Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information

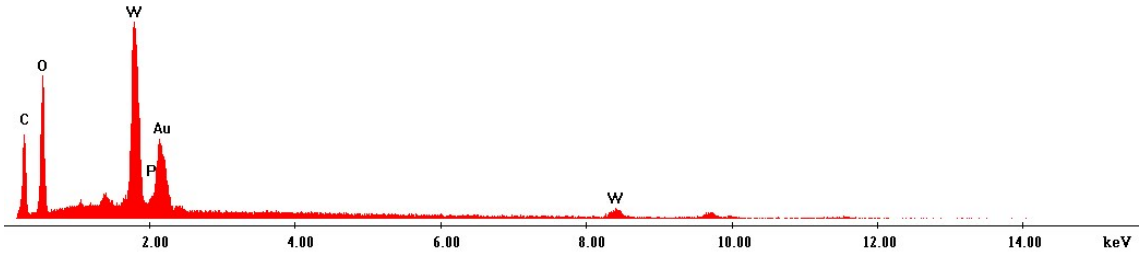

Fig. S1. The EDX of 38 wt% HPW/agarose nanocomposite film.

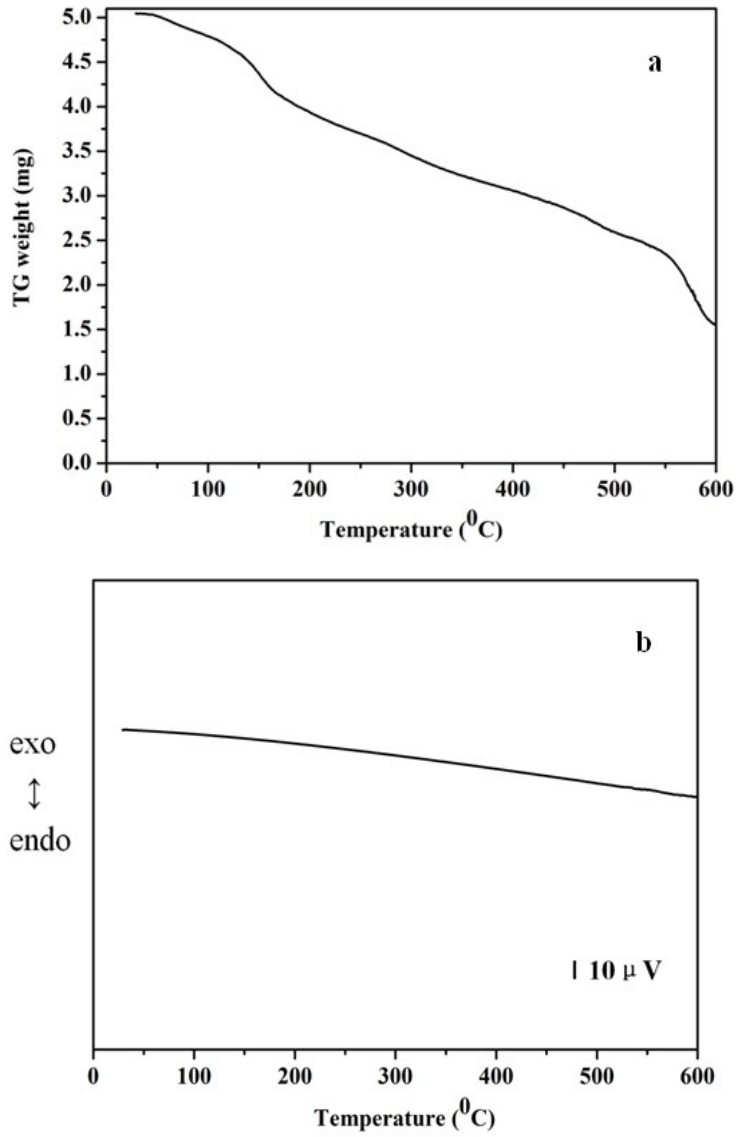

Fig. S2. TG (a) and DTA (b) curves of 38 wt% HPW/agarose with the heating rate of 10 °C min^{-1}.

