EDTA-Mediated Crosslinking of Guar gum: A Sustainable Platform for Transdermal Curcumin Delivery

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1. Information on Guar Gum used: The ratio of mannose to galactose (1.8:1) has been determined by HPLC. The molecular weight of 210000 Daltons has been determined by GPC. The Viscosity=5800 cps (1%, 25^{o}C) was determined using Brookfield RVDV-II+Pro viscometer using spindle no. 4 at 20 rpm after two hours.

2. Table 1 Mean values of degree of di-esterification of cured samples

	Degree of di-esterification		
	Cured		
Sample(g)	120±1^{o}C (3min)	130±1^{o}C (2min)	140±1^{o}C (1 min)
0.25	0.0077 ± (1x10^{-4})*	0.0194 ± (2 x 10^{-4})	0.0174 ± (.2 x10^{-4})
0.5	0.014 ± (3x10^{-4})	0.0217 ± (1.5 x 10^{-4})	0.0210 ± (1.5x10^{-4})
0.75	0.020 ± (2.2x10^{-4})	0.0298 ± (4.1 x 10^{-4})	0.0290 ± (1x10^{-4})
1	0.022 ± (.4x10^{-4})	0.030 ± (0.2 x 10^{-4})	0.0295± (1.5x10^{-4})
F	332.01	271.4	588.12
P	≤0.05	≤0.05	≤0.05
Significant/ Nonsignificant	significant	significant	significant

***Values in brackets represent standard error.**

3. Table 2 Mean values of Solubility and Swelling behavior

Concentration of EDTA acid (g)	Swelling behavior (%)	Solubility (%)
0.25	576[a]±(0.31)*	68±(0.5)
0.5	510[a]±(0.5)	71±(0.5)
0.75	439[b]±(0.15)	83 [c]±(0.10)
1	417[b]±(0.35)	87 [c]±(0.15)
F	754	161
P	≤0.05	≤0.05
Significant/ Non significant	significant	significant

[a,b,c]Means with same superscripts are non significantly different from each other.

4.

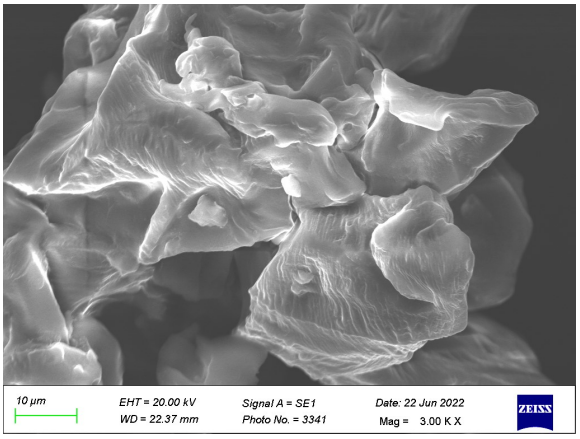


Fig. 1 SEM image of native GG

5.

