Electronic Supporting Information (ESI)

Multicompartment Emulsion Microdroplets for Programmed Release of Hydrophobic Cargoes

Xiao-Wei Chen,[†‡] Xue-Ying Ning,[‡] Yuan Zou, [†§] Xiao Liu,[†] and Xiao-Quan Yang*[†]

[†] Guangdong Province Key Laboratory for Green Processing of Natural Products and Product Safety, Department of Food Science and Engineering, South China University of Technology, Guangzhou 510640, P. R China

[‡] Lipid Technology and Engineering, School of Food Science and Engineering, Henan University of Technology, Lianhua Road 100, Zhengzhou 450001, P. R China

[§] Department of Bioengineering, College of Food Science, South China Agricultural University, Guangzhou, 510642, PR China

Corresponding to: Xiao-Quan Yang

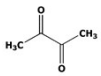
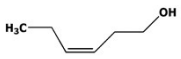
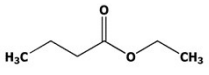
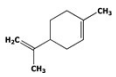
Tel: +86 20 87114262; Fax: +86 20 87114263

E-mail address: fexqyang@scut.edu.cn, fexqyang@163.com

Environmental stress stability

The nanodroplet-stabilized multicompartment core/shell microdroplets were subjected to a range of environmental stresses for monitoring their physical stability. ***pH stability***. Newly prepared microdroplets dispersions were placed into a series of different glass tubes, and then their pH values were adjusted to obtain values ranging from 2 to 9 by addition of 1 M HCl or 1 M NaOH. ***Ionic strength stability.*** Newly prepared microdroplets dispersions (pH 7) were transferred to glass tubes, then varying levels of NaCl solution were added with salt levels ranging from 0 to 500 mM NaCl. ***Thermal processing stability***. Newly prepared microdroplets dispersions (pH 7, 0 mM NaCl) were distributed amongst a series of sealed glass tubes that were placed into water baths set at different temperatures (25-100 °C) for 30 min. ***Agitation stability***. Newly prepared microdroplets dispersions (pH 7, 0 mM NaCl) were subjected to a series of stirring rate (0-600 rpm) with magnetic rotor for 30 min, and transferred to glass tubes for storage and analysis.

Table S1. Physicochemical characteristic of studied aroma compounds.

Fragrance compounds	**2,3-Butanedione**	***cis*-3-Hexen-1-ol**	**Ethyl butyrate**	***d*-Limonene**
Chemical formula	$C_4H_6O_2$	C_8H_{12O}	$C_6H_{12}O_2$	$C_{10}H_{16}$
Structural formula				
Boiling point (°C)	87	156.5	120	176
LogP	−1.80	1.34	1.85	4.57
Vapour pressure (Pa) at 25 °C	7572.71	317	1510	199.98
Solubility in water (g/L) at 25 °C	200	14.7	4.90	13.80
Odour descriptor	Butter, Fat	Fresh-green	Ethereal-fruity	Citrus-like

[a] P-Partition coefficient between octanol and water.

[b]Water solubility at 25 °C.

Table S2. Environmental stress (pH, ionic strength, temperature and external force) on the mean microdroplets diameter.[a]

pH	**pH 2.0**	**pH 4.0**	**pH 7.0**	**pH 9.0**
$D_{4,3}$	13.94±0.06a	13.97±0.30a	13.99±0.07a	14.14±0.12a
ionic concentration[b]	**0 mmol**	**100 mmol**	**300 mmol**	**500 mmol**
$D_{4,3}$	13.95±0.06a	14.04±1.00a	14.04±0.40a	14.23±0.39a
Temperture [c]	**25 °C**	**50 °C**	**80 °C**	**100 °C**
$D_{4,3}$	13.95±0.06a	14.23±0.12a	14.18±0.61a	14.40±0.15a
Agitation [d]	**0 rpm**	**100 rpm**	**300 rpm**	**600 rpm**
$D_{4,3}$	13.95±0.06a	13.83±1.01a	14.05±0.10a	13.94±1.04a

[a] Data are the means of duplicate measurements and their standards deviations; [b] ionic is NaCl; [c] heat shock in water baths for 30 min; [d] Agitation was operating by magnetic stirring for 30 min. Different letters in same row indicates there is significant difference between the values ($p < 0.05$).