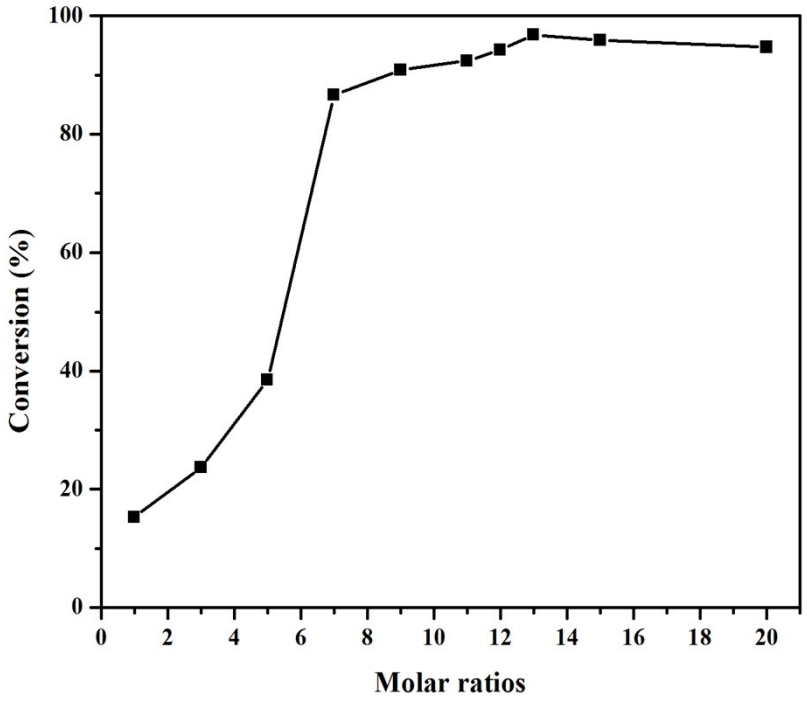

Fig. S3. The effect of different molar ratios between methanol and PA on esterification

Reaction condition: 65 °C, 5 wt% of HPW/agarose (38 wt%) catalyst, 7 h.

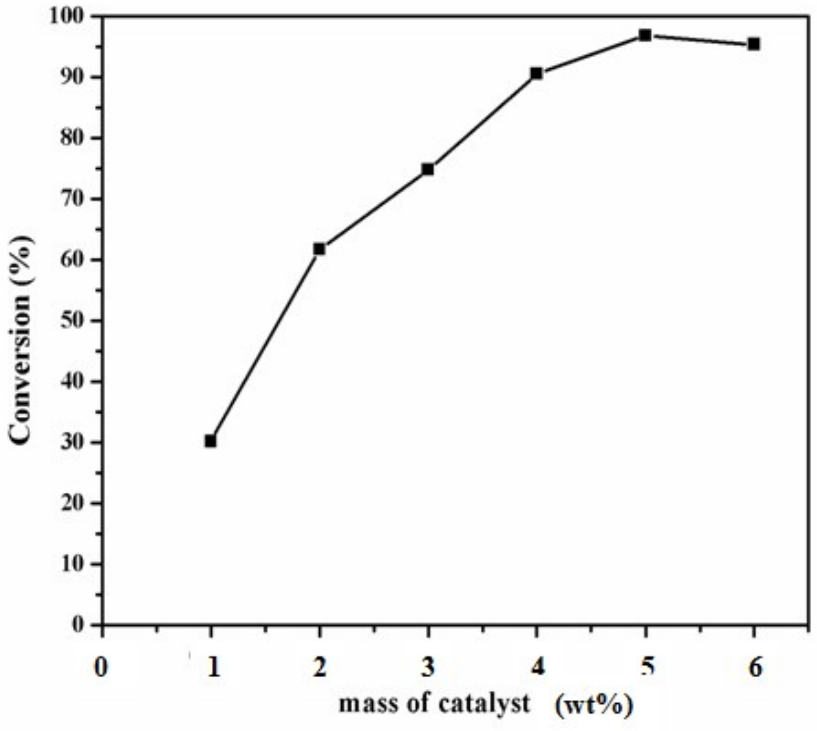

Fig. S4. The effect of different usage of catalyst on esterification of palmitic acid. Reaction condition: molar ratio of methanol/acid = 13:1, 65 °C, 7 h.