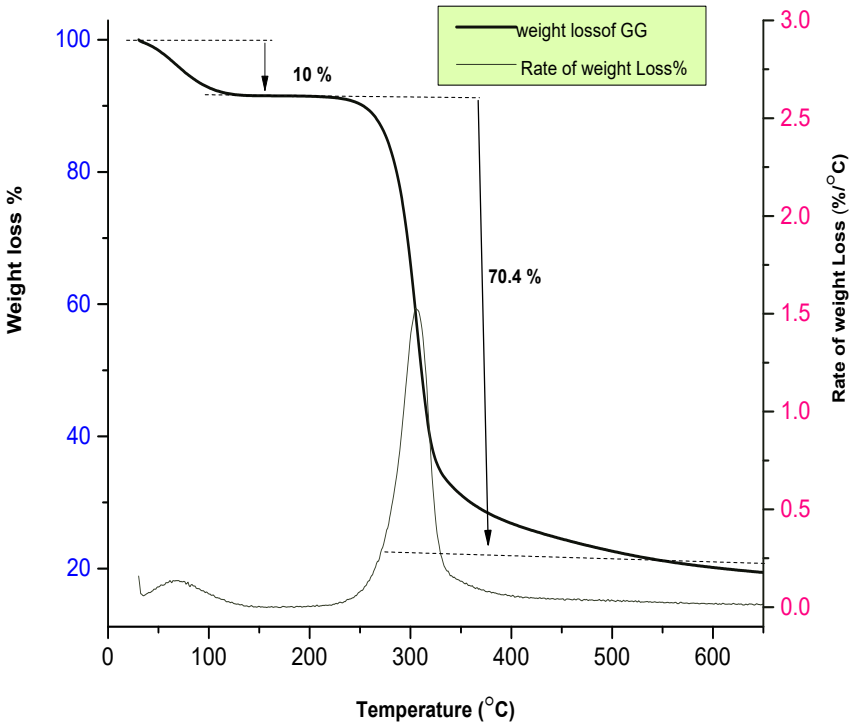
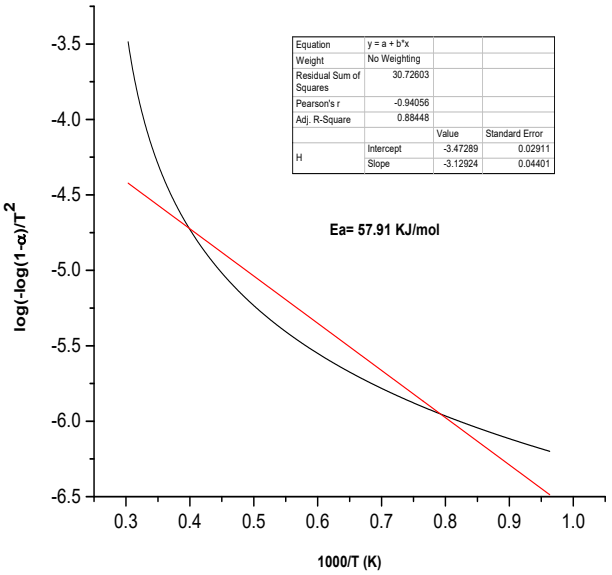
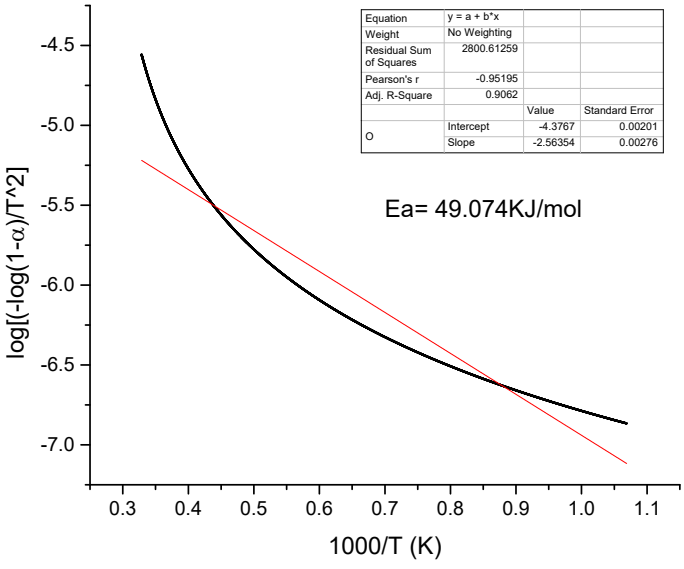


Fig. 2 TGA-DTG graph of native GG

6.The activation energy (Ea) was also calculated by plotting the graph between log (−log(1 − α/T^2) against 1000/T $^{(k-1)}$ according to the Coats and Redfern method. The activation energy of native GG was determined as 56.06 kJ mol^{-1} while EGG showed activation energy of 49.074 kJ mol^{-1}.



