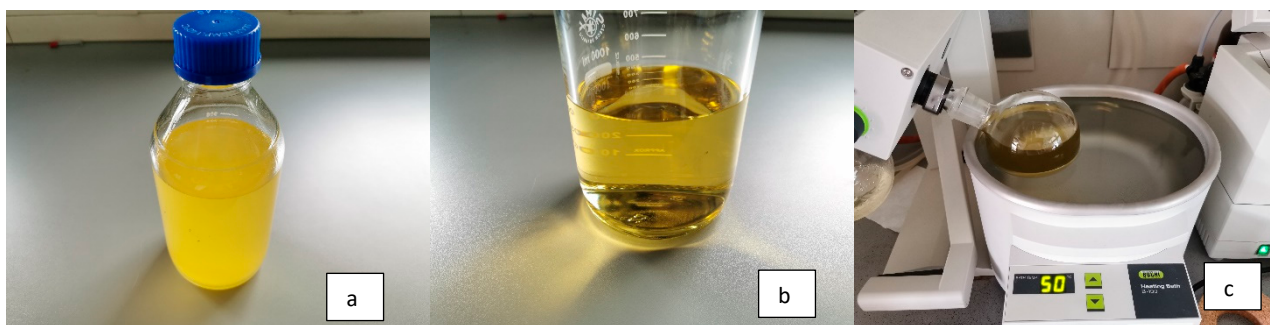


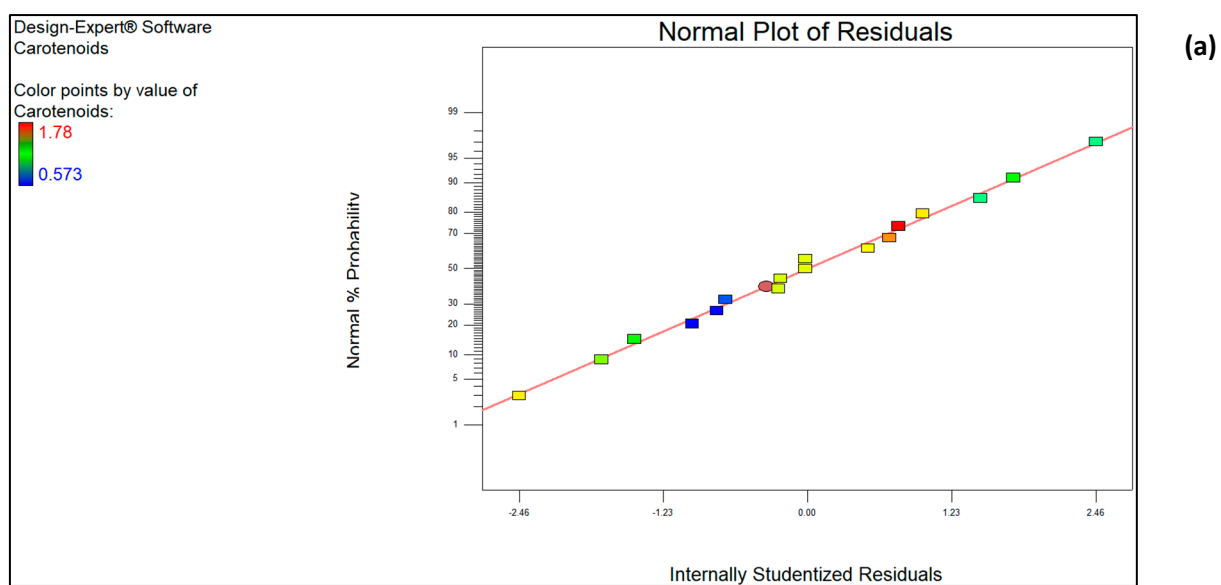
## Supplementary Data

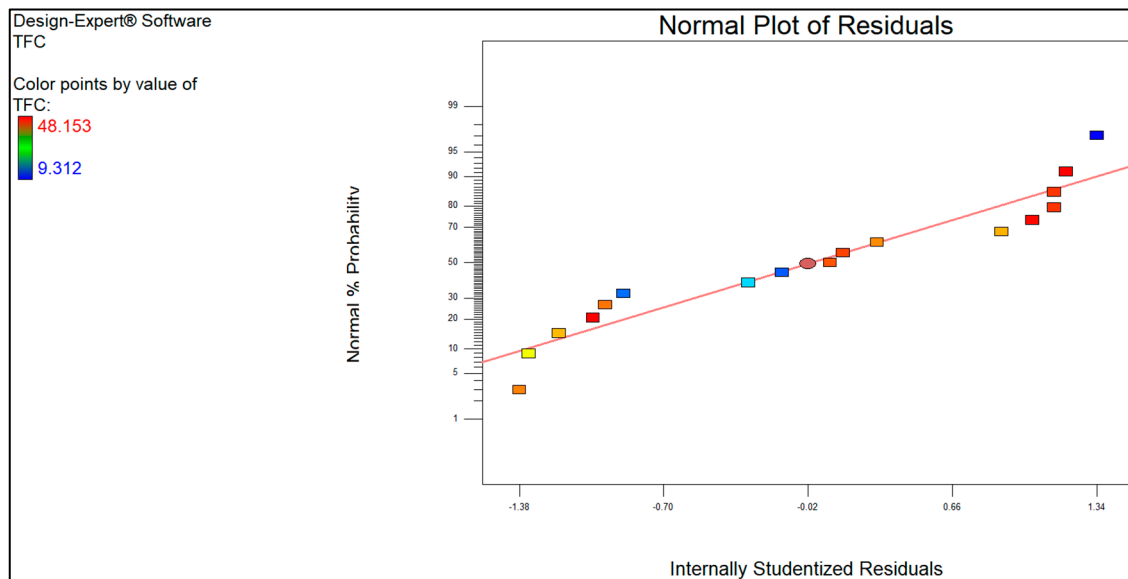