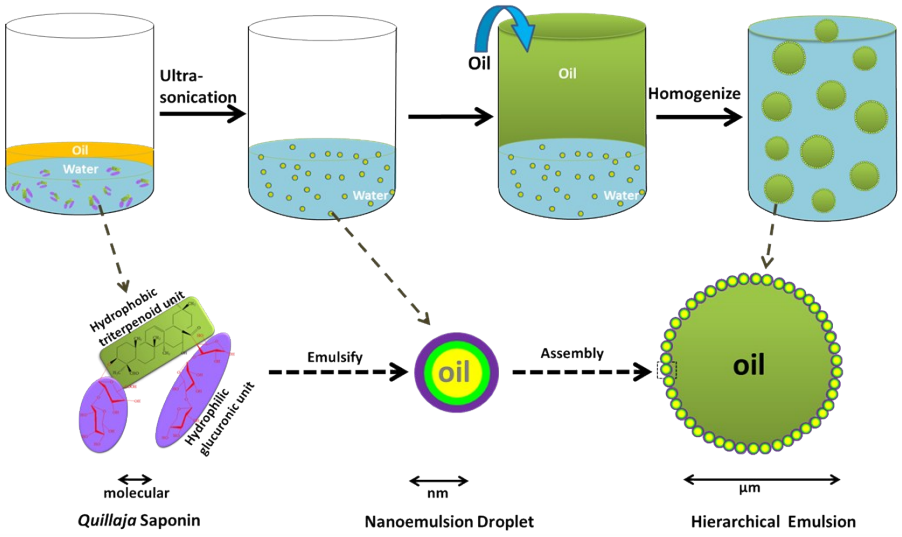
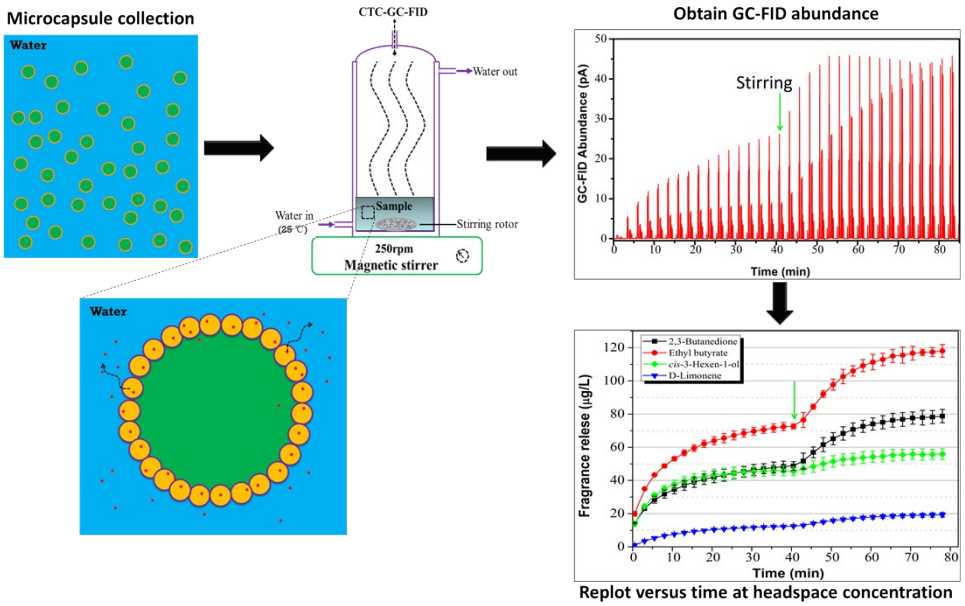


Figure S1. Schematic illustration of the fabrication route for multicompartment core/shell microdroplets over two-step processes by a bottom-up approach: Emulsification of *quillaja* saponin (QS), a natural small molecule biosurfactant from the soapbark tree (*Quillaja Saponaria* Molina), gave rise to the formation of nano-scale droplets. Then, the saponin-coated nanodroplets as emulsifying agents were stable the oil-water interfaces and lead to the formation of microdroplets with hierarchically multicompartment core/shell structure.



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49 **Figure S2.** Schematics showing the detailed CTC-GC-FID procedures to acquire the fragrance

50 release profile.

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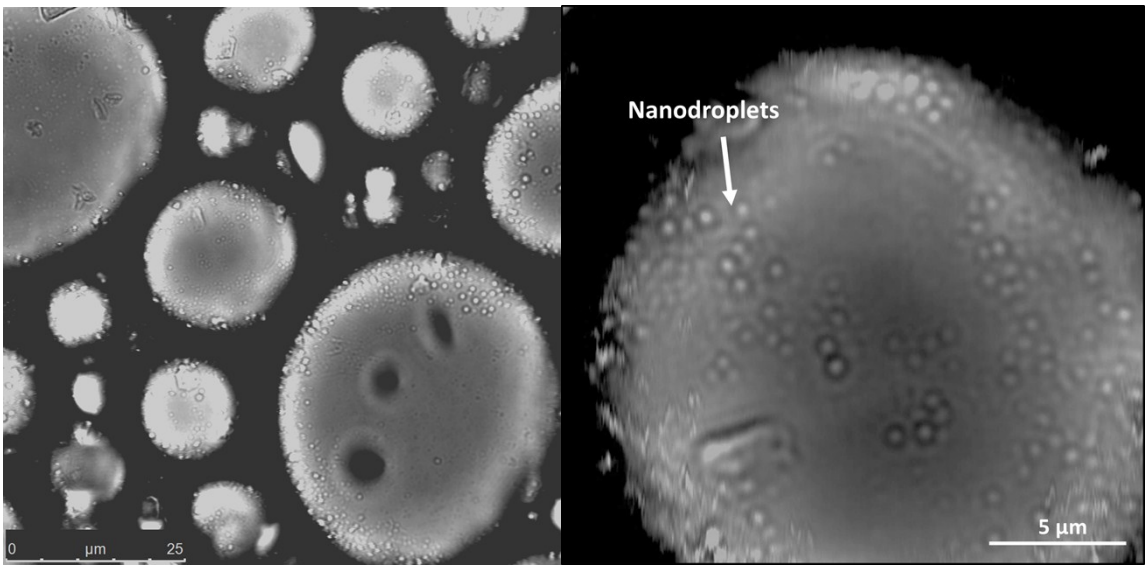