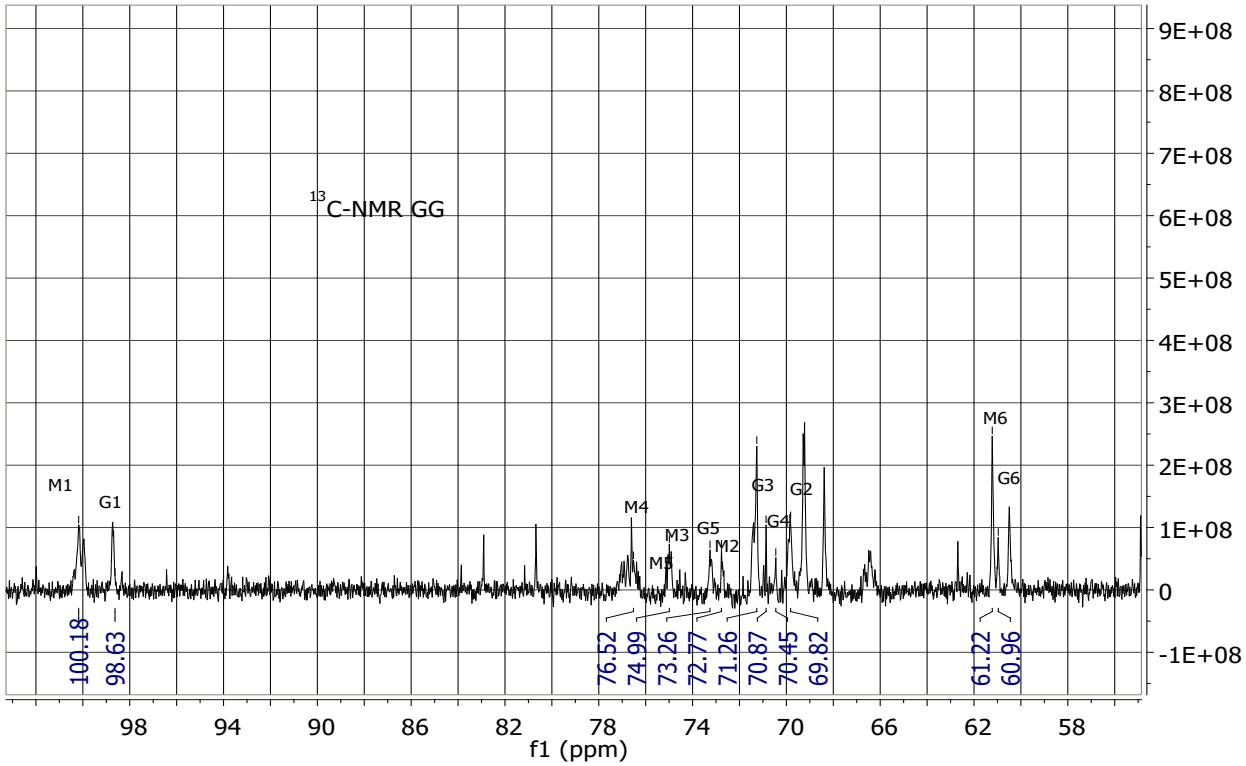
(a)



