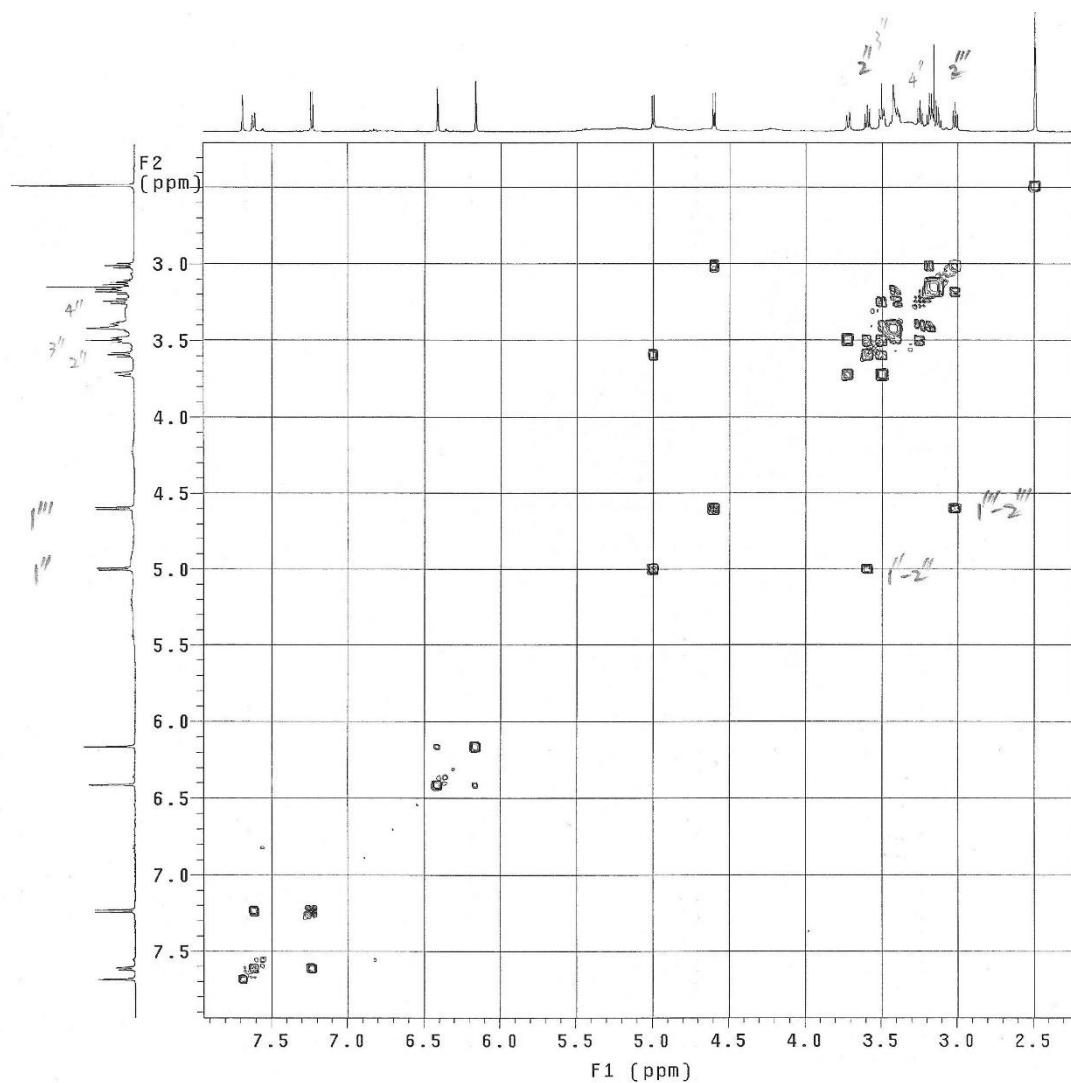
S36. HMBC NMR (500 MHz, acetone-*d*₆) spectrum of ugonin Y (**6**)



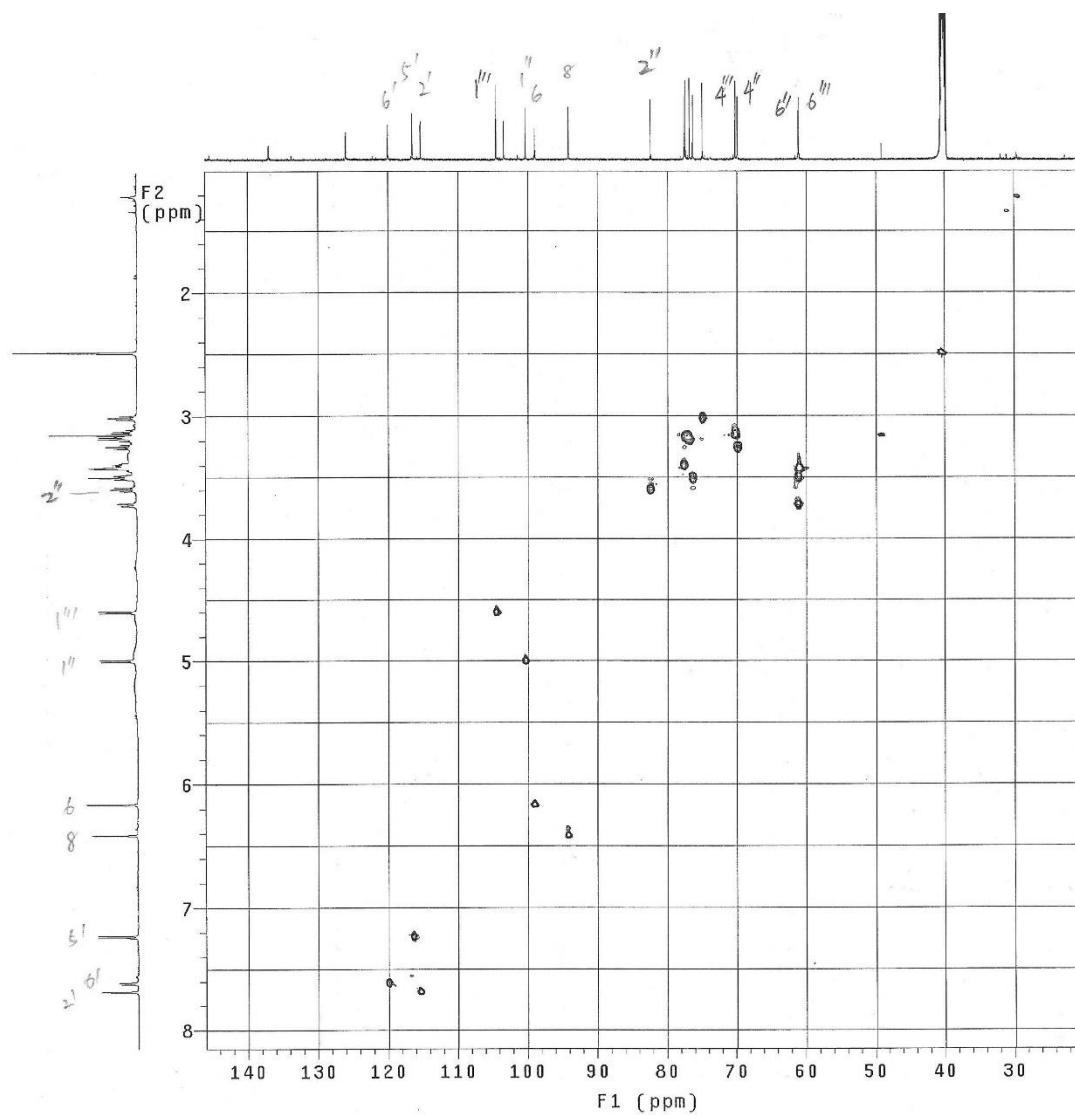
S38. ¹H NMR (600 MHz, DMSO-*d*₆) spectrum of quercetin-4'-O- β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (7)



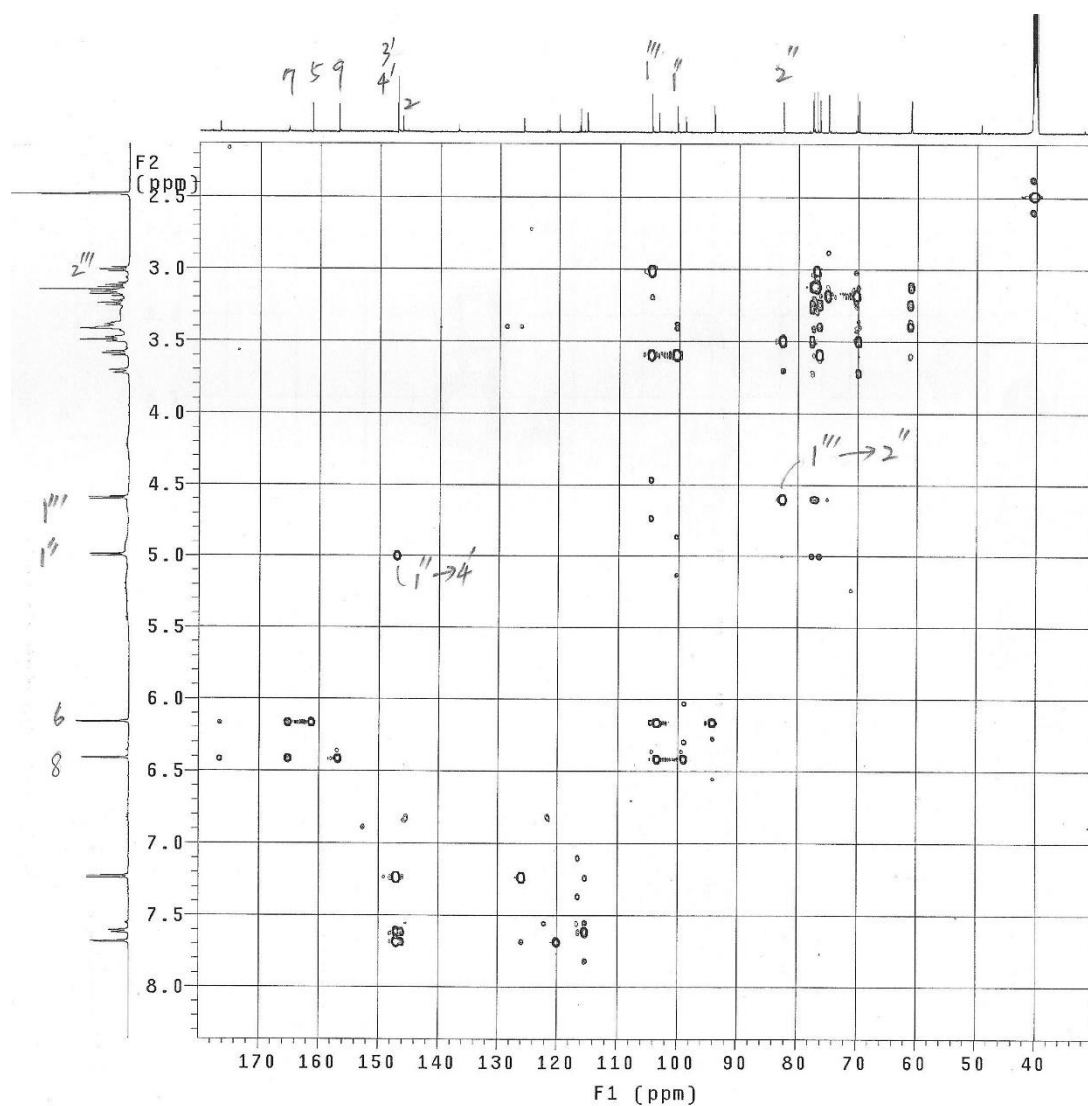
S39. ^{13}C NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-4'- O - β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (7)



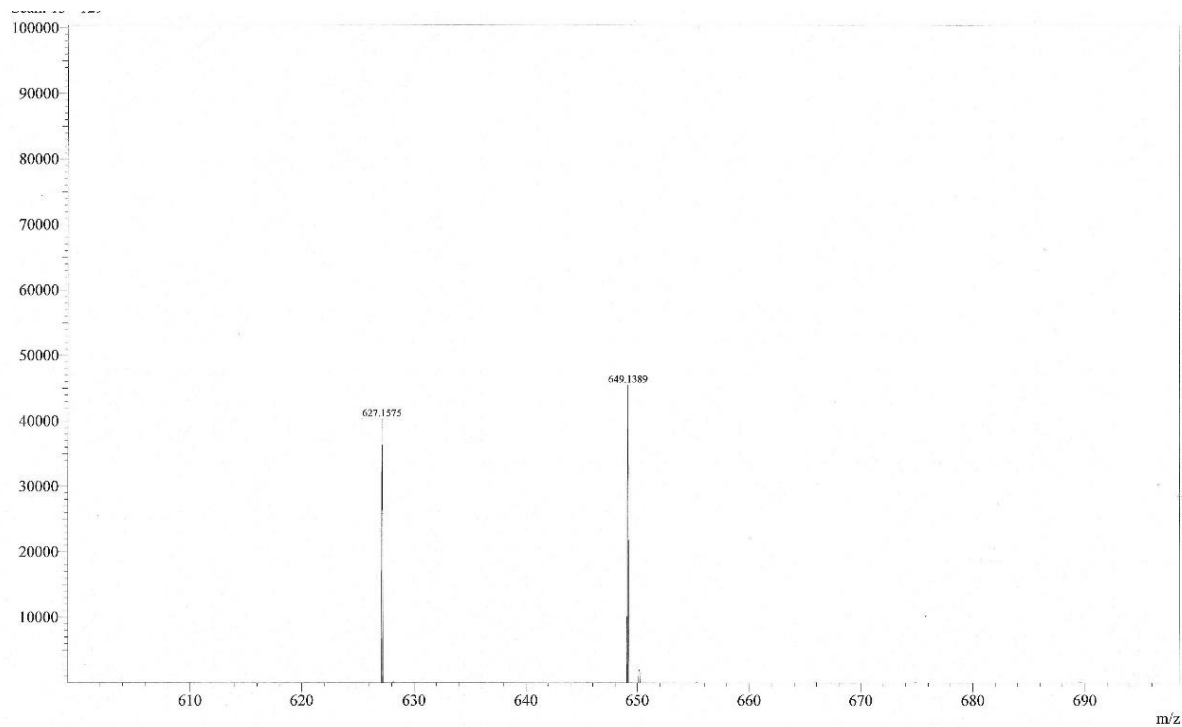
S40. ^1H - ^1H COSY NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-4'- O - β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (7)