**Figure S1.** Lyophilized mandarin peels (particle size  $<450\ \mu\text{m}$ )

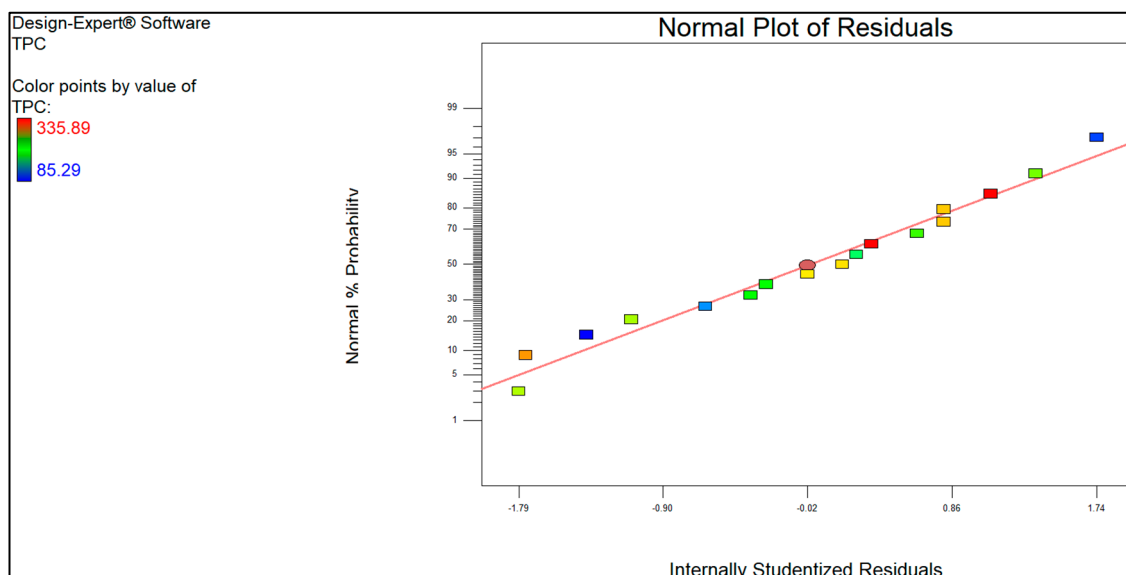


**Figure S2.** Mandarin peel suspension before (a) and after the filtration (b) and subjection to evaporation (c).

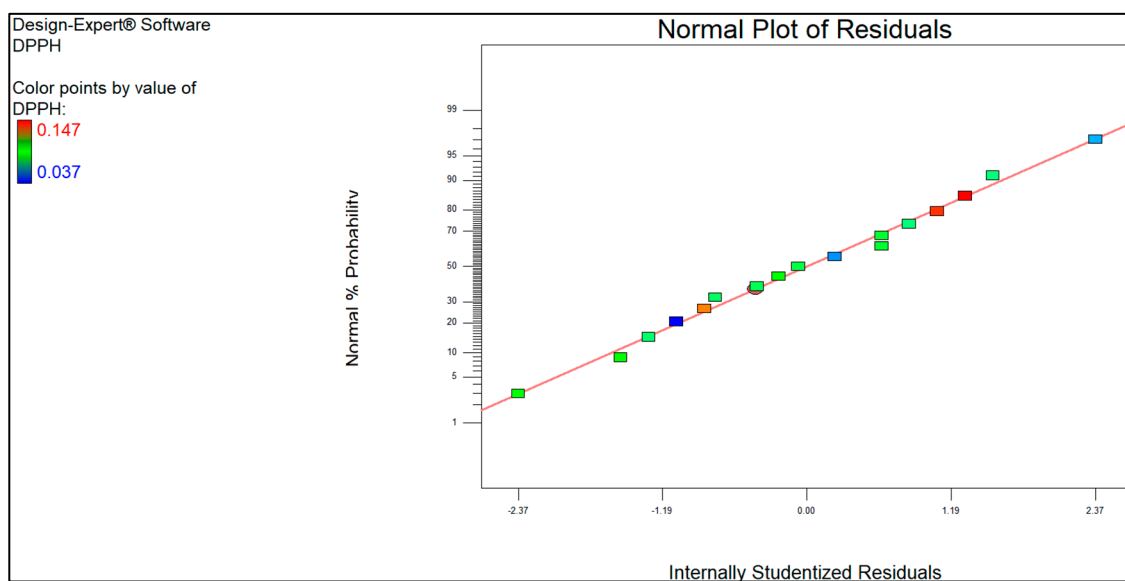




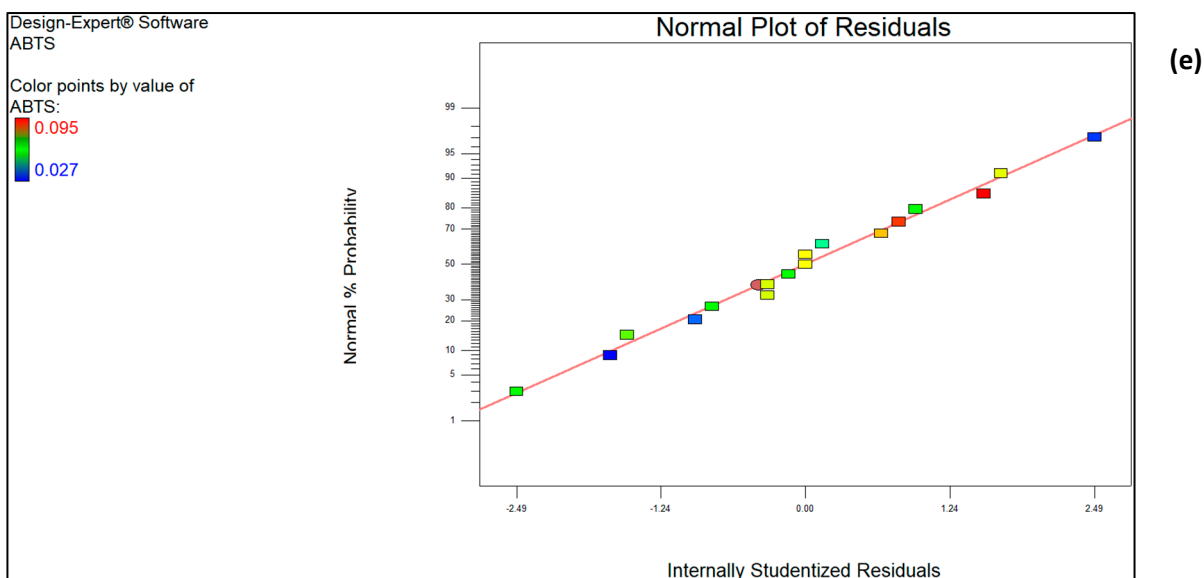
(b)



