Supporting Information

Membranes for Continuous Non-Energized Air Freshener Perfume Delivery

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Number of tables: 5

Number of figures: 3

Table S1. The physicochemical properties of the selected four perfume compounds

Chemical name	Conc. in model perfume solution (wt%)	Vapor pressure at 25 °C (torr)	Molecular weight (g/mol)	Boiling point (°C)	Liquid viscosity (Pa·s)	Surface tension (mN/m)
Ethyl-2-methyl butyrate	25	7.33	130.20	132-133	7.74E-04	25.5
Benzyl acetate	25	0.177	150.18	212	2.12E-03	36.0
Phenyl ethyl alcohol	25	0.0868	122.17	219-221	1.12E-02	39.6
Cyclamen aldehyde	25	0.00881	190.30	270	8.31E-03	32.5

Table S2. The densities of perfume compounds, the experimental and calculated liquid sorption amounts based on the two different porosity values

Chemical name	Liquid density (g/cm^3)	g(solvent)/g(membrane) Experimental data	Ideal g(solvent)/g(membrane) 42% porosity
Ethyl 2-methyl butyrate	0.865	0.411	0.432
Benzyl acetate	1.05	0.535	0.524
Phenyl ethyl alcohol	1.017	0.517	0.508
Cyclamen aldehyde	0.95	0.480	0.474

Table S3. The contact angles and liquid sorption behaviours of the different perfume compounds

Chemical name	Contact angle	g(solvent absorbed)/g(membrane)*100		
		25 °C	35 °C	45 °C
Water	111.9	-	-	-
Ethyl-2-methyl butyrate	9.0	41.08	40.73	40.39
Benzyl acetate	33.2	53.47	53.15	52.84
Phenyl ethyl alcohol	47.1	51.73	51.30	50.91
Cyclamen aldehyde	32.2	48.04	47.84	47.61

Table S4. The compounds absorbed by the membrane through capillary. The initial ratio is 1:1:1:1 (25 wt% each); the final weight ratios are normalized with benzyl acetate (set as 1)
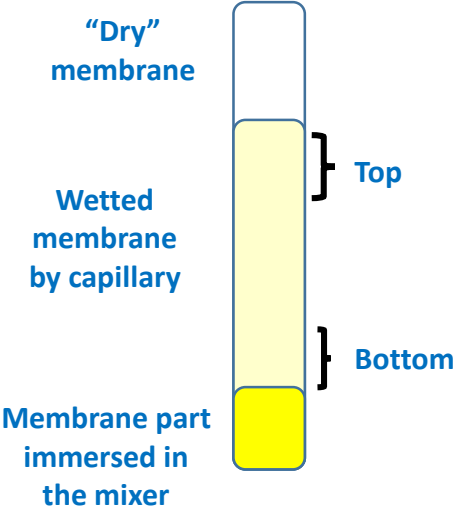
Diagram	Condition	Ethyl 2-methyl butyrate	Benzyl acetate	Phenyl ethyl alcohol	Cyclamen aldehyde
"Dry" membrane / Wetted membrane by capillary (Top, Bottom) / Membrane part immersed in the mixer	25 °C top	0.93±0.01	1.00	0.94±0.01	0.69±0.02
	25 °C bottom	0.90±0.01	1.00	1.03±0.01	0.65±0.04

Table S5. The perfume release rates of the air freshener membrane for the pure perfume compounds and the calculated release rate that the liquid perfume spills out of the membrane (testing conditions: air velocity: 0.1 m/s, temperature: 25 °C)

Diagram	Chemical name	Ethyl-2-methyl butyrate	Benzyl acetate	Phenyl ethyl alcohol	Cyclamen aldehyde
	Perfume release rate, (mg/cm²-h)	41.6	0.73	0.45	0.002
	The critical static head when the membrane starts to leak, cm	-	11	10	9
	The calculated flow rate for one pore using Darcy-Weisbach equation, (m³/s)	-	3.89E-24	6.46E-25	7.20E-25
	The calculated membrane flux, (mg/cm²-h)	-	1.97	0.317	0.329