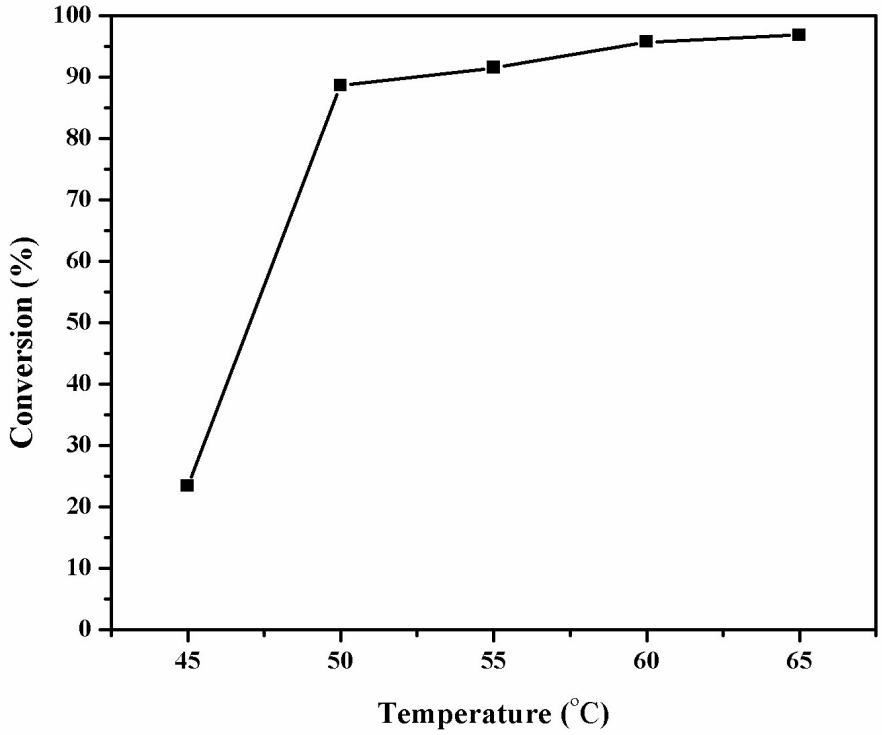

Fig. S5. The effect of different temperature on esterification of palmitic acid. Reaction condition: molar ratio of methanol/acid = 13:1, 5 w% of HPW/agarose (38 wt%) catalyst, 7 h.