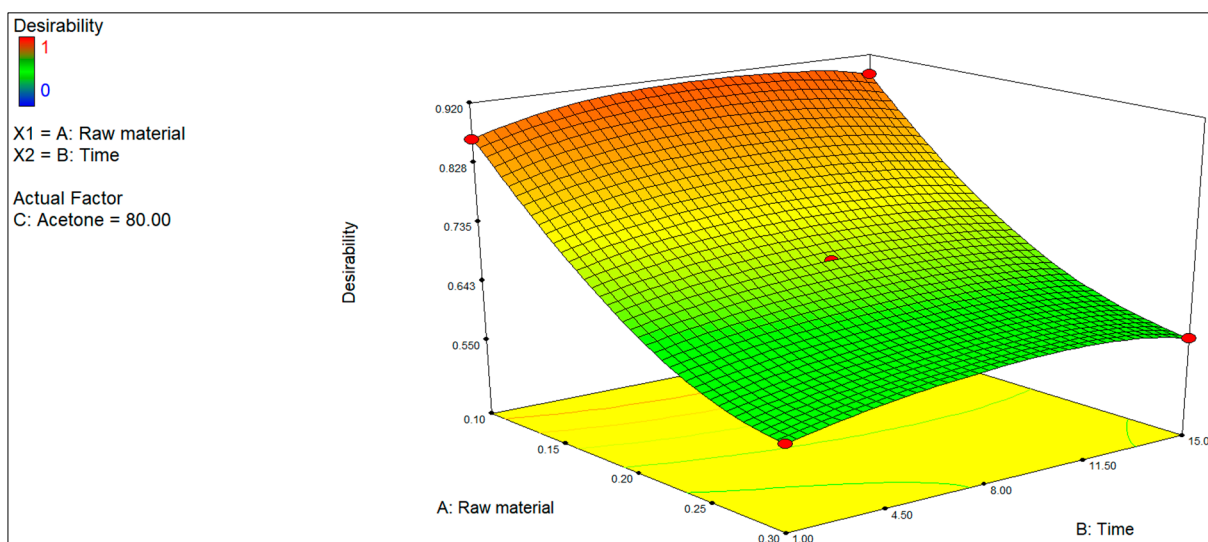
(c)