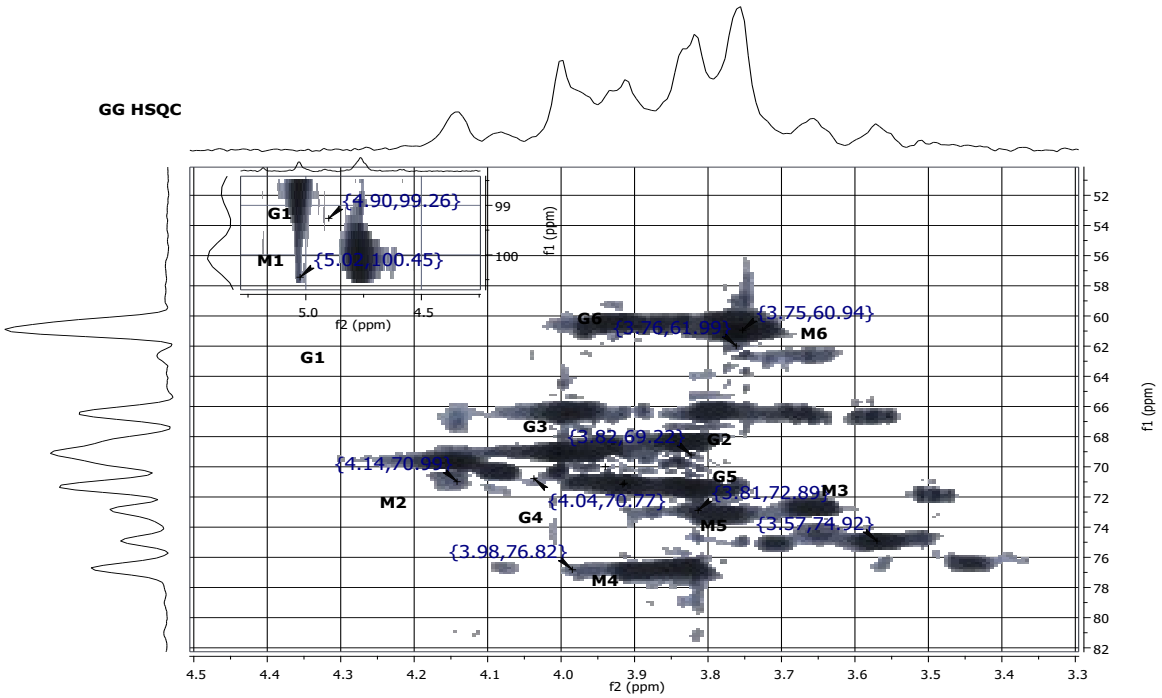
(b)

Fig. 3 (a) Activation energy of GG (b) Activation energy of EGG

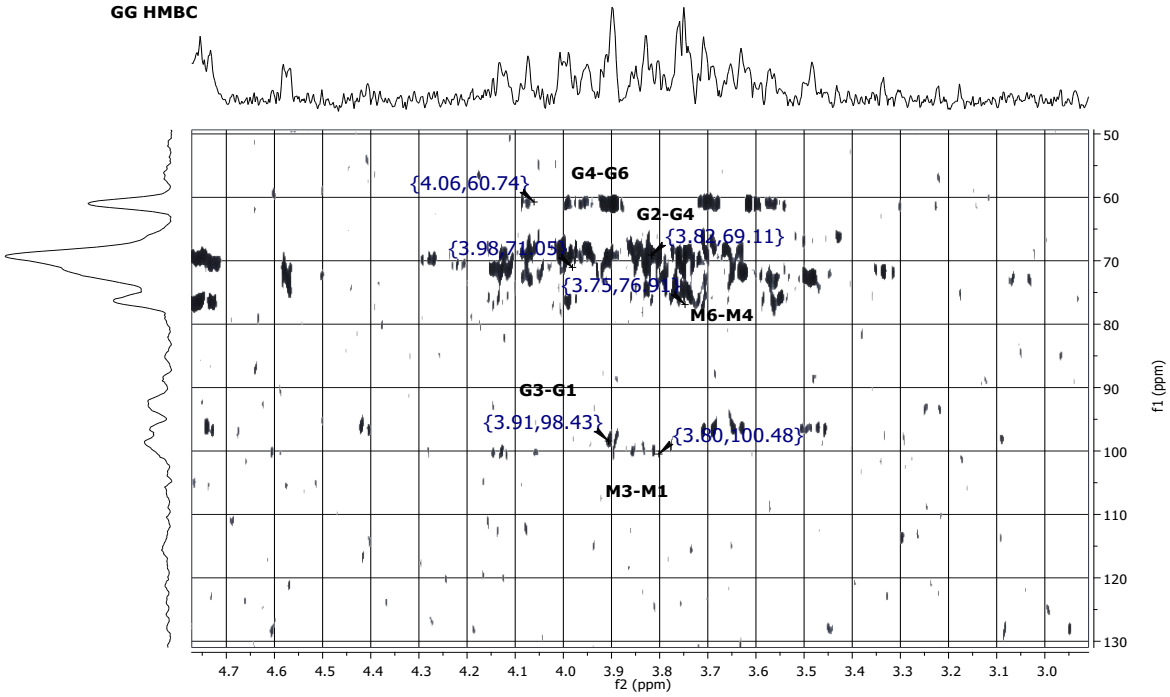
7.