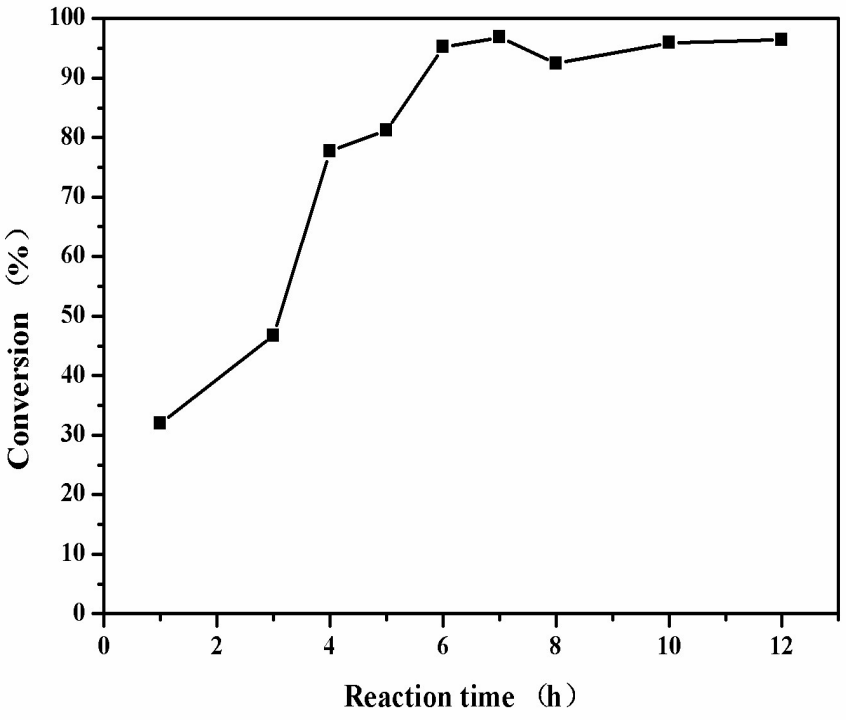

Fig. S6. The effect of different time on esterification of palmitic acid. Reaction condition: molar ratio of methanol/acid= 13:1, 65 °C, 5 wt% of HPW/Agarose (38 wt%) catalyst.

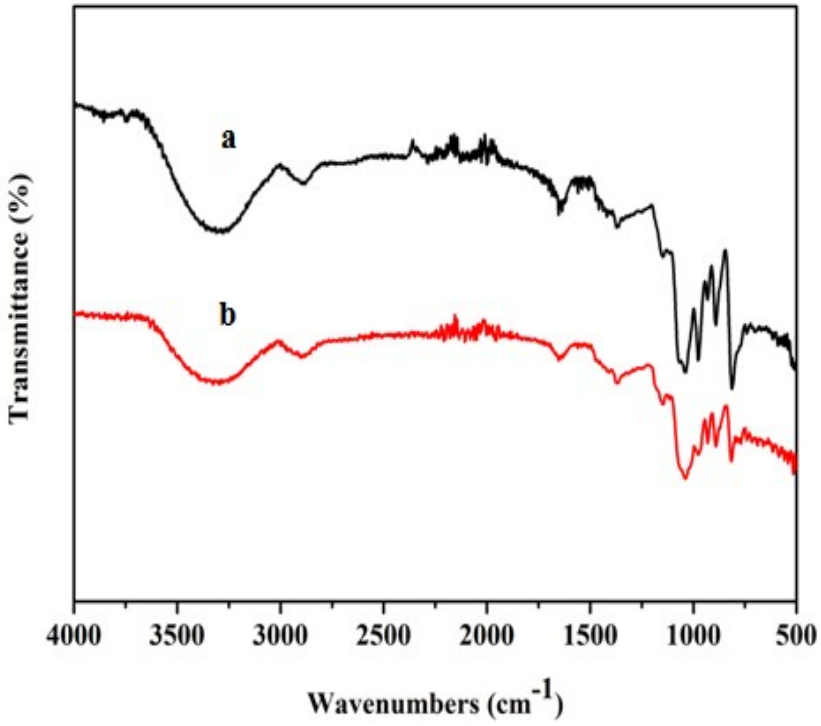

Fig. S7. The IR spectra of 38 wt% HPW/agarose nanocomposite film (a) before reaction (b)after reaction.