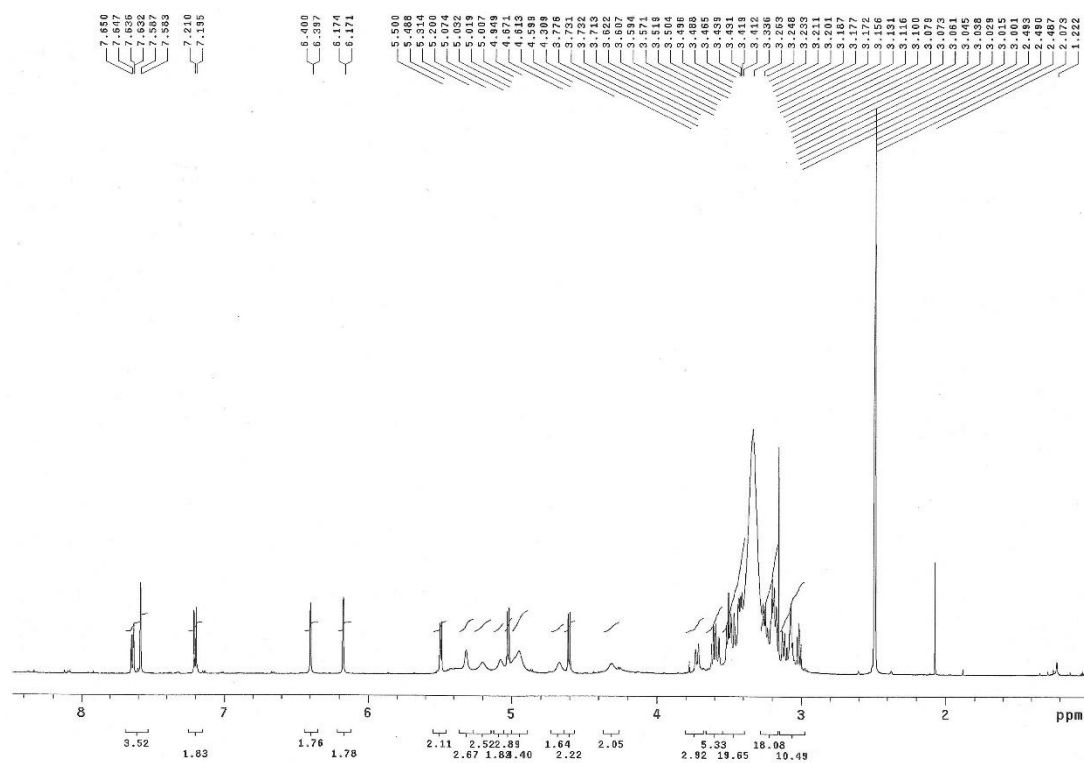
S41. HMQC NMR (600 MHz, DMSO- d_6) spectrum of quercetin-4'- O - β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (7)



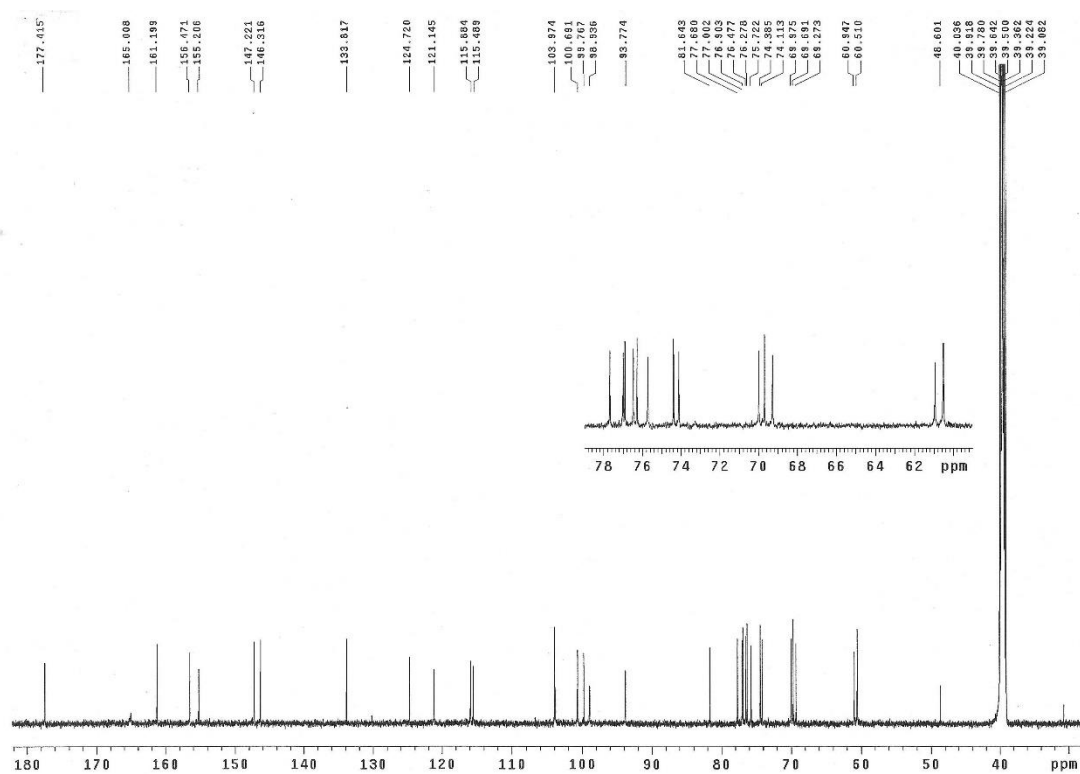
S42. HMBC NMR (600 MHz, DMSO-*d*₆) spectrum of quercetin-4'-*O*- β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (7)



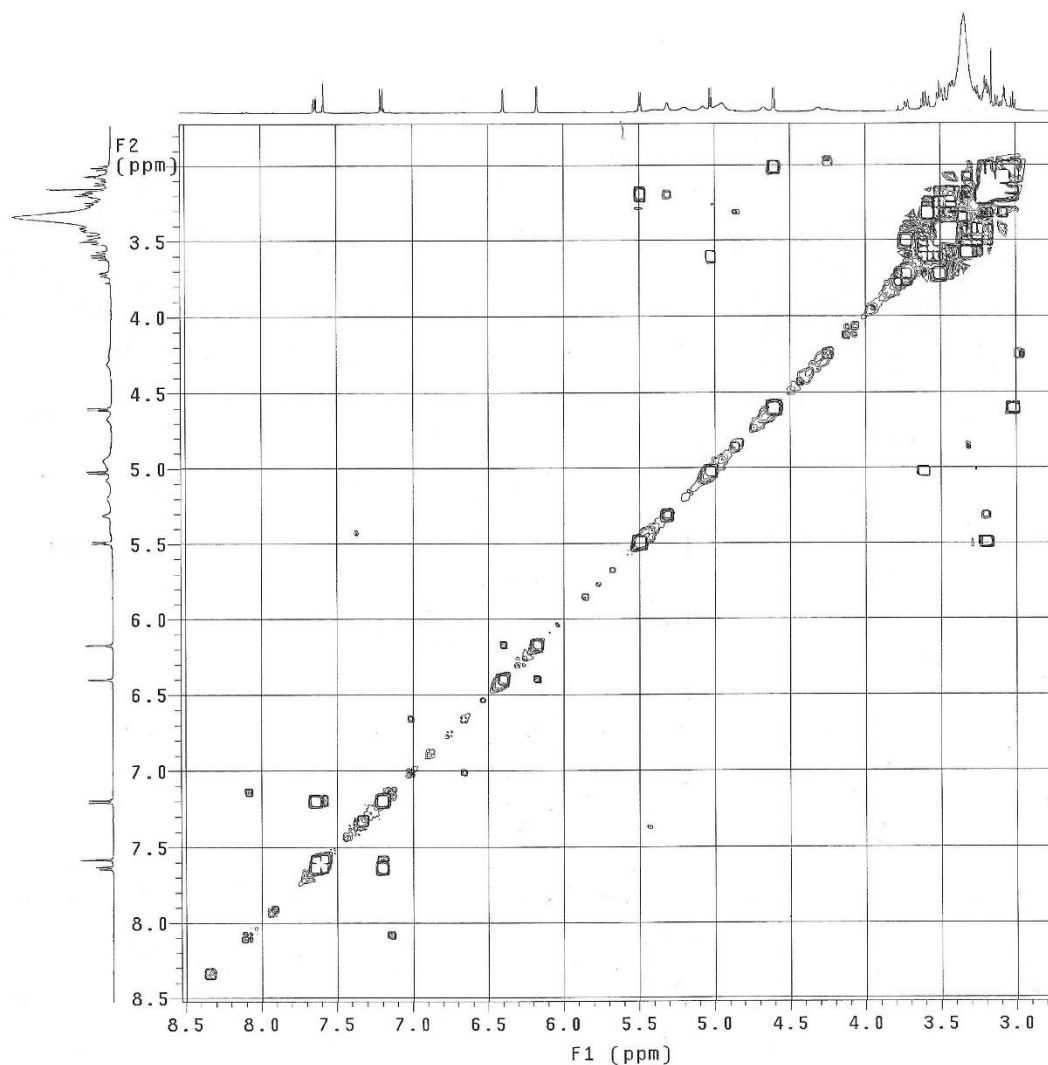
S43. HRESIMS spectrum of quercetin-4'-*O*- β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (**7**)



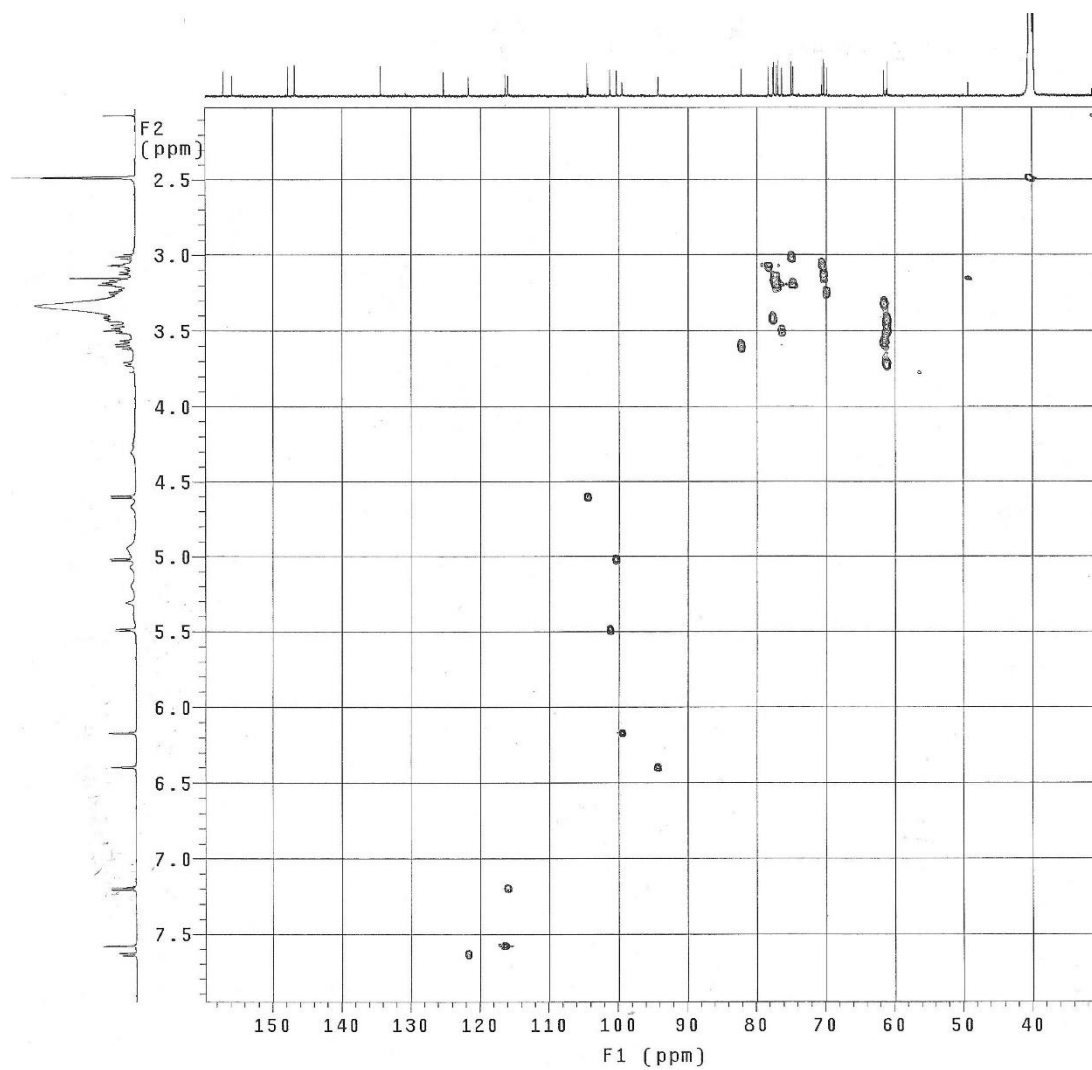
S44. ^1H NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3- O - β -D-glucopyranose-4'- O - β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (**8**)