13C-NMR GG
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
M1
G1
M4
M3
G5
M2
M5
G3
G2
G4
M6
G6
100.18
98.63
76.52
74.99
73.26
72.77
71.26
70.87
70.45
69.82
61.22
60.96
98
94
90
86
82
78
74
70
66
62
58
f1 (ppm)

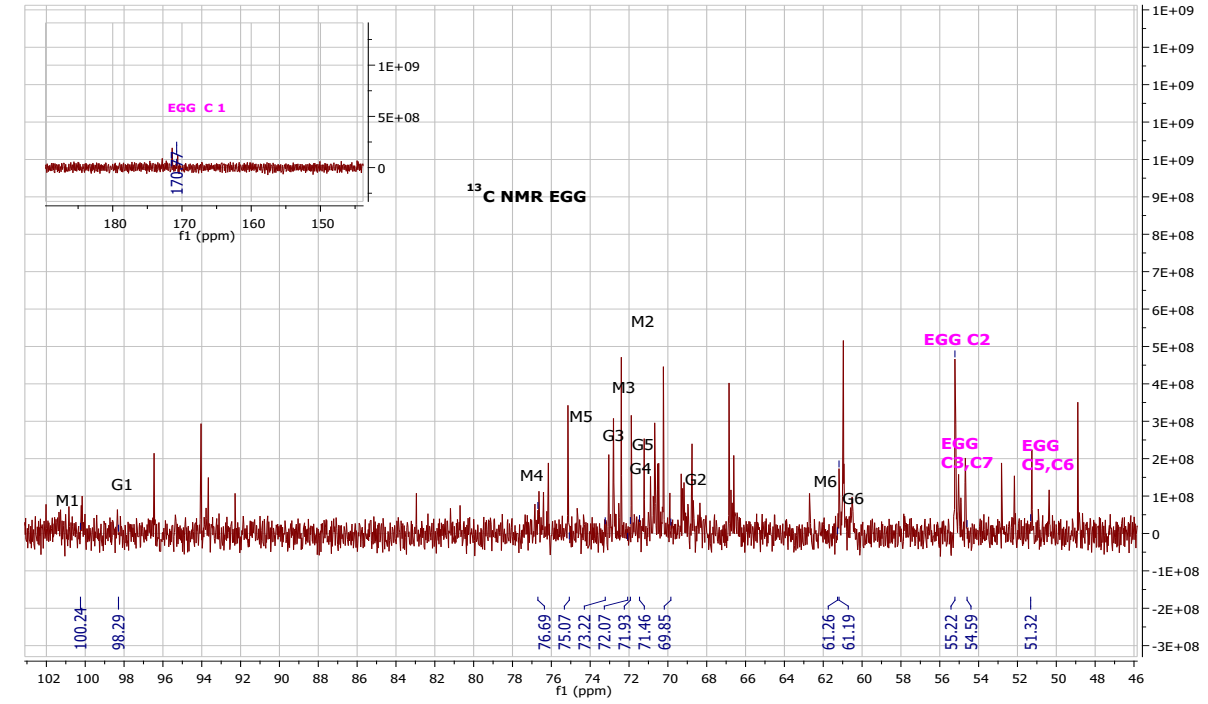
(a)