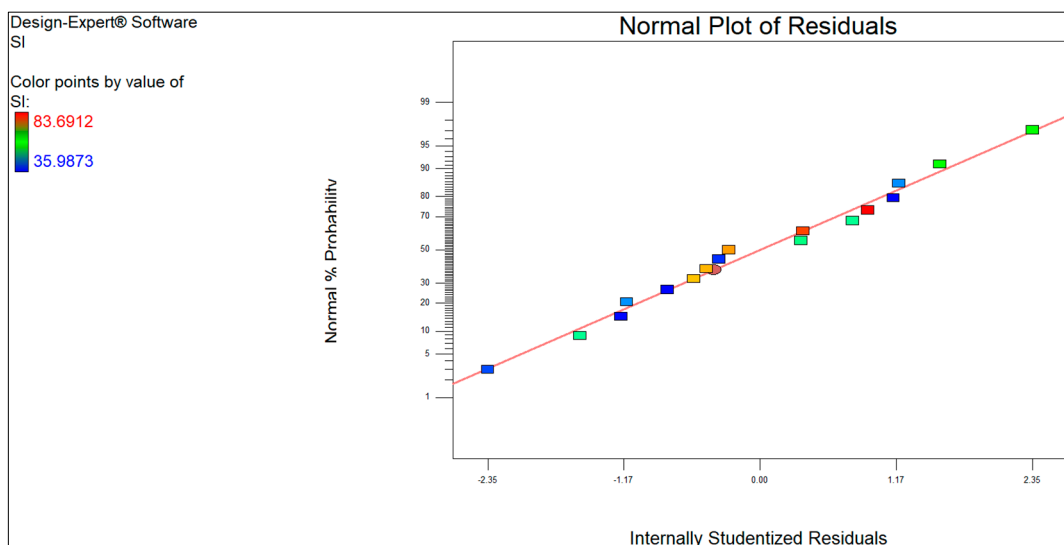
(d)



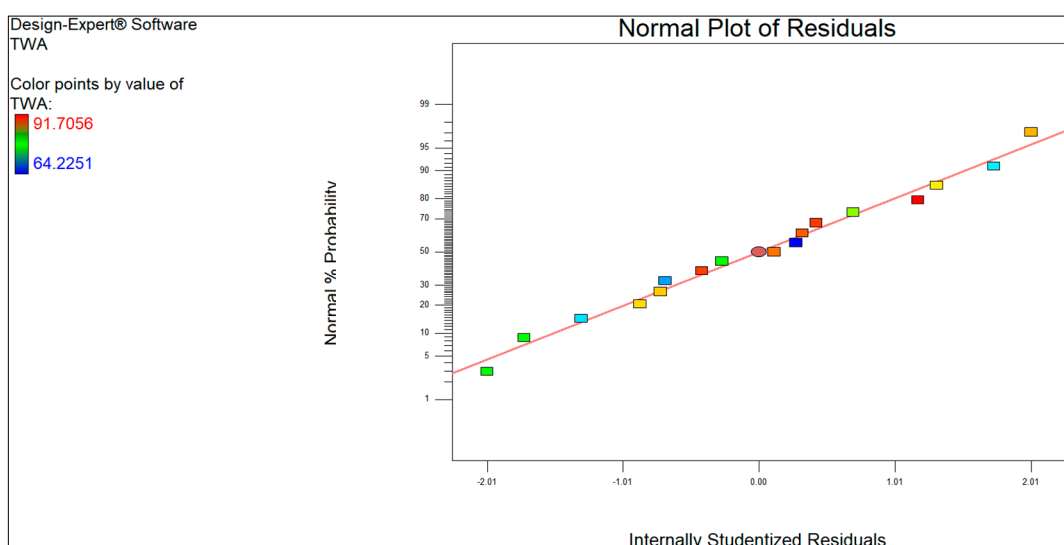
**Figure S3** Normal plots of residuals for Carotenoids (a), Flavonoids (b), Polyphenols (c) DPPH (d) and ABTS (e) response. The near-linear distribution of points indicates normality of residuals