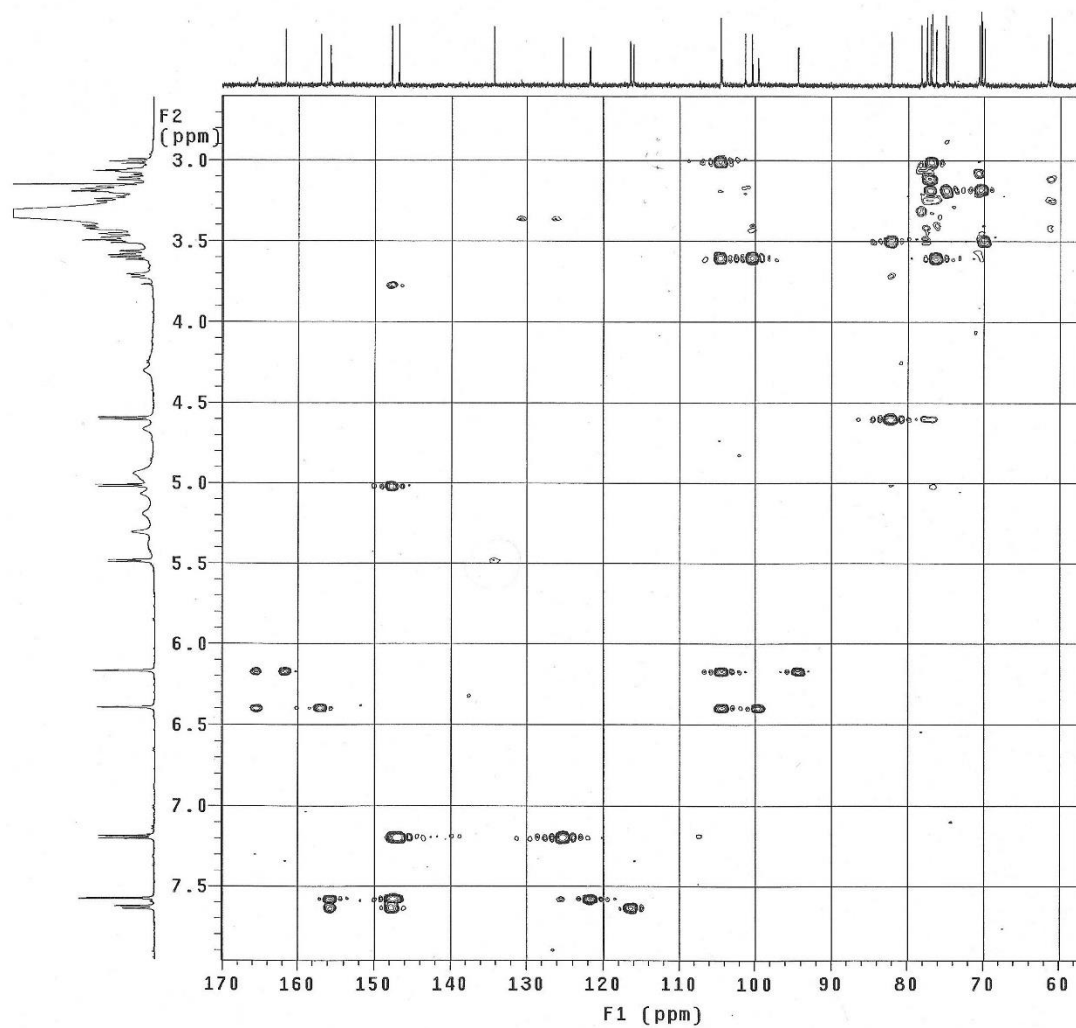
S45. ^{13}C NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3-*O*- β -D-glucopyranose-4'-*O*- β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (**8**)



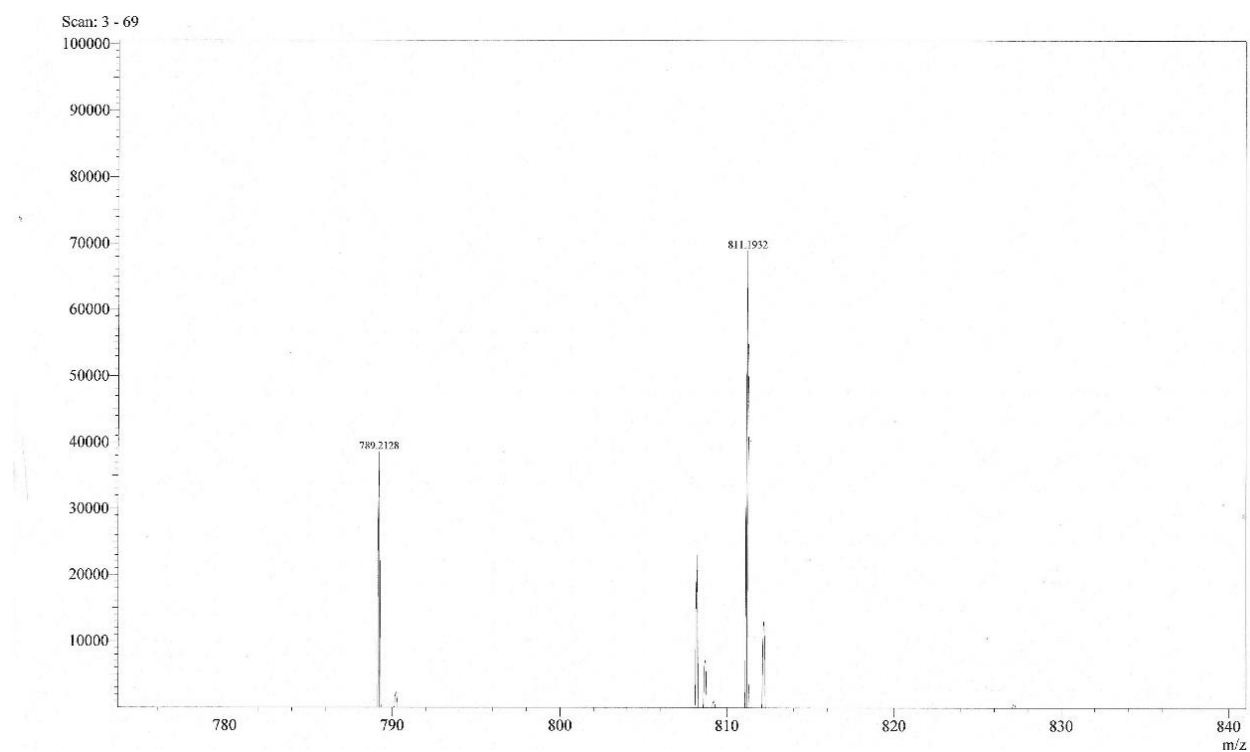
S46. ^1H - ^1H COSY NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3-*O*- β -D-glucopyranose-4'-*O*- β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (**8**)



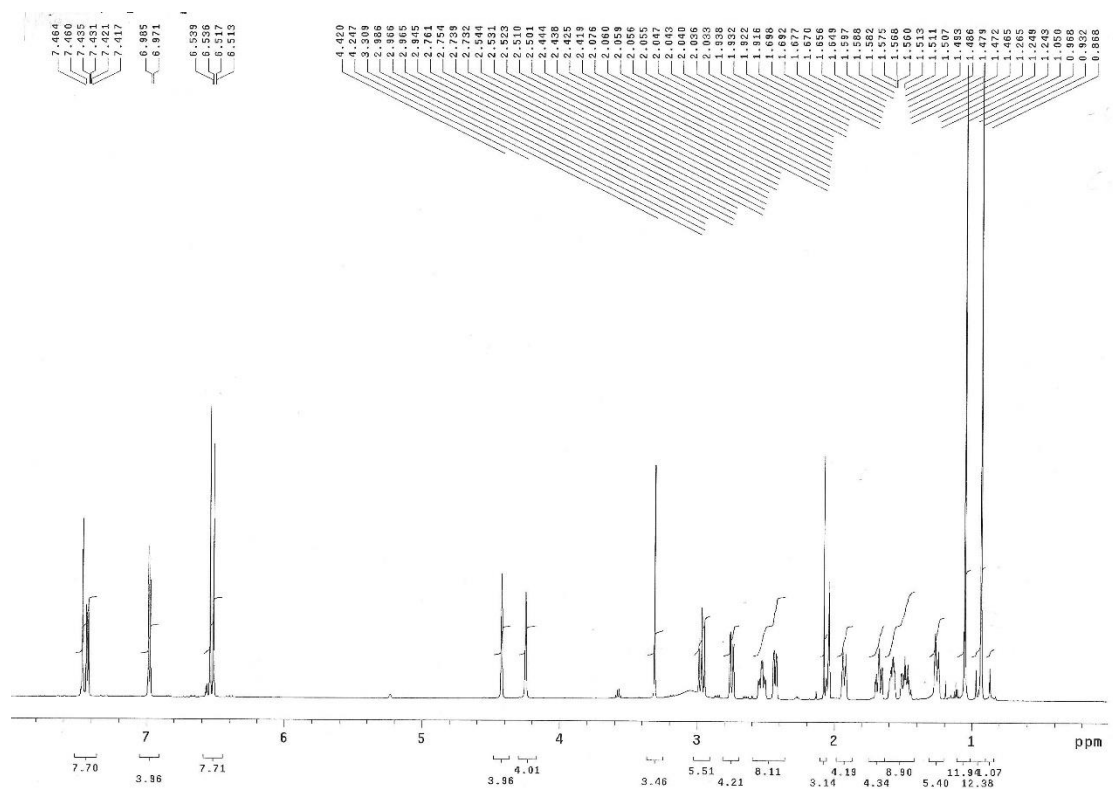
S47. HMQC NMR (600 MHz, DMSO-*d*₆) spectrum of quercetin-3-*O*- β -D-glucopyranose-4'-*O*- β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (**8**)



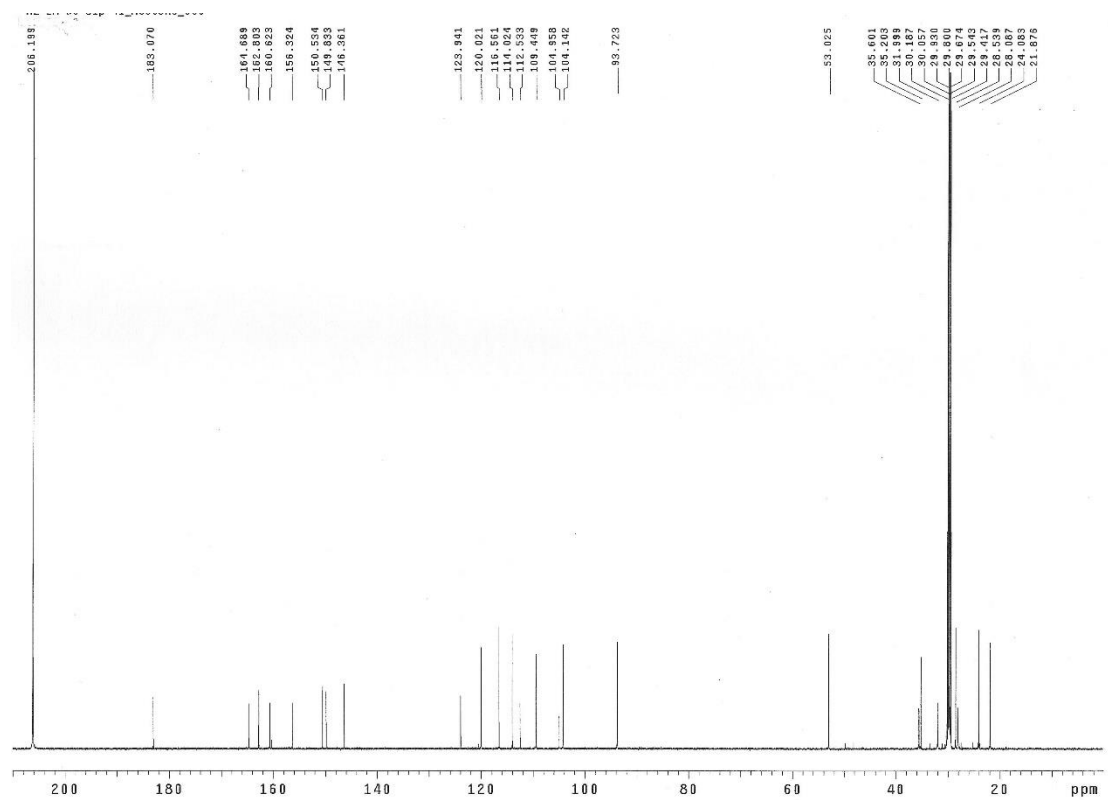
S48. HMBC NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3- O - β -D-glucopyranose-4'- O - β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (**8**)