GG HSQC
G1
{4.90,99.26}
M1
{5.02,100.45}
f2 (ppm)
f1 (ppm)
G6
{3.75,60.94}
M6
G1
G3
{3.82,69.22}
G2
{4.14,70.39}
G5
M2
{4.04,70.77}
M3
{3.81,72.89}
G4
M5
{3.57,74.92}
{3.98,76.82}
M4

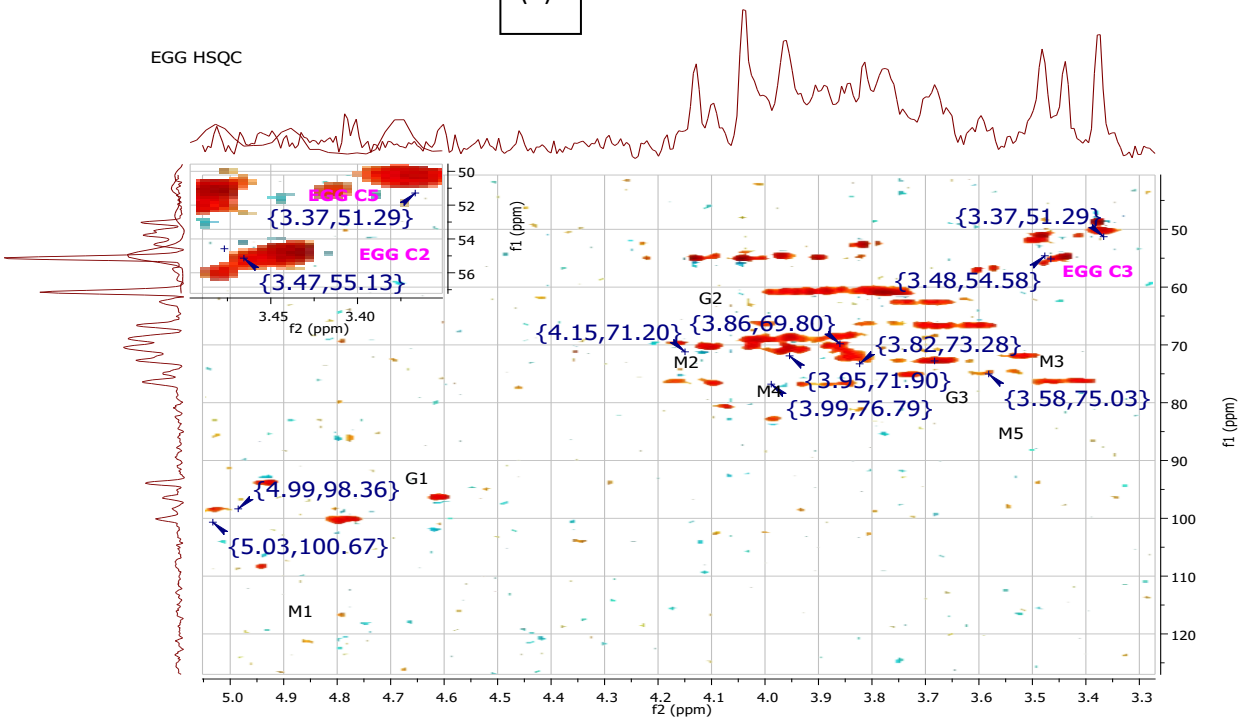
(b)


GG HMBC
{4.06,60.74}
G4-G6
G2-G4
{3.82,69.11}
{3.98,71.05}
{3.75,76.91}
M6-M4
G3-G1
{3.91,98.43}
{3.80,100.48}
M3-M1
f2 (ppm)
f1 (ppm)