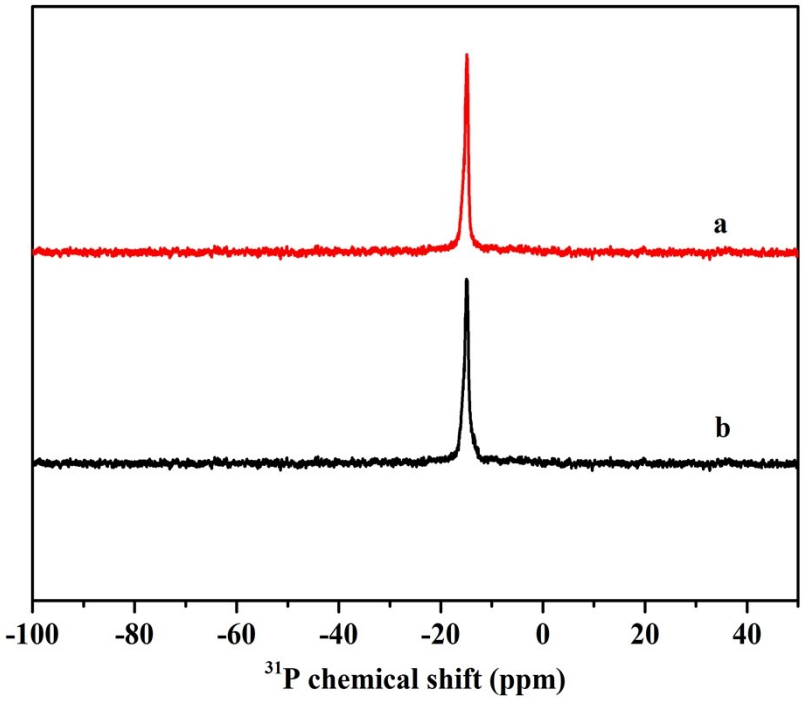

Fig. S8. ^{31}P MAS NMR spectra of 38 wt% HPW/agarose nanocomposite film (a) before reaction (b) after reaction.

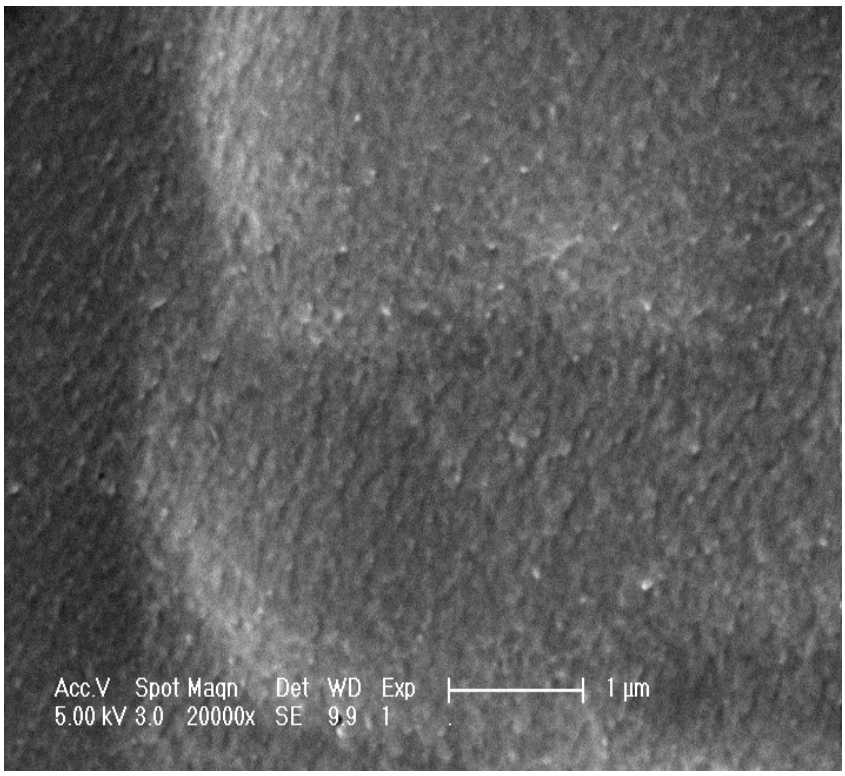

Fig. S9. The SEM image of HPW/agarose (38 wt%) after the esterification reaction.

