Electronic Supplementary Material (ESI) for Food & Function.

Supplementary information

Title

Formation, structural characteristics and physiochemical properties of beeswax oleogel prepared with tea polyphenols loaded gelator

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Supplementary data

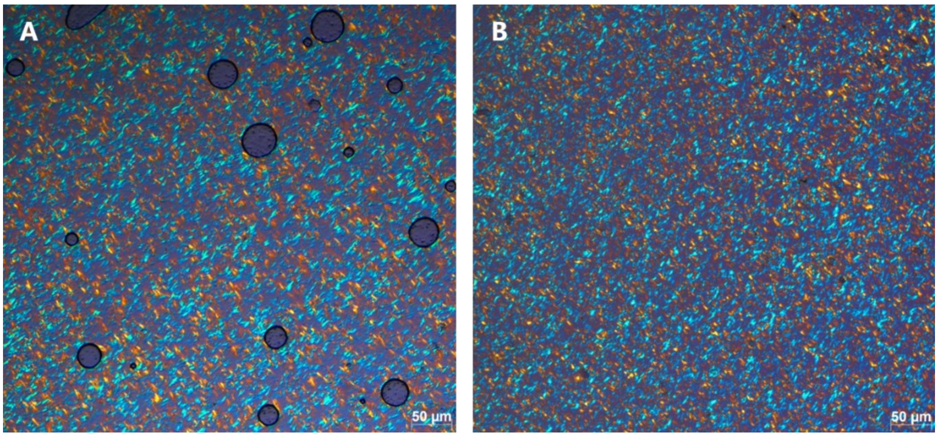

Fig. S1 Polarized micrographs of TP gelator before (A) and after (B) freeze-drying. Microscopic images were captured at 200× magnification.

In order to analyze the structure of solid W/O emulsions during the preparation of TP gelator, the microstructure of samples before and after freeze-drying was observed with PLM, as shown in Fig. S1. Beeswax and TP aqueous solution were shear emulsified to form a W/O emulsion. The X-ray diffractogram signified the crystalline nature of beeswax, which was determined by its chemical composition. When removed from high temperature, beeswax could be rapidly cooled because of the long saturated fatty acid chains in the structure to ensure the size of the TP solution dispersed in it. From Fig. S1(A), it could be clearly observed that the dispersed TP droplets were wrapped in the network structure formed by beeswax crystallization. The beeswax crystals prevented the aggregation of TP droplets and ensured the stability of the emulsion. And the TP gelator after the removal of water by lyophilization from solid W/O emulsion was shown in Fig. S1(B).