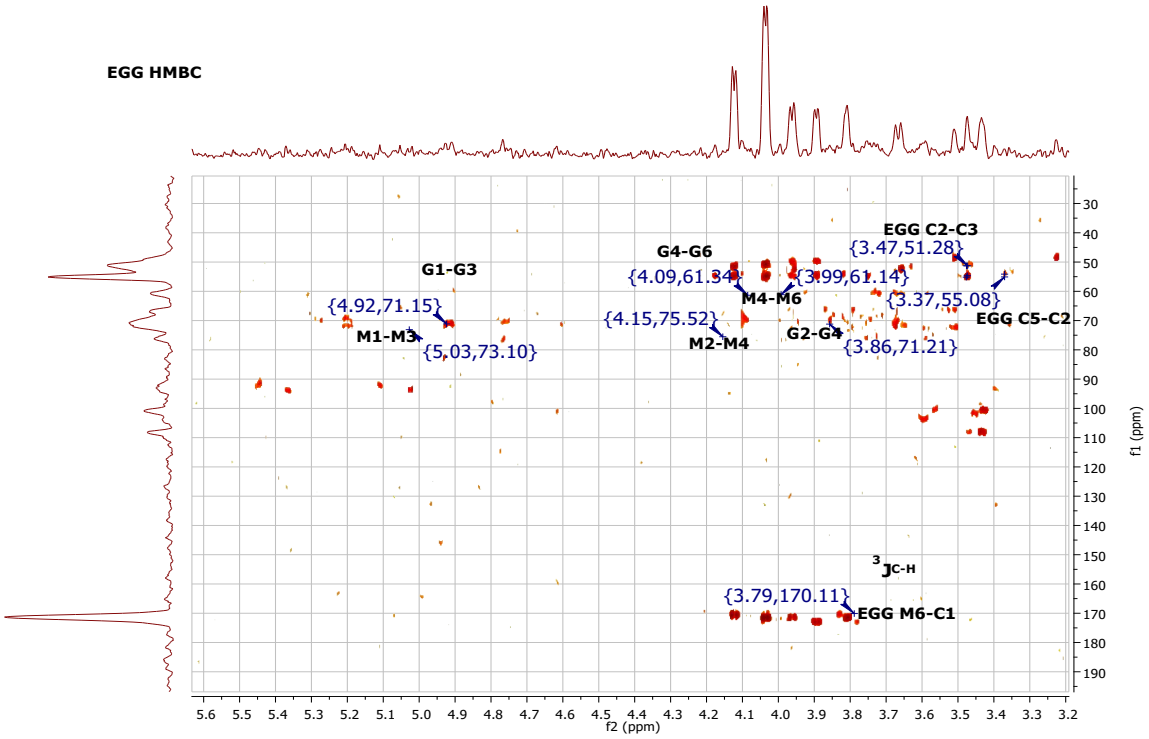
(c)


EGG C 1
170.87
1E+09
5E+08
0
180
170
160
150
f1 (ppm)
13C NMR EGG
M1
G1
M4
M5
G3
M2
M3
G4
G5
G2
M6
G6
EGG C2
EGG C3,C7
EGG C5,C6
100.24
98.29
76.69
75.07
73.22
72.07
71.93
71.46
69.85
61.26
61.19
55.22
54.59
51.32
f1 (ppm)