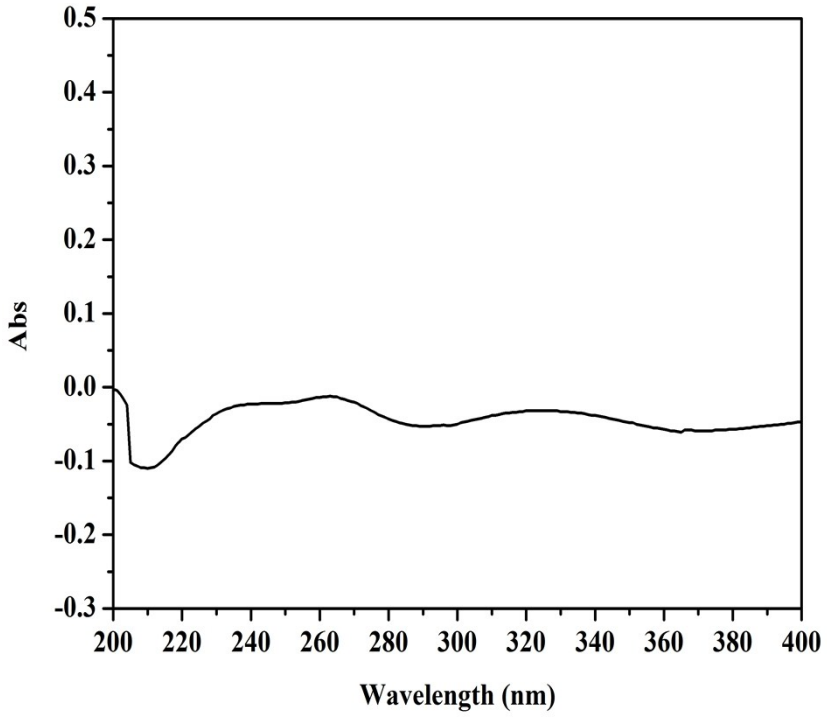

Fig. S10. Uv-vis spectroscopy of HPW/agarose (38 wt%).

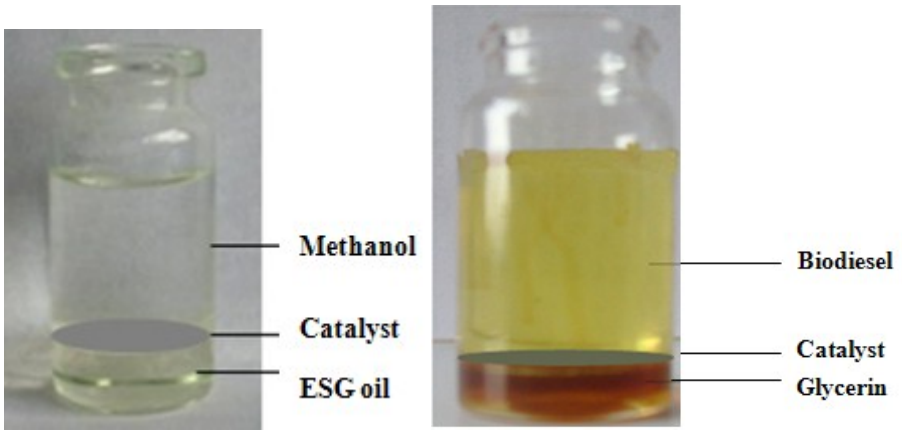

Fig. S11. The photo for HPW/agarose membrane before transeterification of EGS oil (left) and after transeterification of EGS oil (right).

Table S1 Results of elemental analysis

Catalysts	Elemental analysis (calcd) wt%				
	C	H	P	O	W
HPW/Agarose (14 wt%)	27.86(17.80)	3.97(3.57)	3.00(3.21)	91.32(90.11)	17.80(17.43)
HPW/Agarose (20 wt%)	23.87(23.21)	3.40(3.01)	2.57(2.24)	78.24(77.56)	15.25(15.11)
HPW/Agarose (25 wt%)	21.32(20.95)	3.04(3.31)	2.30(2.11)	69.90(69.55)	13.62(13.54)
HPW/Agarose (28 wt%)	20.04(19.11)	2.85(2.64)	2.16(2.20)	65.69(65.34)	12.80(12.54)
HPW/Agarose (38 wt%)	17.27(17.35)	2.46(2.29)	1.86(1.78)	56.62(56.32)	11.04(10.98)