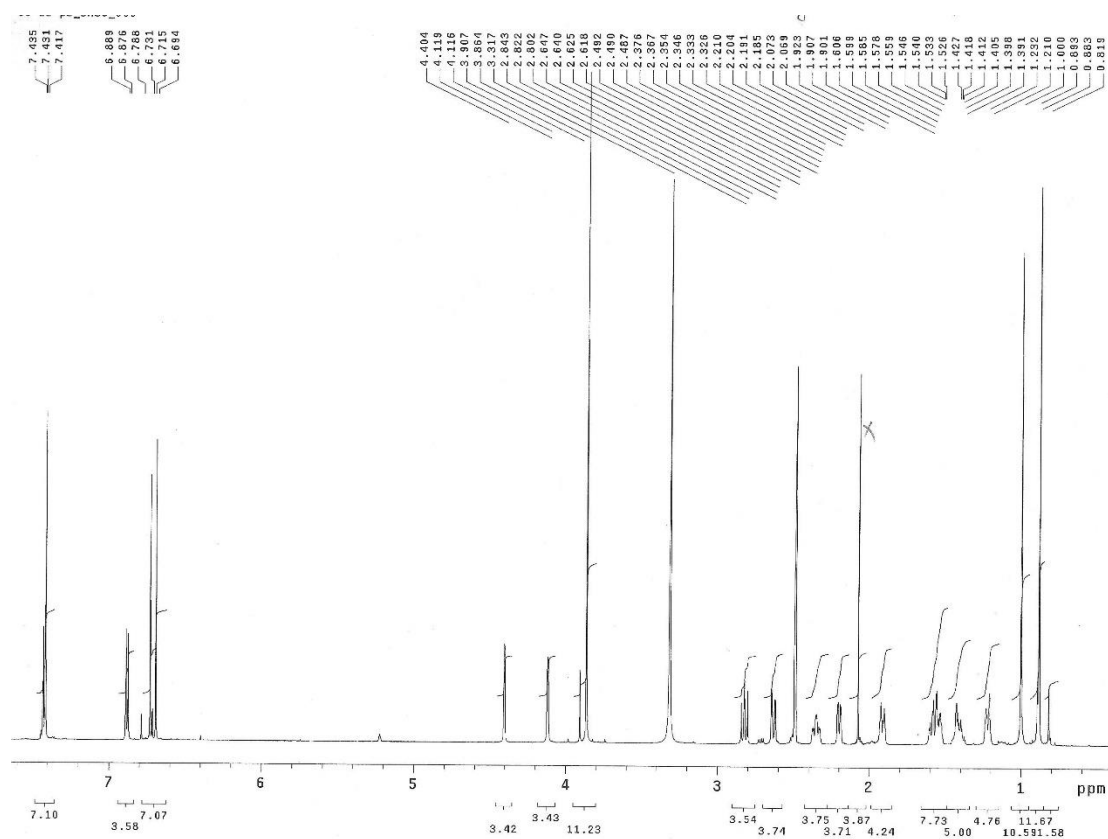
S49. HRESIMS spectrum of quercetin-3-*O*- β -D-glucopyranose-4'-*O*- β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (**8**)



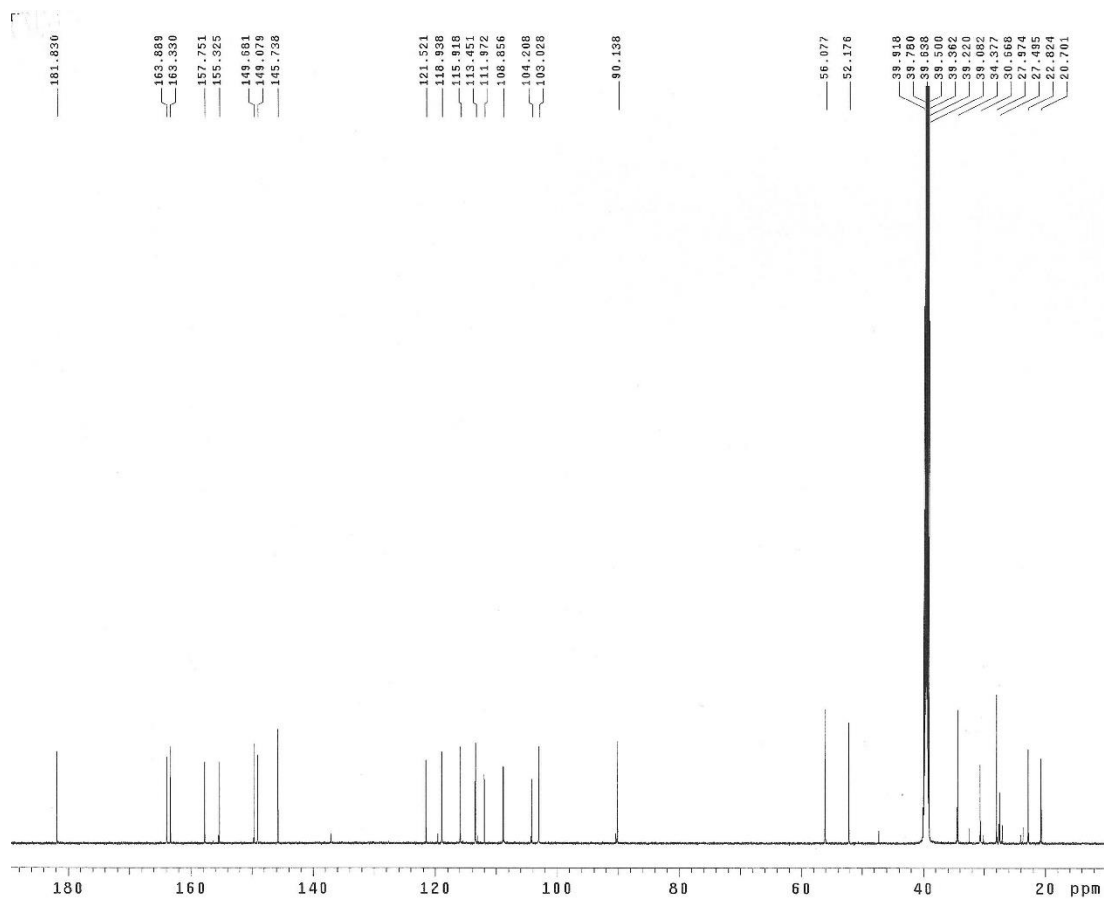
S50. ^1H NMR (600 MHz, acetone- d_6) spectrum of ugonin J (**9**)



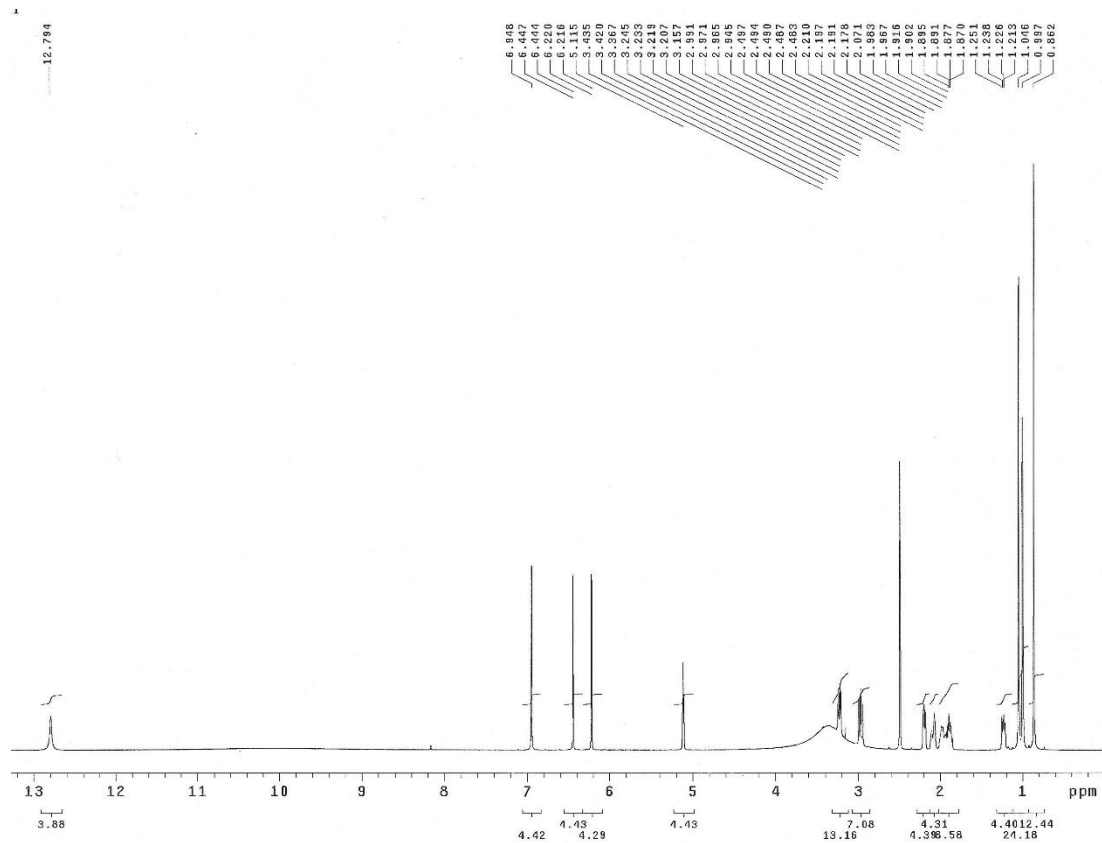
S51. ¹³C NMR (600 MHz, acetone-*d*₆) spectrum of ugonin J (**9**)



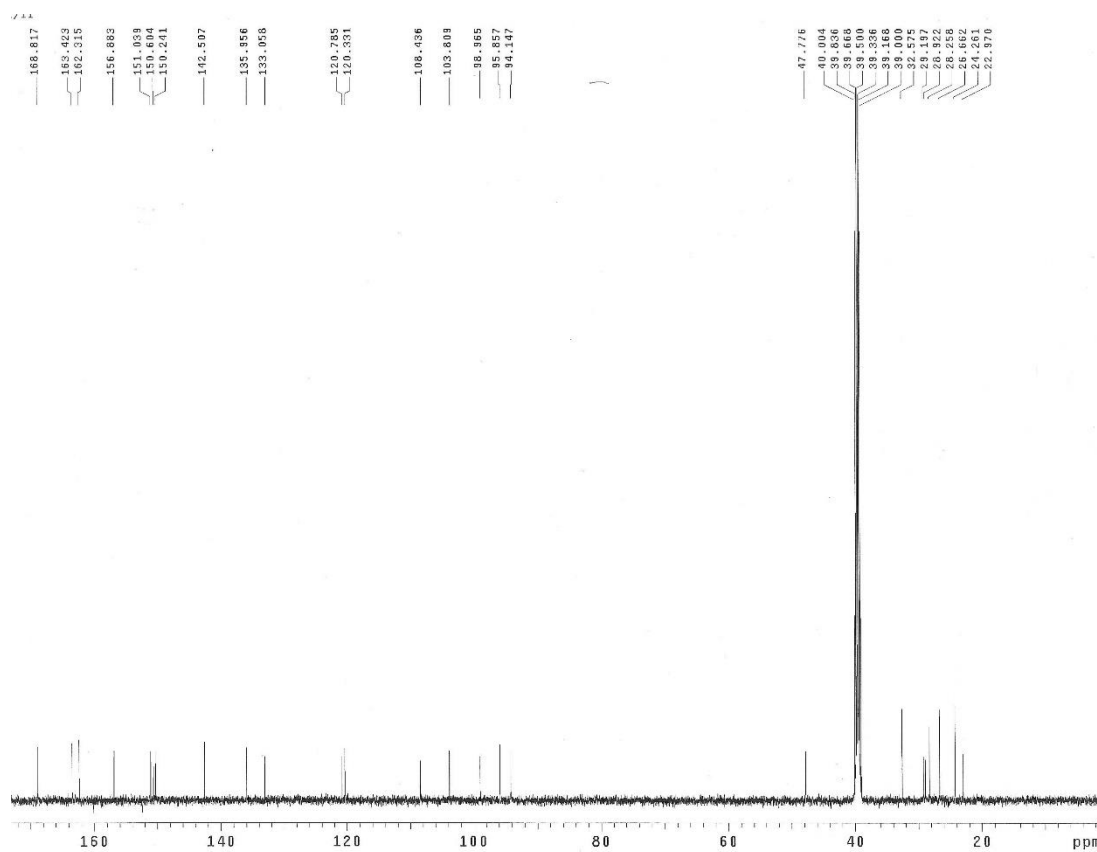
S52. ¹H NMR (600 MHz, DMSO-*d*₆) spectrum of ugonin K (**10**)