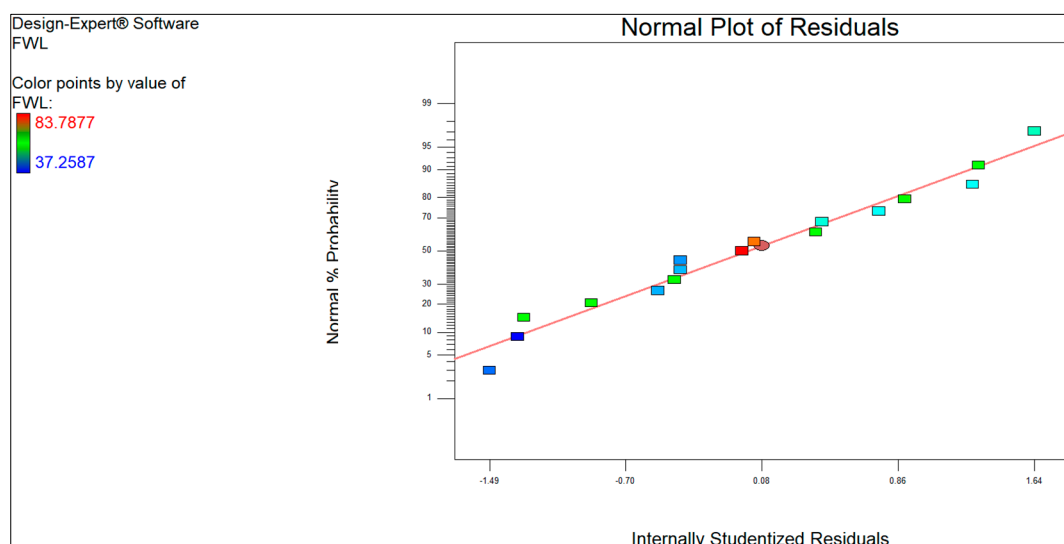
**Figure S4** Response surface plot of overall desirability showing the combined effects of raw material concentration (A) and extraction time (B) at a fixed acetone concentration (80%). Maximum desirability (0.92) was achieved at 0.1% raw material, 8.97 min extraction time, and 80.06% (v/v) acetone.



(a)



(b)



(c)

**Figure S5** Normal plots of residues residuals for Swelling index (a), Total Water absorption (b) and Film Weight loss (c) response. The near-linear distribution of points indicates normality of residuals