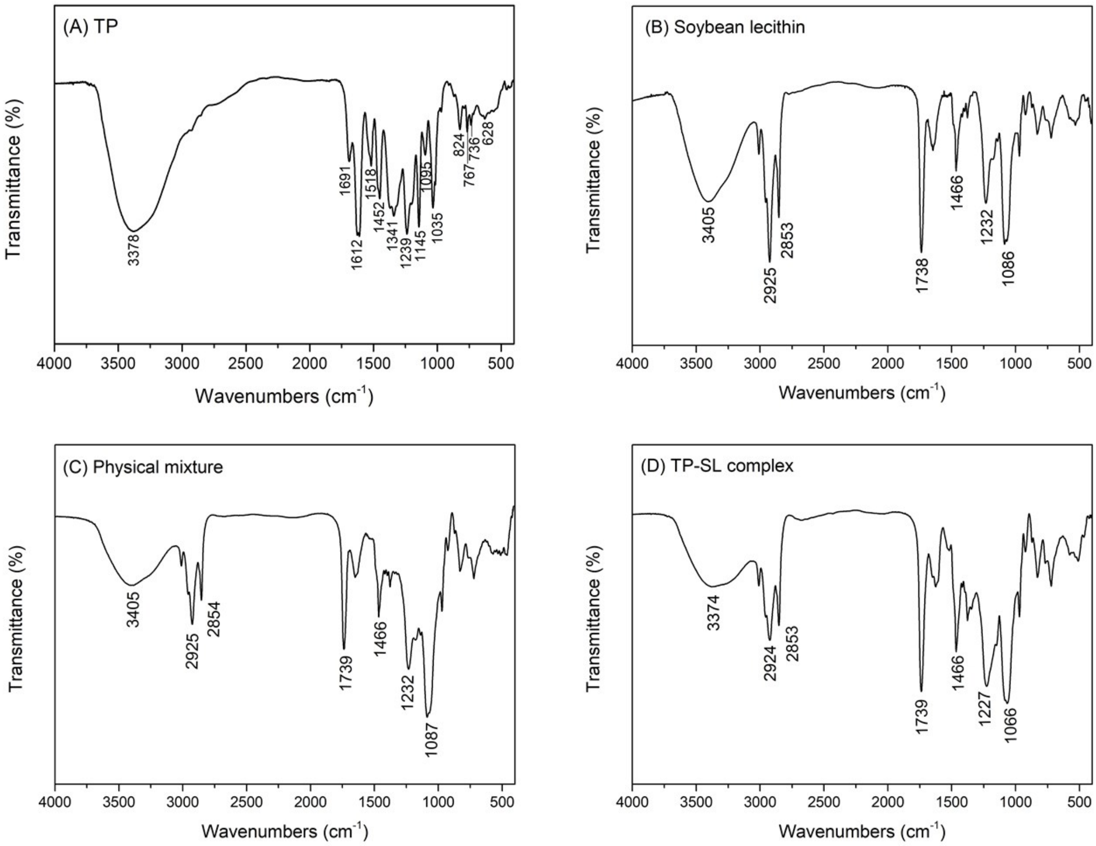

Fig. S2 Fourier-transform infrared spectra of TP (A), Soybean lecithin (B), Physical mixture of TP and soybean lecithin (C) and TP-SL complex (D), respectively.

TP-SL complex was prepared according to the method in Section 2.2, and beeswax was replaced by deionized water. The characteristic absorption peaks of soybean lecithin appeared at 2925 and 2853 cm^{-1} for C-H stretching of long fatty acid chain, 1738 cm^{-1} for C=O stretching vibration of fatty acid ester, 1232 and 1086 cm^{-1} for P=O and P-O-C stretching [1, 2]. The infrared spectrum of physical mixture was only the superposition of TP and soybean lecithin. It was similar to the spectra of soybean lecithin without peak shift, while the characteristic absorption peak of TP was not obvious due to the small amount of addition. The TP-SL complex spectra showed that the peak corresponding to the functional group N-H (3374 cm^{-1}) was shifted to lower wavenumber and the intensity decreased. In addition, the absorption peaks corresponding to the P=O (1227 cm^{-1}) and P-O-C (1066 cm^{-1}) stretching was shifted to lower wavenumber by 5 cm^{-1} and 20 cm^{-1}, respectively. The shifting of peaks in TP-SL complex compared with soybean lecithin indicated that the presence of intermolecular interactions between the phenolic hydroxyl group in TP and the quaternary ammonium nitrogen in the choline portion of soybean lecithin [3].

Table S1 Composition of the Tea Polyphenols (HPLC).

Peak	Compound	Content (%)
1	catechin (C)	32.01
2	epigallocatechin-3- gallate (EGCG)	28.80
3	gallocatechin-3-gallate (GCG)	9.82
4	epicatechin-3-gallate (ECG)	19.36

Reference:

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2. J. Li, P. Liu, J. P. Liu, J. K. Yang, W. L. Zhang, Y. Q. Fan, S. L. Kan, Y. Cui and W. J. Zhang, Bioavailability and foam cells permeability enhancement of Salvianolic Acid B pellets based on drug-phospholipids complex technique, *Eur J Pharm Biopharm.*, 2014, **86**, 562-562.
3. D. R. Telange, N. K. Sohail, A. T. Hemke, P. S. Kharkar and A. M. Pethe, Phospholipid complex-loaded self-assembled phytosomal soft nanoparticles: evidence of enhanced solubility, dissolution rate, ex vivo permeability, oral bioavailability, and antioxidant potential of mangiferin, *Drug Deliv Transl Re.*, 2020, DOI: 10.1007/s13346-020-00822-4.