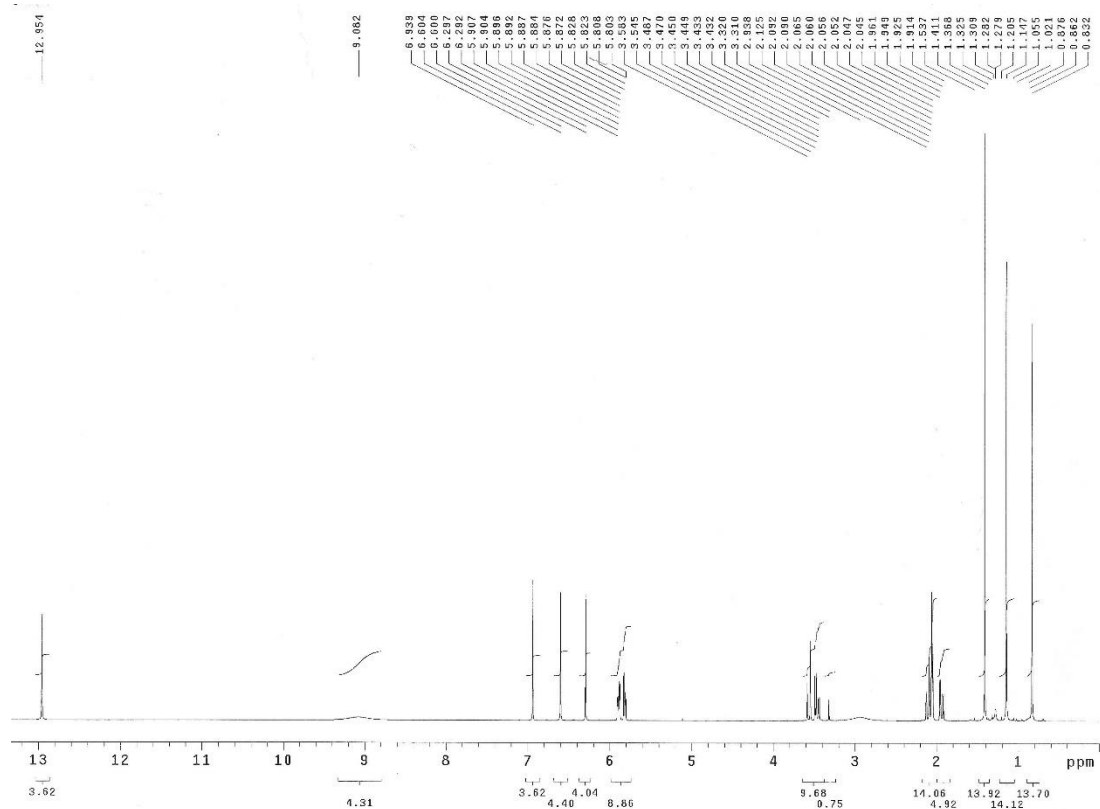
S53. ^{13}C NMR (600 MHz, $\text{DMSO}-d_6$) spectrum of ugonin K (**10**)



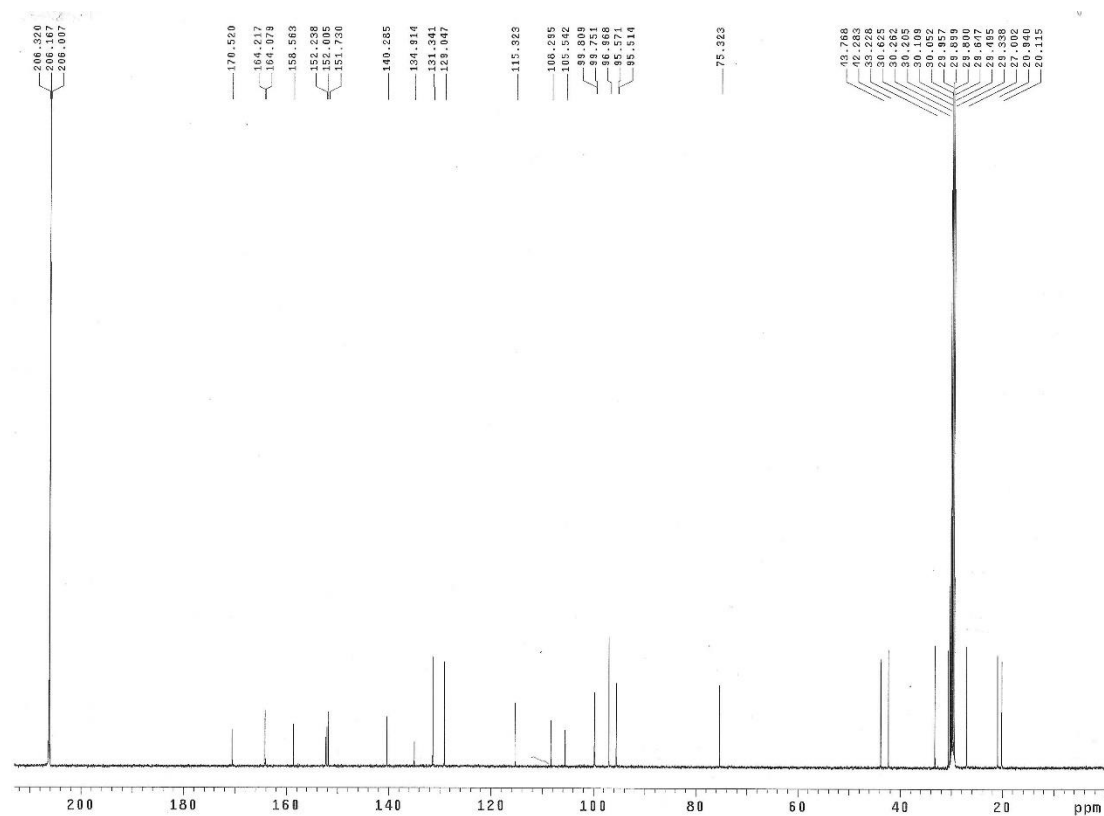
S54. ^1H NMR (500 MHz, $\text{DMSO}-d_6$) spectrum of ugonin M (**11**)



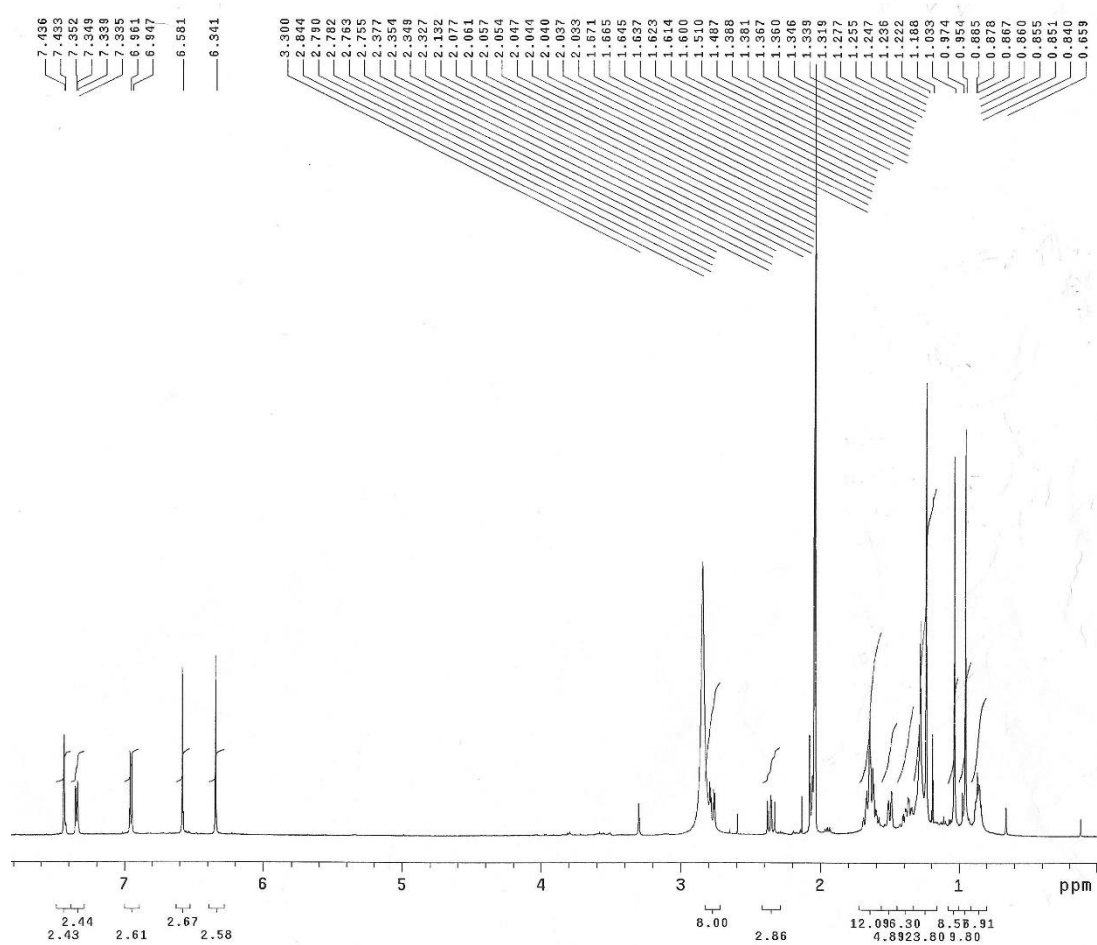
S55. ^{13}C NMR (500 MHz, $\text{DMSO-}d_6$) spectrum of ugonin M (**11**)



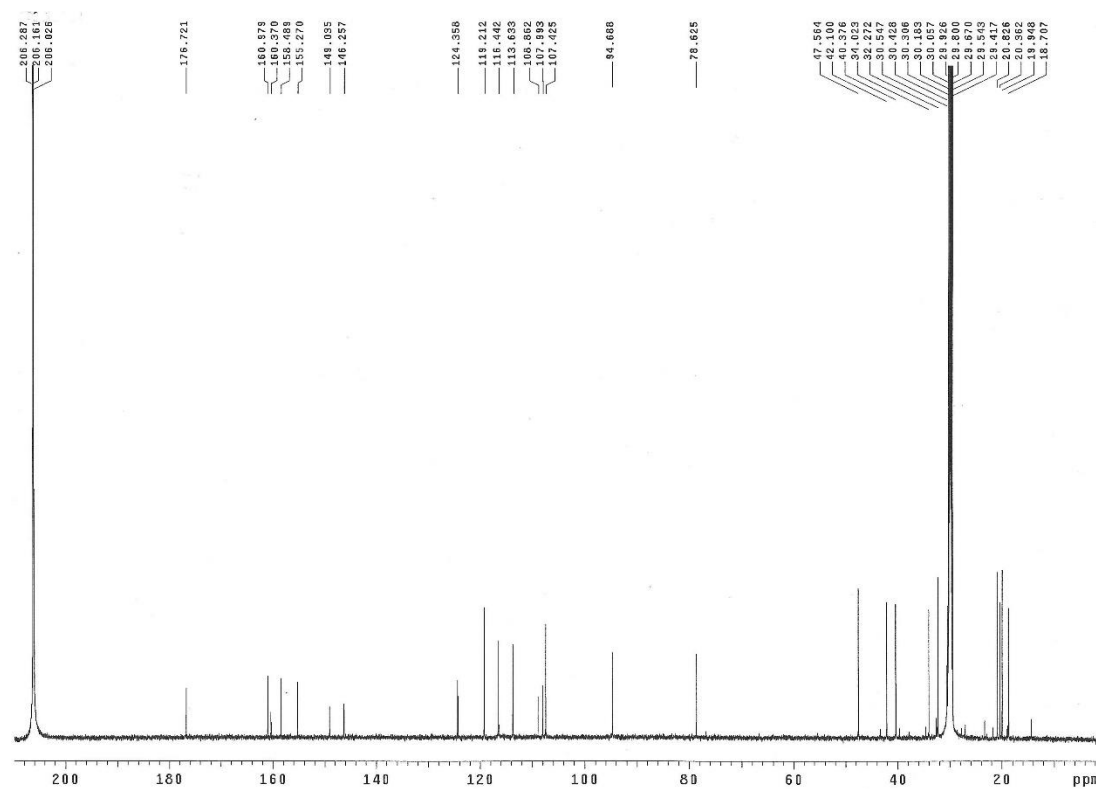
S56. ¹H NMR (500 MHz, acetone-*d*₆) spectrum of ugonin O (**12**)



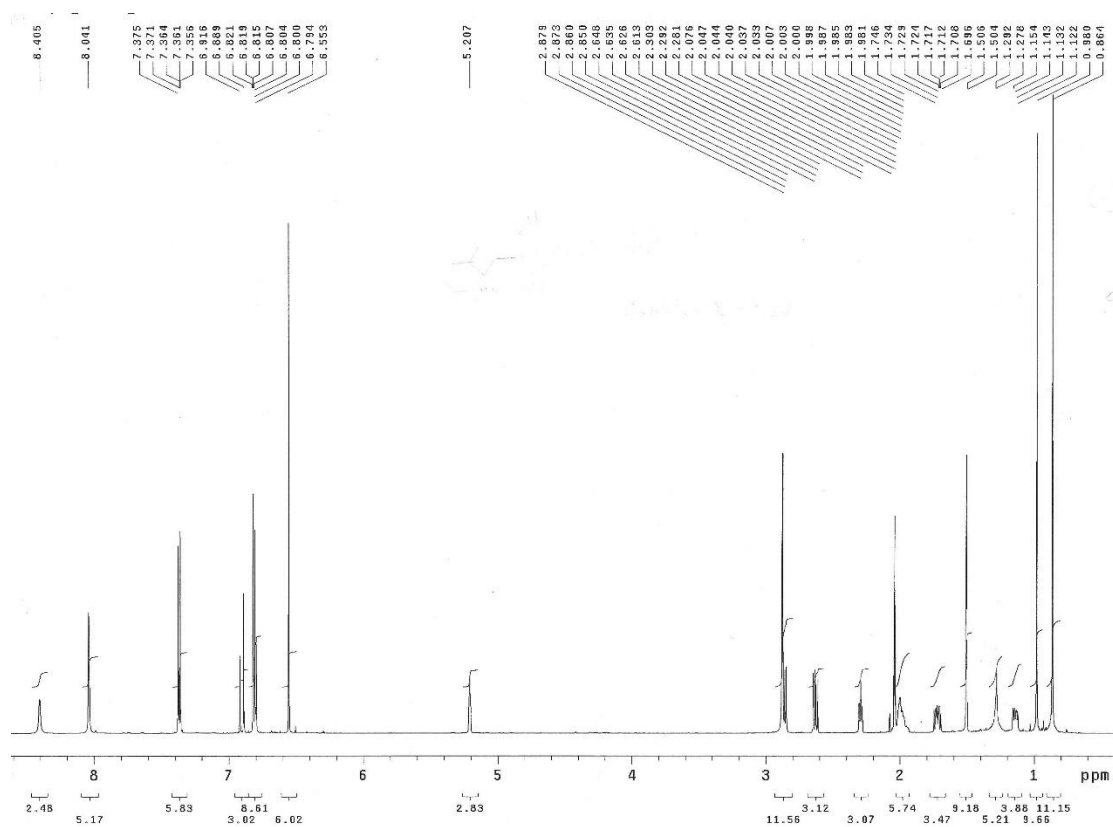
S57. ^{13}C NMR (500 MHz, acetone- d_6) spectrum of ugonin O (**12**)