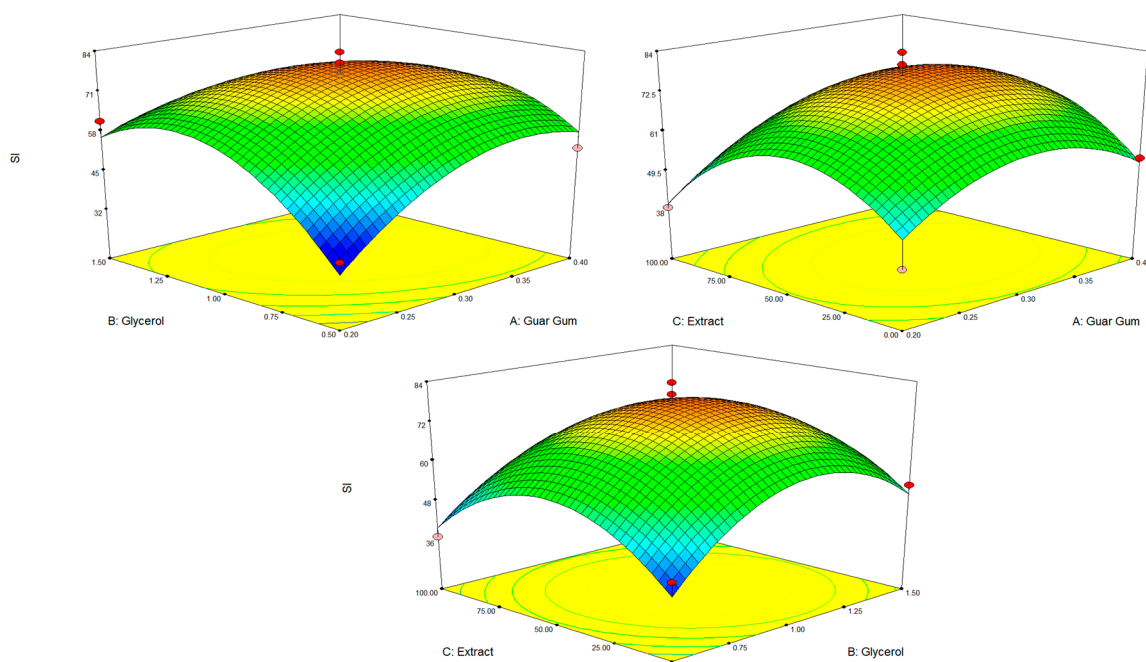
Design-Expert® Software

SI  
83.6912  
35.9873

X1 = A: Guar Gum

X2 = B: Glycerol

Actual Factor  
C: Extract = 50.00



**Figure S6** 3D plots of Swelling Index (SI) showing the interactive effects of Guar gum/chitosan ratio (A) , Glycerol (B) and MPE extract (C)

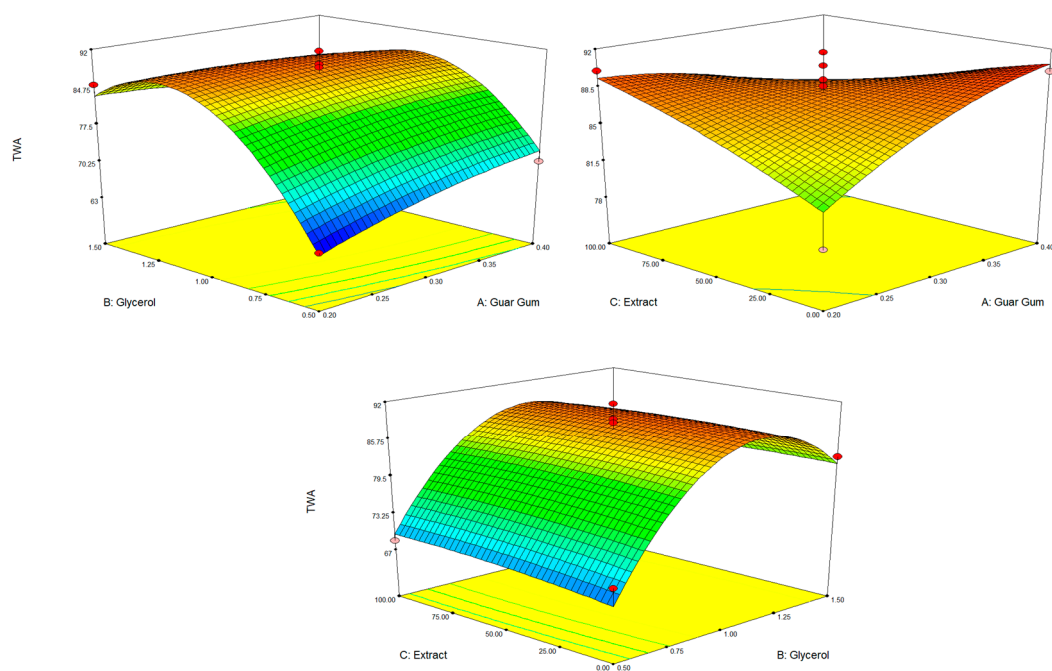
Design-Expert® Software

TWA  
91.7056  
64.2251

X1 = A: Guar Gum

X2 = B: Glycerol

Actual Factor  
C: Extract = 50.00



**Figure S7** 3D plots of Total Water Absorption (TWA) showing the interactive effects of Guar gum/chitosan ratio (A) , Glycerol (B) and MPE extract (C)