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53 **Figure S3.** Magnified bright field optical microscopy of microdroplets surface clearly showing the

54 nanodroplets arrangement. The arrow clearly indicates that a large amount of nanodroplets are

55 situated on the microdroplets surface.

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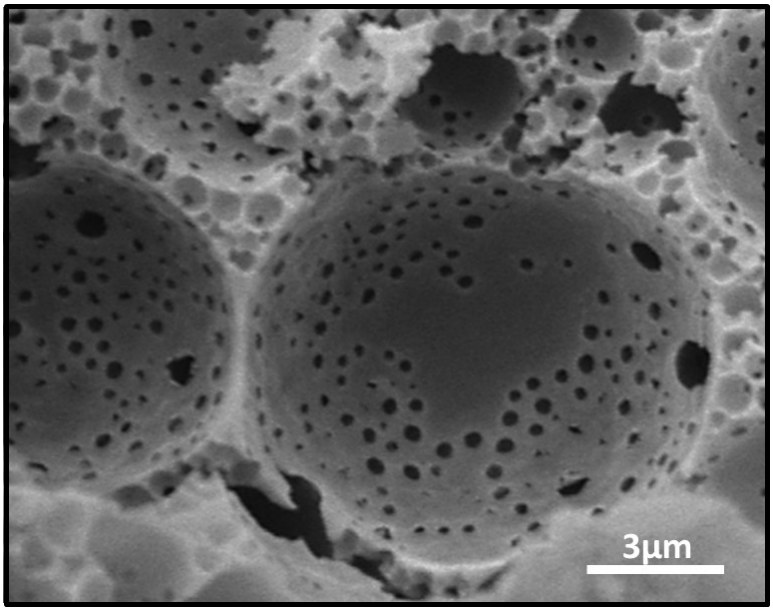

Figure S4. FE-SEM micrographs of microdroplets stabilized by nanodroplets, where the oil phase was replaced by cyclohexane and dried at 60 °C overnight.

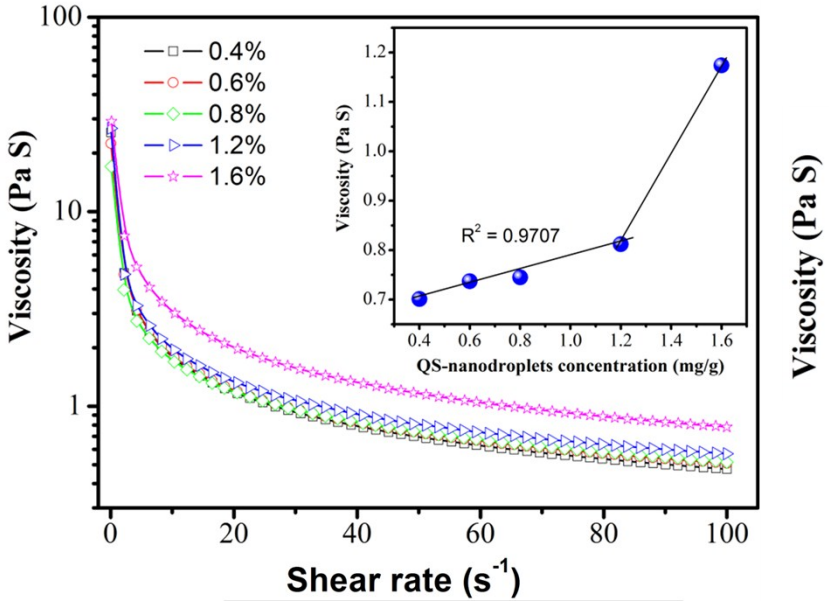

Figure S5. Effect of saponin-coated nanodroplets concentration on the viscosity of emulsion droplets at room temperature.