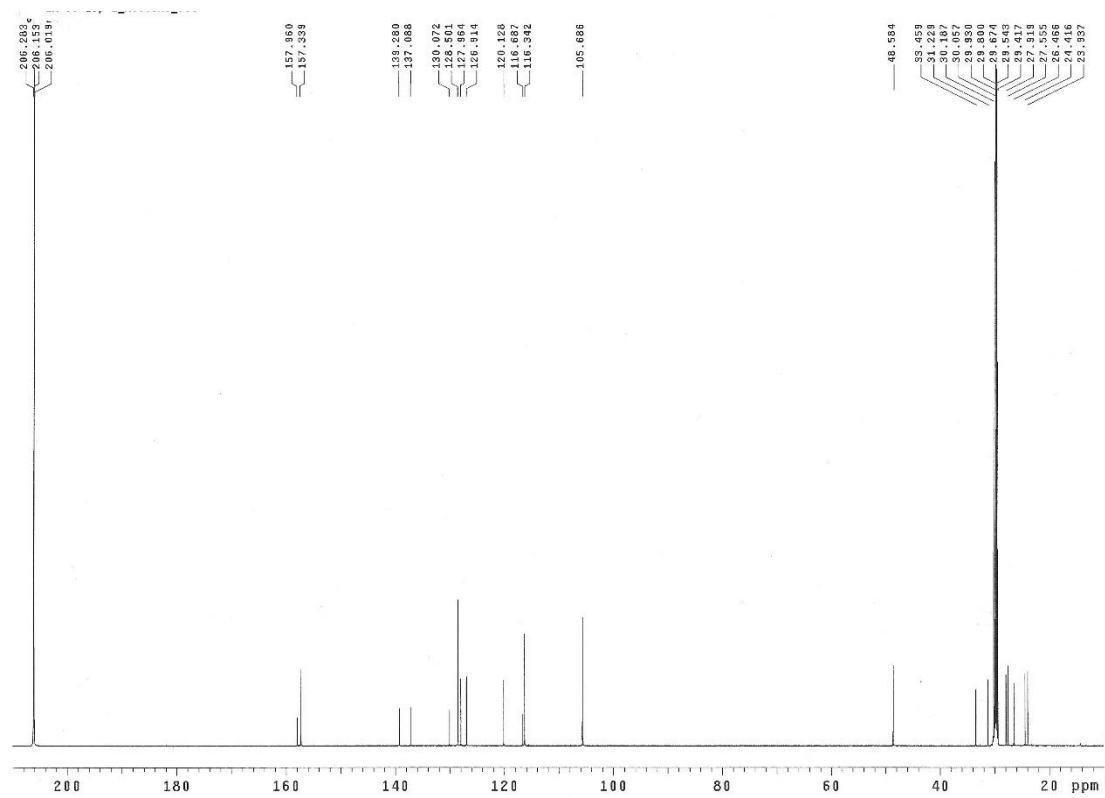
S58. ¹H NMR (600 MHz, acetone-*d*₆) spectrum of (10*R*,11*R*)-ugonins S (**13**)



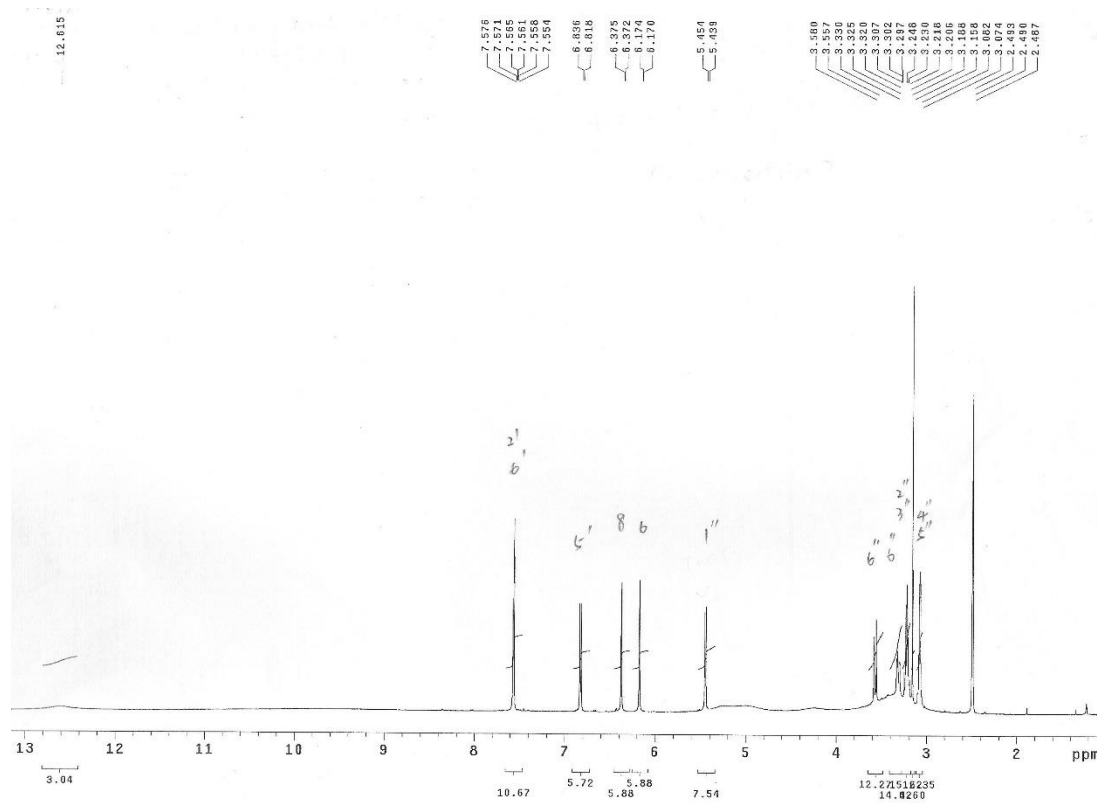
S59. ^{13}C NMR (600 MHz, acetone- d_6) spectrum of (10*R*,11*R*)-ugonins S (**13**)



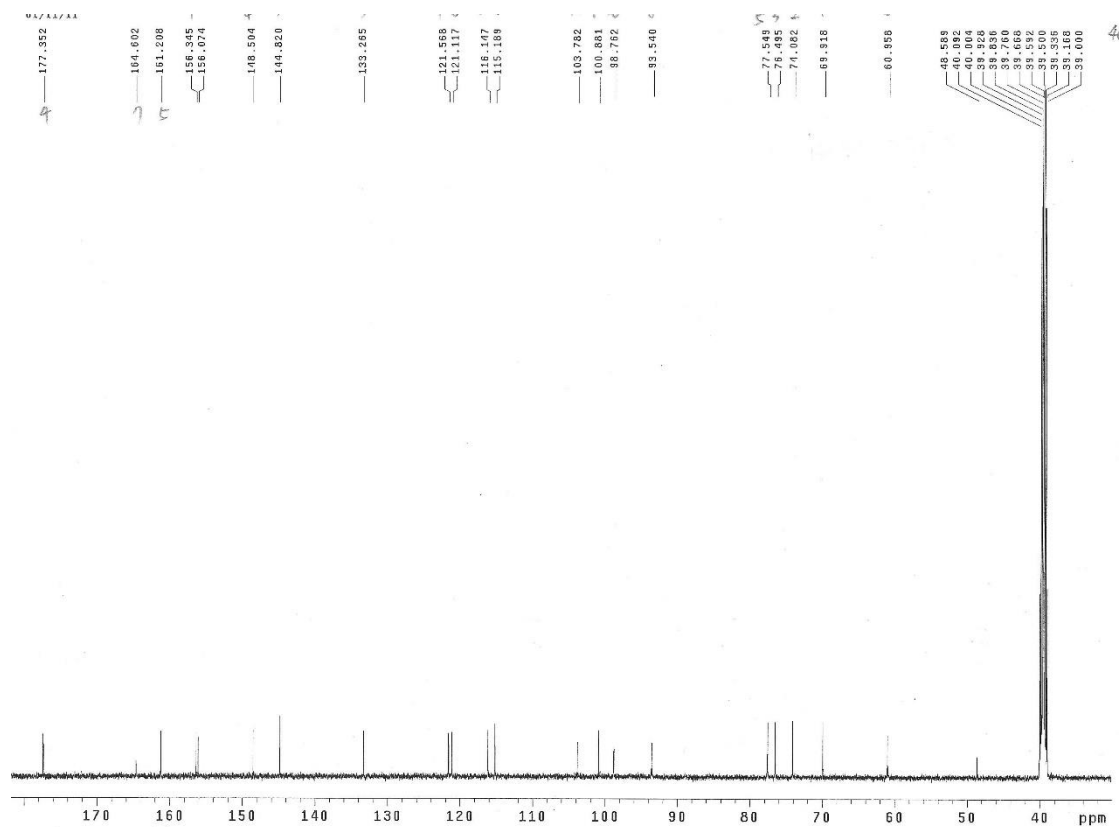
S60. ^1H NMR (600 MHz, acetone- d_6) spectrum of ugonstilbene A (**14**)



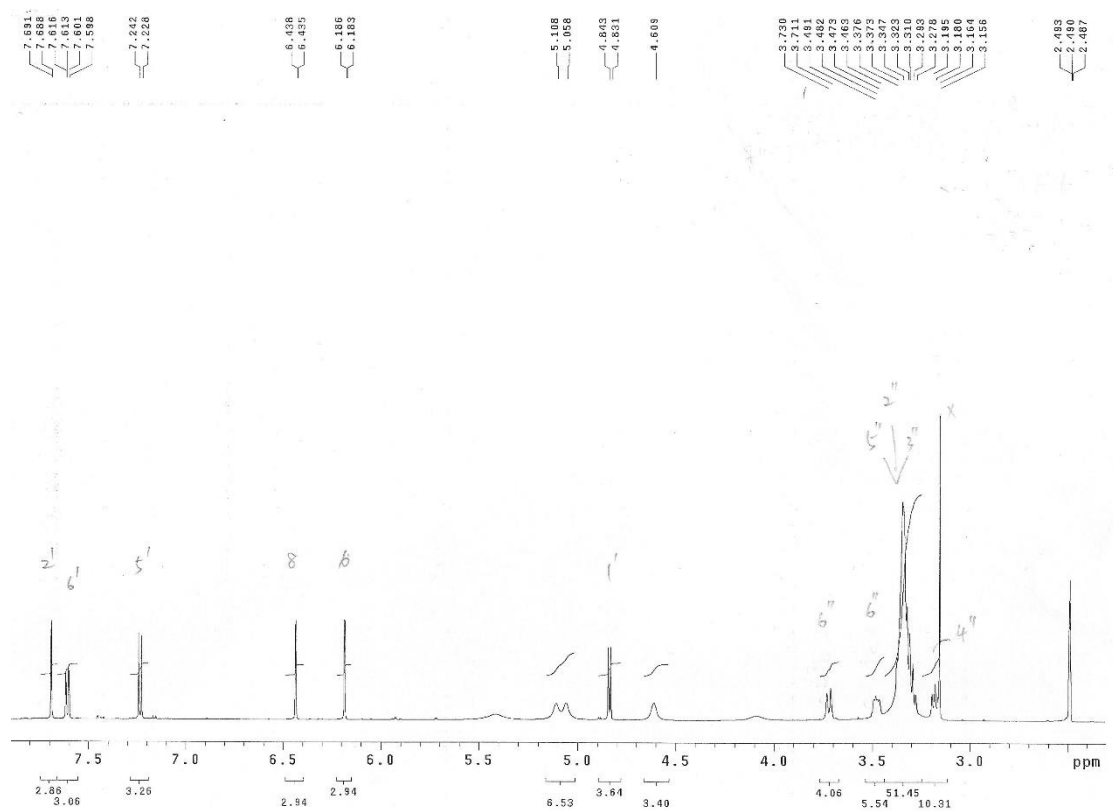
S61. ¹³C NMR (600 MHz, acetone-*d*₆) spectrum of ugonstilbene A (**14**)