Design-Expert® Software

FWL

83.7877

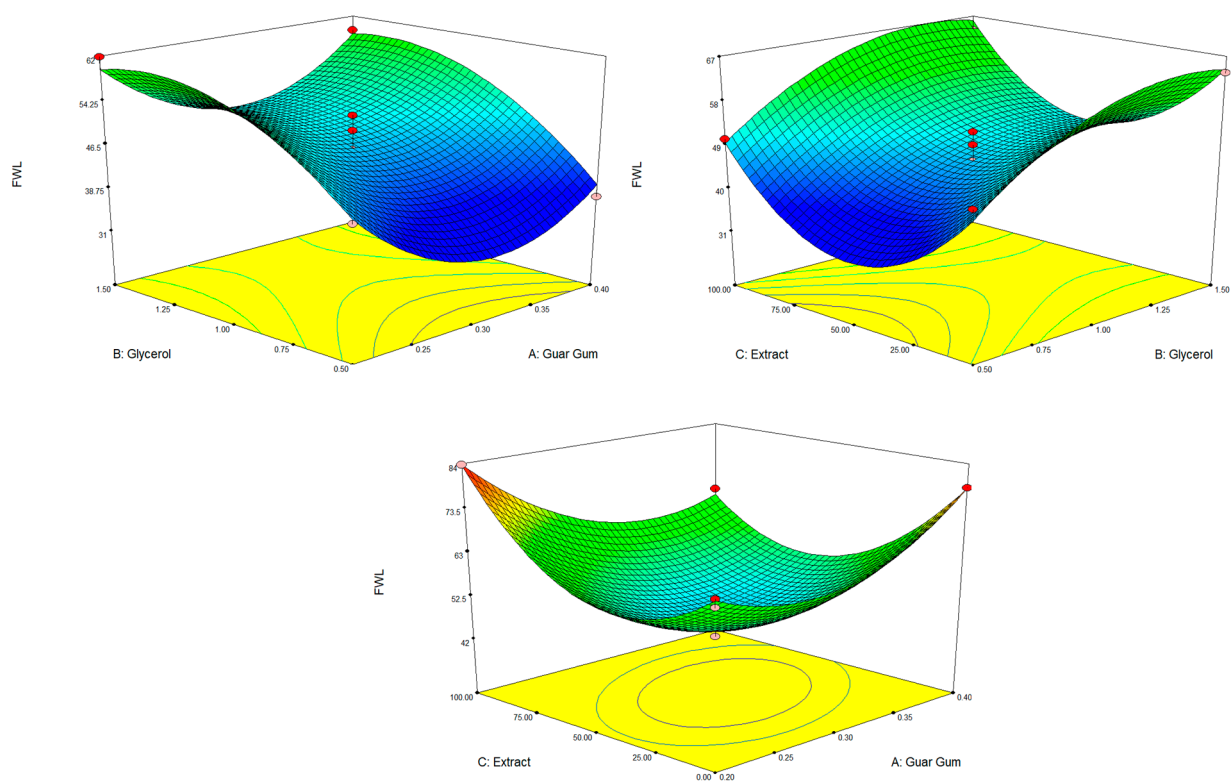
37.2587

X1 = A: Guar Gum

X2 = B: Glycerol

Actual Factor

C: Extract = 50.00



**Figure S8** 3D plots of Film Weight Loss (FWL) showing the interactive effects of Guar gum/chitosan ratio (A) , Glycerol (B) and MPE extract (C)

**Table S1.** Experimental design to optimize the mandarin peel extraction

<i>Run</i>	<i>F1 Raw material (%)</i>	<i>F2 Time (min)</i>	<i>F3 Acetone (%)</i>
1	0.10 (1 g/L)	15.00	80.00
2	0.20 (2 g/L)	8.00	80.00
3	0.30 (3 g/L)	8.00	60.00
4	0.20 (2 g/L)	8.00	80.00
5	0.10 (1 g/L)	8.00	100.00
6	0.20 (2 g/L)	15.00	60.00
7	0.20 (2 g/L)	1.00	60.00
8	0.30 (3 g/L)	15.00	80.00
9	0.30 (3 g/L)	8.00	100.00
10	0.10 (1 g/L)	8.00	60.00
11	0.20 (2 g/L)	1.00	100.00
12	0.20 (2 g/L)	8.00	80.00
13	0.20 (2 g/L)	8.00	80.00
14	0.30 (3 g/L)	1.00	80.00
15	0.20 (2 g/L)	8.00	80.00
16	0.10 (1 g/L)	1.00	80.00
17	0.20 (2 g/L)	15.00	100.00