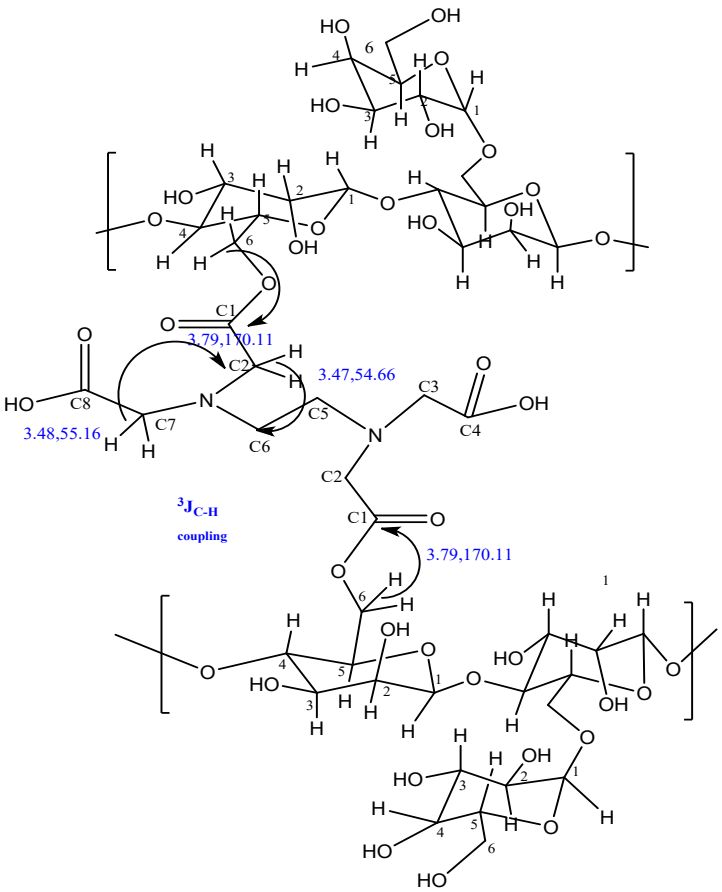
(d)


EGG HSQC
EGG C5
{3.37,51.29}
EGG C2
{3.47,55.13}
3.45
3.40
f2 (ppm)
f1 (ppm)
{3.37,51.29}
EGG C3
{3.48,54.58}
G2
{4.15,71.20}
{3.86,69.80}
{3.82,73.28}
M2
M3
{3.95,71.90}
M4
G3
{3.58,75.03}
{3.99,76.79}
M5
{4.99,98.36}
G1
{5.03,100.67}
M1
f2 (ppm)
f1 (ppm)

(e)


EGG HMBC
G1-G3
{4.92,71.15}
M1-M3
{5,03,73.10}
G4-G6
{4.09,61.34}
M4-M6
{4.15,75.52}
M2-M4
{3.99,61.14}
G2-G4
{3.86,71.21}
EGG C2-C3
{3.47,51.28}
{3.37,55.08}
EGG C5-C2
3JC-H
{3.79,170.11}
EGG M6-C1
f2 (ppm)
f1 (ppm)

(f)



(g)

Fig. 4 (a) ^{13}C NMR of GG (b) HSQC of GG (c) HMBC of GG (d) ^{13}C NMR of EGG (e) HSQC of EGG (f) HMBC of EGG (g) $^{3}J_{C-H}$ correlation of HMBC in EGG

8.

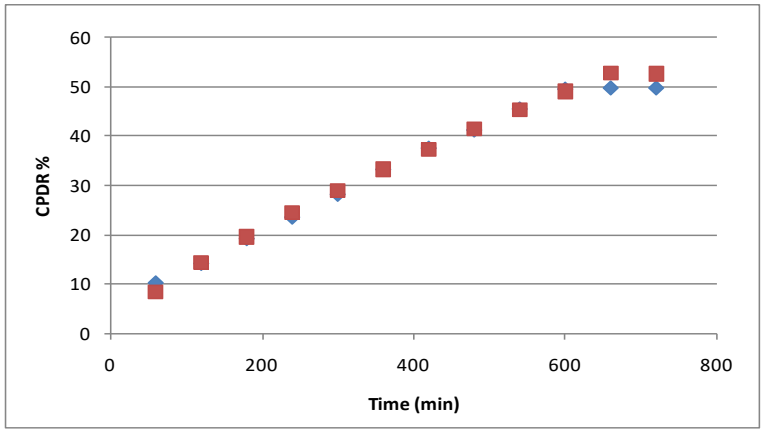


Fig.5. Graphical depiction of CPDR% of EGG in 720 min