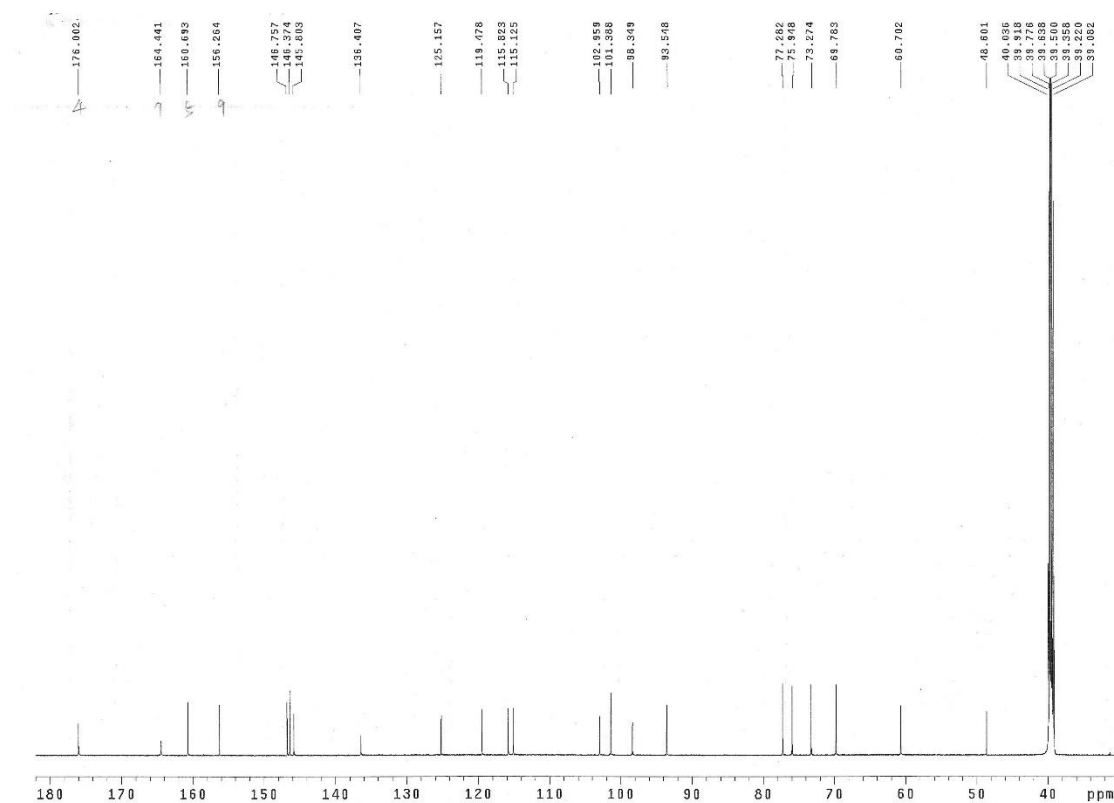
S62. ^1H NMR (500 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3- O - β -D-glucopyranoside (16)



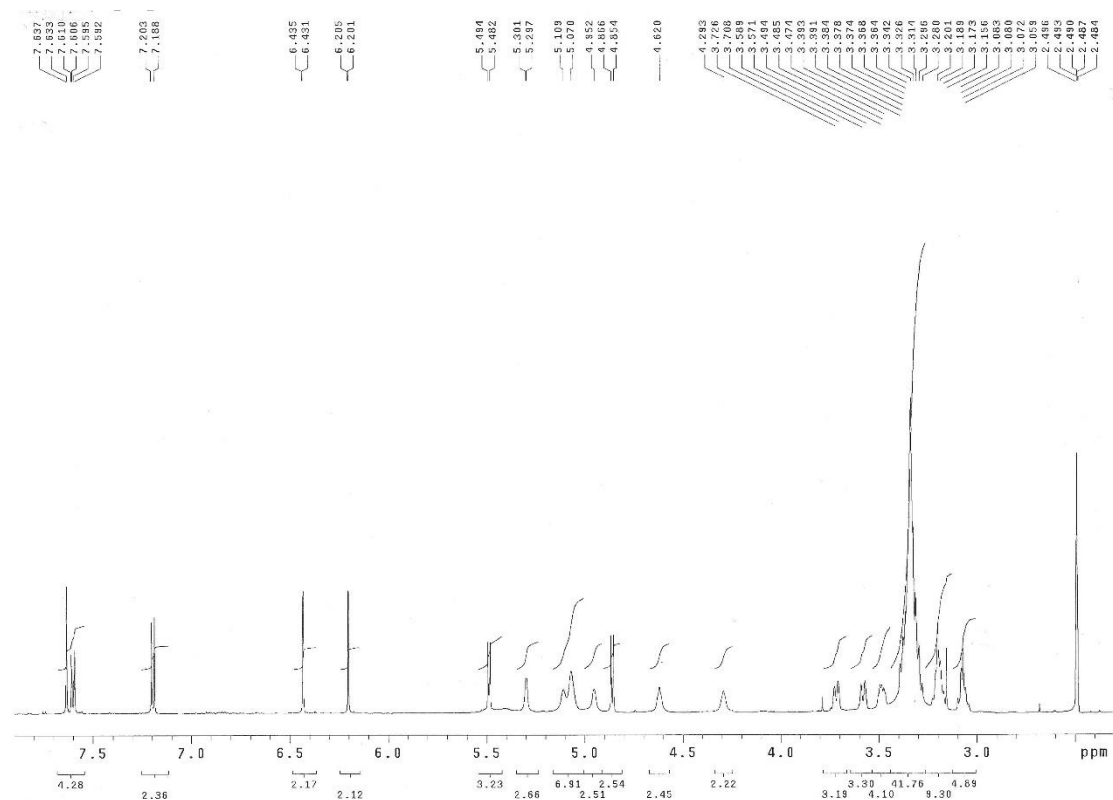
S63. ^{13}C NMR (500 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3- O - β -D-glucopyranoside (16)



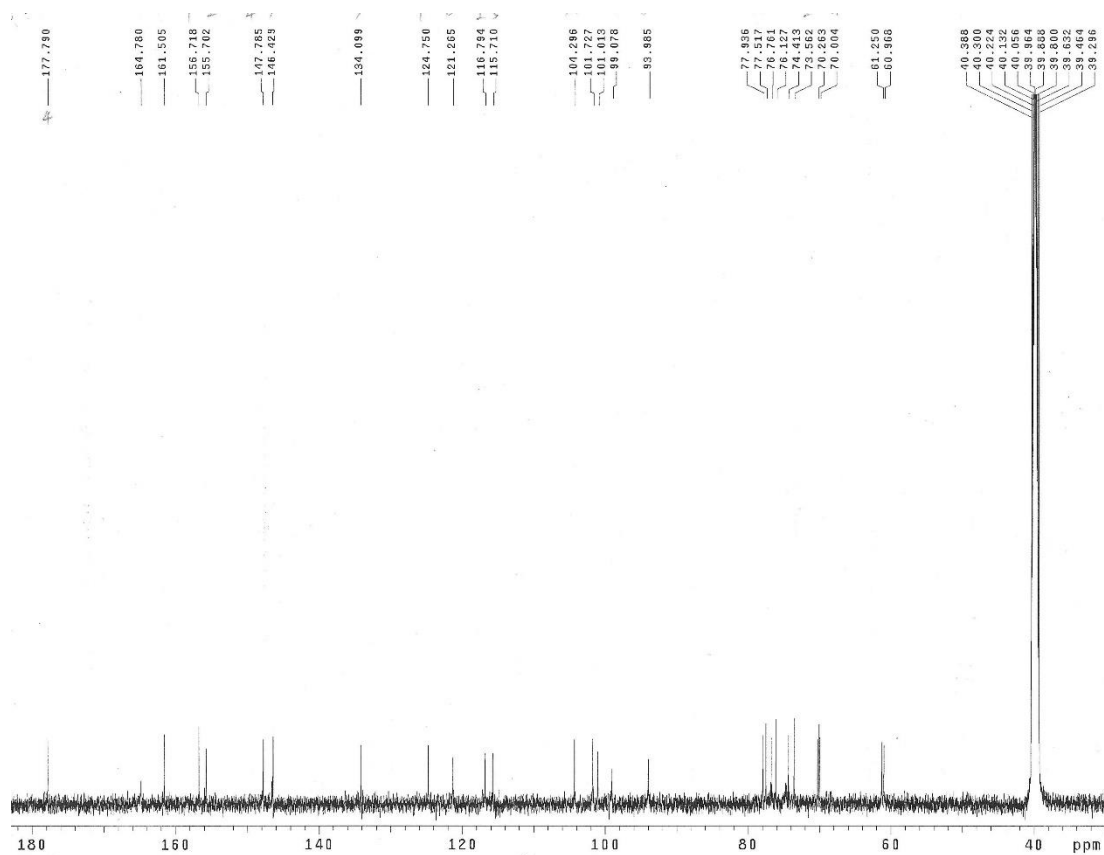
S64. ^1H NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-4'- O - β -D-glucopyranoside (17)



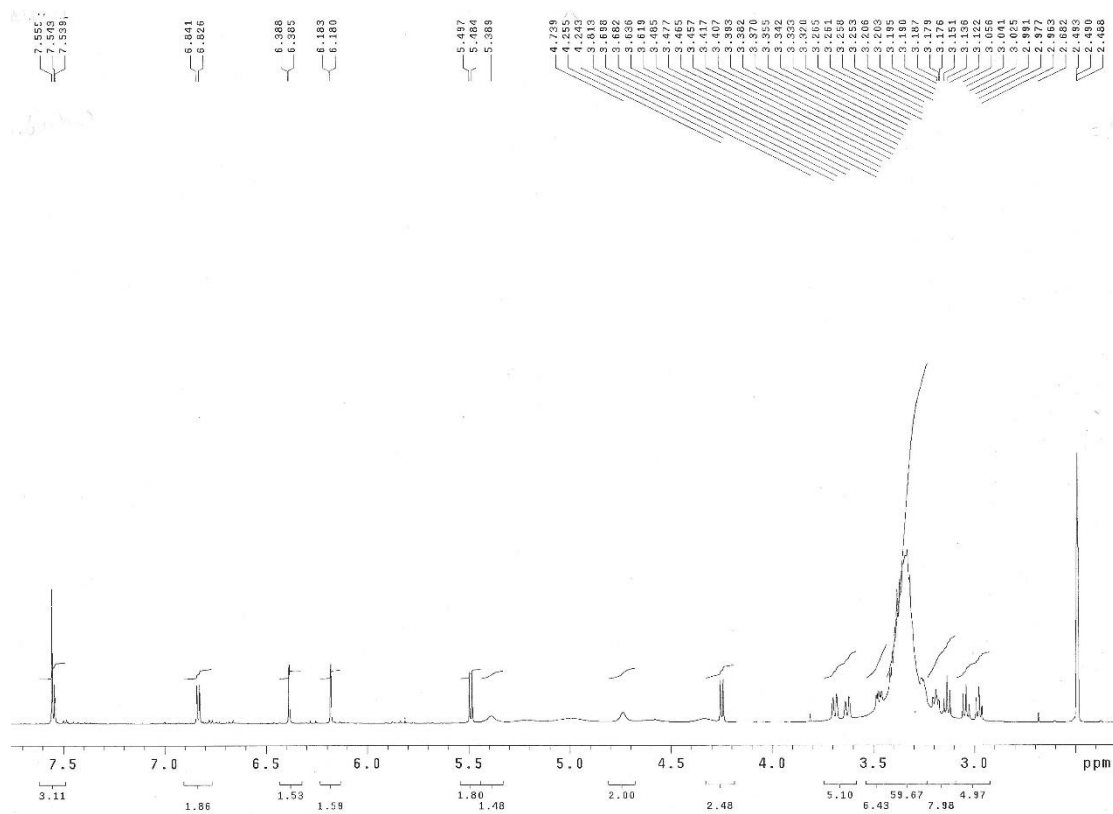
S65. ^{13}C NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-4'- O - β -D-glucopyranoside (**17**)



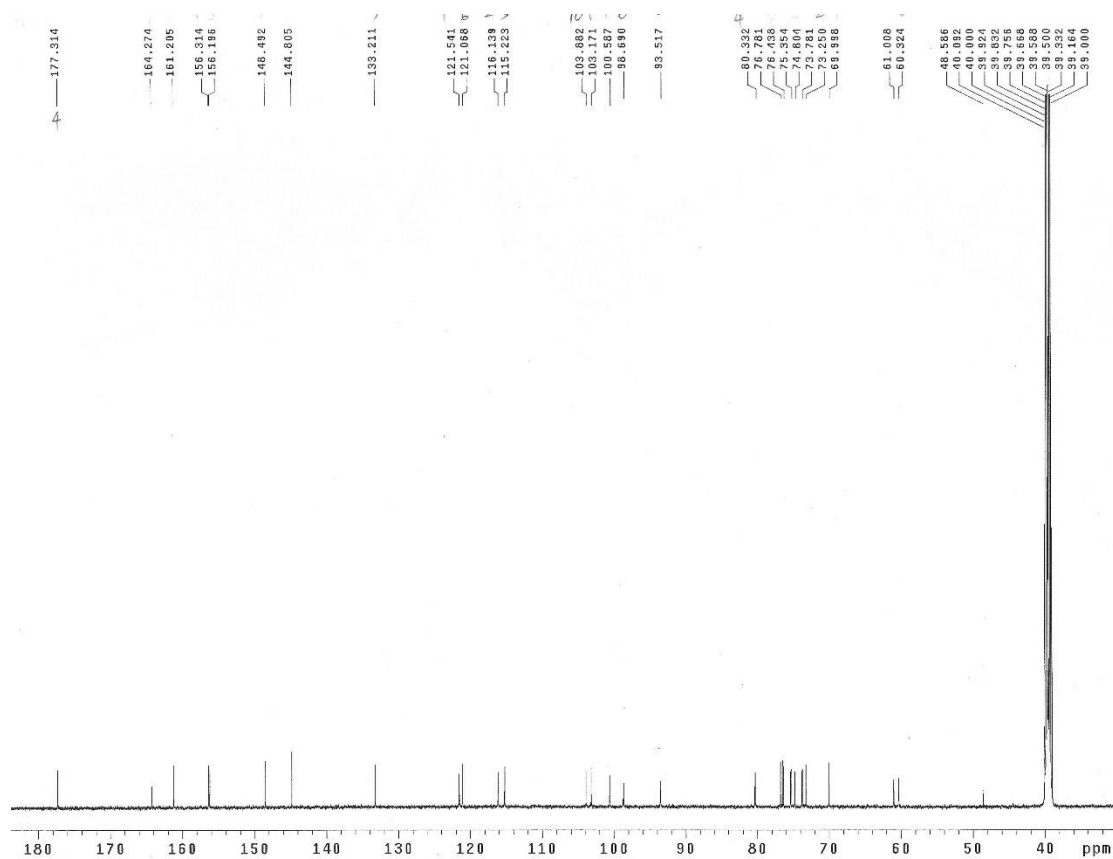
S66. ¹H NMR (600 MHz, DMSO-*d*₆) spectrum of quercetin-3,4'-di-*O*-β-D-glucopyranoside (**18**)



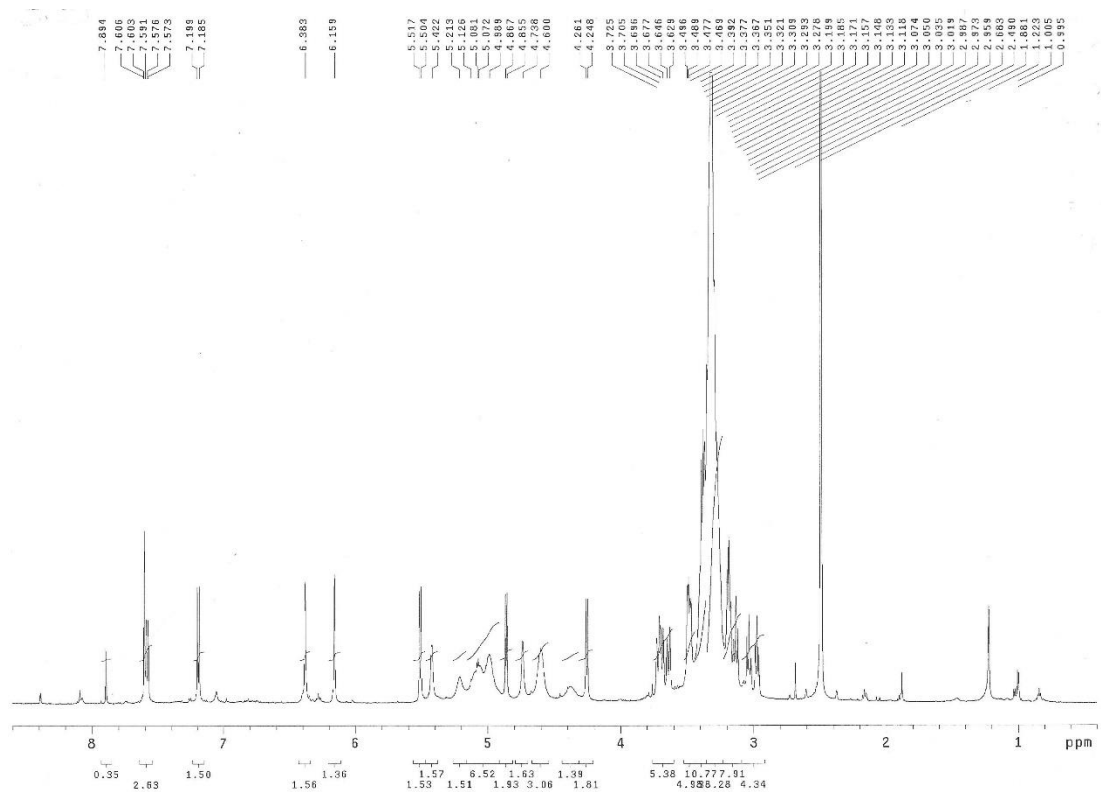
S67. ^{13}C NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3,4'-di- O - β -D-glucopyranoside (**18**)



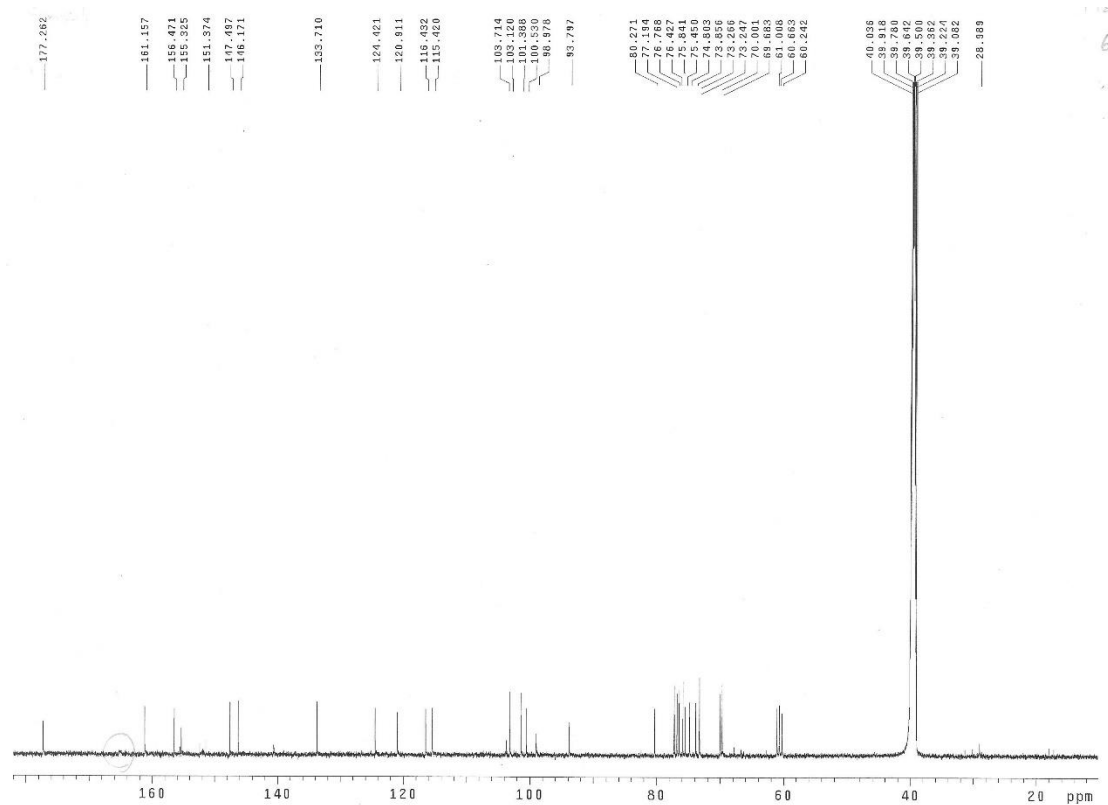
S68. ¹H NMR (500 MHz, DMSO-*d*₆) spectrum of quercetin-3-*O*- β -D-glucopyranosyl-(1 $\rightarrow$ 4)- β -D-glucopyranoside (**19**)



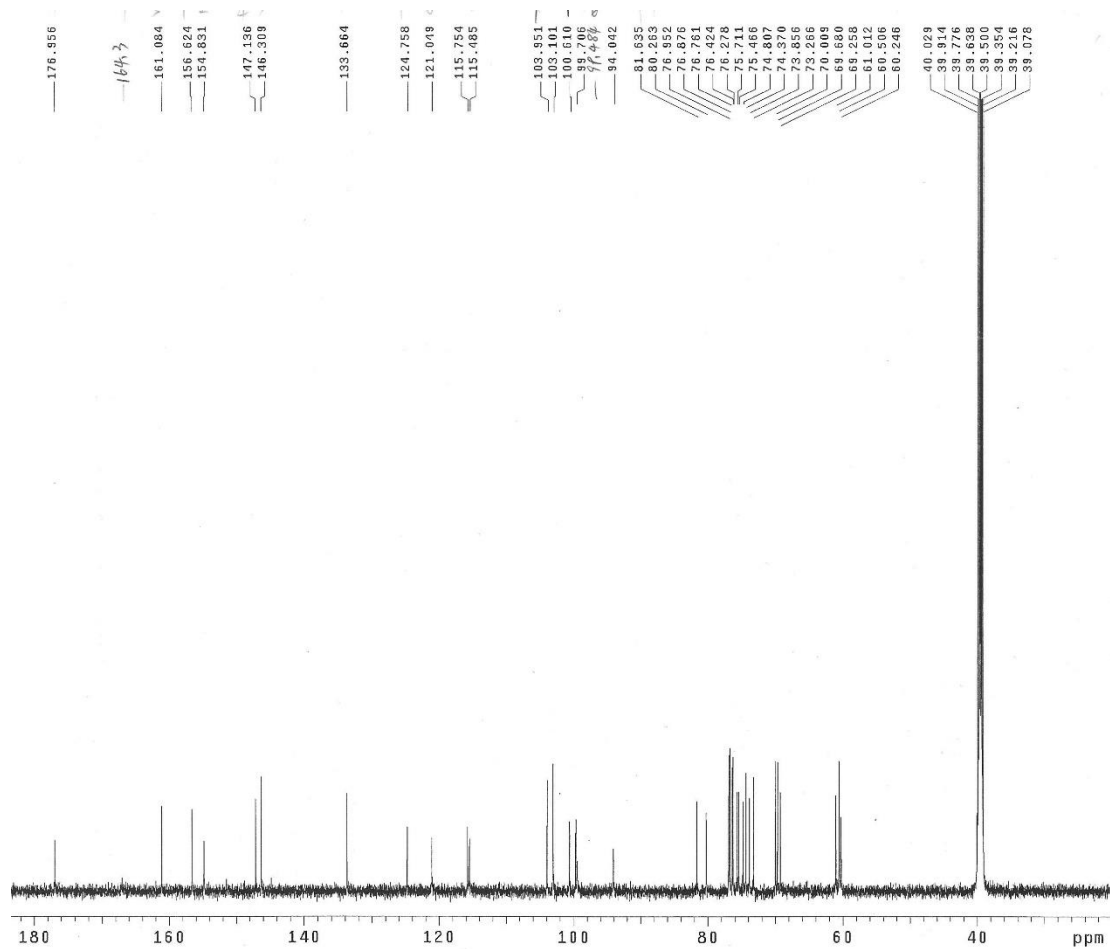
S69. ¹³C NMR (500 MHz, DMSO-*d*₆) spectrum of quercetin-3-*O*-β-D-glucopyranosyl-(1→4)-β-D-glucopyranoside (**19**)



S70. ^1H NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3- O - β -D-glucopyranosyl-(1 $\rightarrow$ 4)- β -D-glucopyranose-4'- O - β -D-glucopyranoside (**20**)



S71. ^{13}C NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3- O - β -D-glucopyranosyl-(1 $\rightarrow$ 4)- β -D-glucopyranose-4'- O - β -D-glucopyranoside (**20**)



S73. ^{13}C NMR (600 MHz, $\text{DMSO-}d_6$) spectrum of quercetin-3- O - β -D-glucopyranosyl-(1 $\rightarrow$ 4)- β -D-glucopyranose-4'- O - β -D-glucopyranosyl-(1 $\rightarrow$ 2)- β -D-glucopyranoside (**21**)

Table 3. Inhibition of LPS-induced nitric oxide (NO) production in microglial cells by compounds **1**, **2**, **5**, **6**, **9-14**, and **23**.

Compound	IC ₅₀ (μ M) in LPS-induced NO production
1	18.0 $\pm$ 8.3
2	7.0 $\pm$ 0.7
5	19.7 $\pm$ 9.1
6	6.7 $\pm$ 1.5
9	6.5 $\pm$ 0.8
10	8.1 $\pm$ 2.2
11	10.1 $\pm$ 1.5
12	7.7 $\pm$ 0.7
13	24.1 $\pm$ 10.6
14	6.2 $\pm$ 0.1
23	10.1 $\pm$ 1.0
PDTC	10.8 $\pm$ 1.8

Data were calculated as 50% inhibitory concentration (IC₅₀). Values are expressed as mean $\pm$ SD (n = 3). Pyrrolidine dithiocarbamate (PDTC, a NF-kB inhibitor) was used as a positive control.

S74. The values of mean $\pm$ SD of **Table 3**

Table 4. Effects of compounds **1**, **2**, **5**, **6**, and **10-13** on the differentiation of primary cultured osteoclasts.

Compound	IC ₅₀ (μ M) in TRAP activity
1	4.5 $\pm$ 0.3
2	3.5 $\pm$ 0.5
5	4.6 $\pm$ 0.7
6	3.2 $\pm$ 0.6
10	1.8 $\pm$ 0.4
11	2.5 $\pm$ 0.2
12	3.3 $\pm$ 0.6
13	> 10
Genistein	11.4 $\pm$ 1.0

Data were calculated as 50% inhibitory concentration (IC₅₀).

Values are expressed as mean $\pm$ SD (n = 3). Genistein was used as a positive control.

S75. The values of mean $\pm$ SD of **Table 4**