Perfume static head

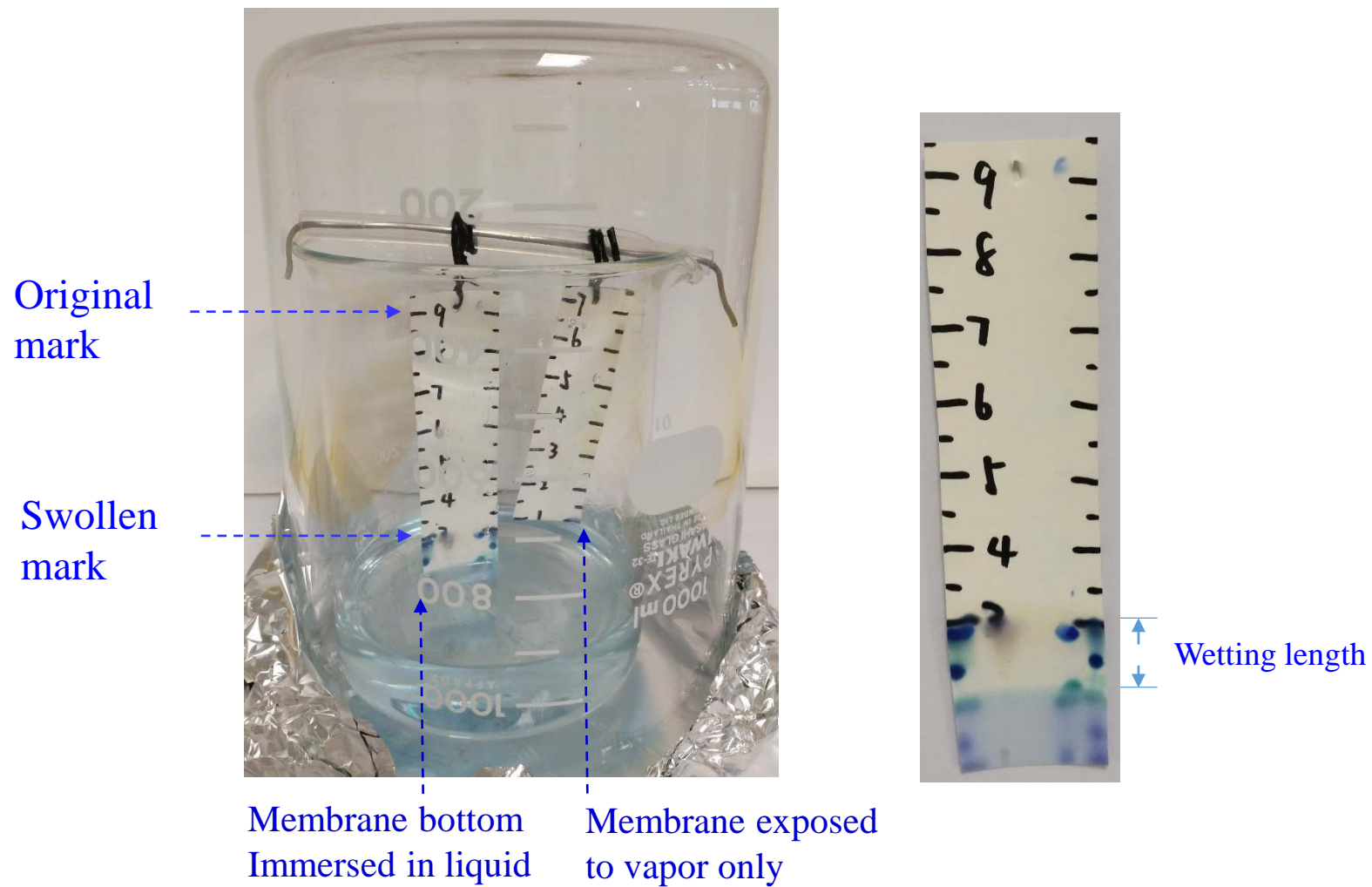Membrane-enclosed perfume reservoir

Perfume liquid droplets

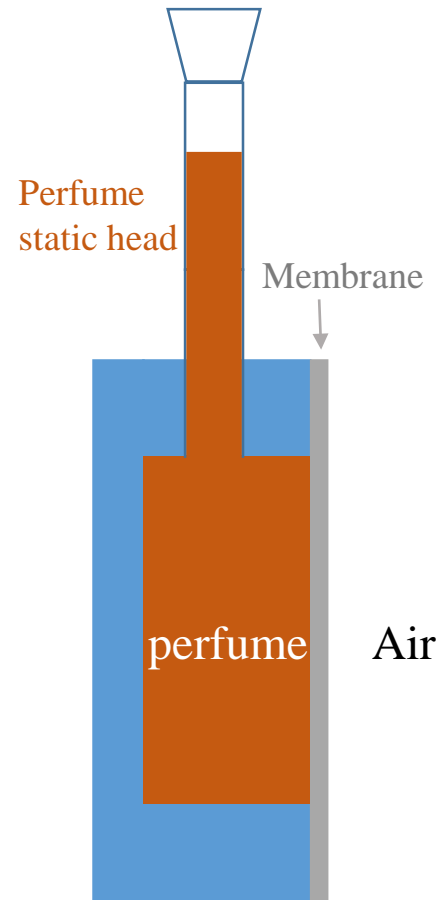Fig. S1. The device to estimate the wetting lengths and rates in different perfume compounds.

Fig. S2. The device to measure the static head in the air freshener membrane-enclosed perfume reservoir.
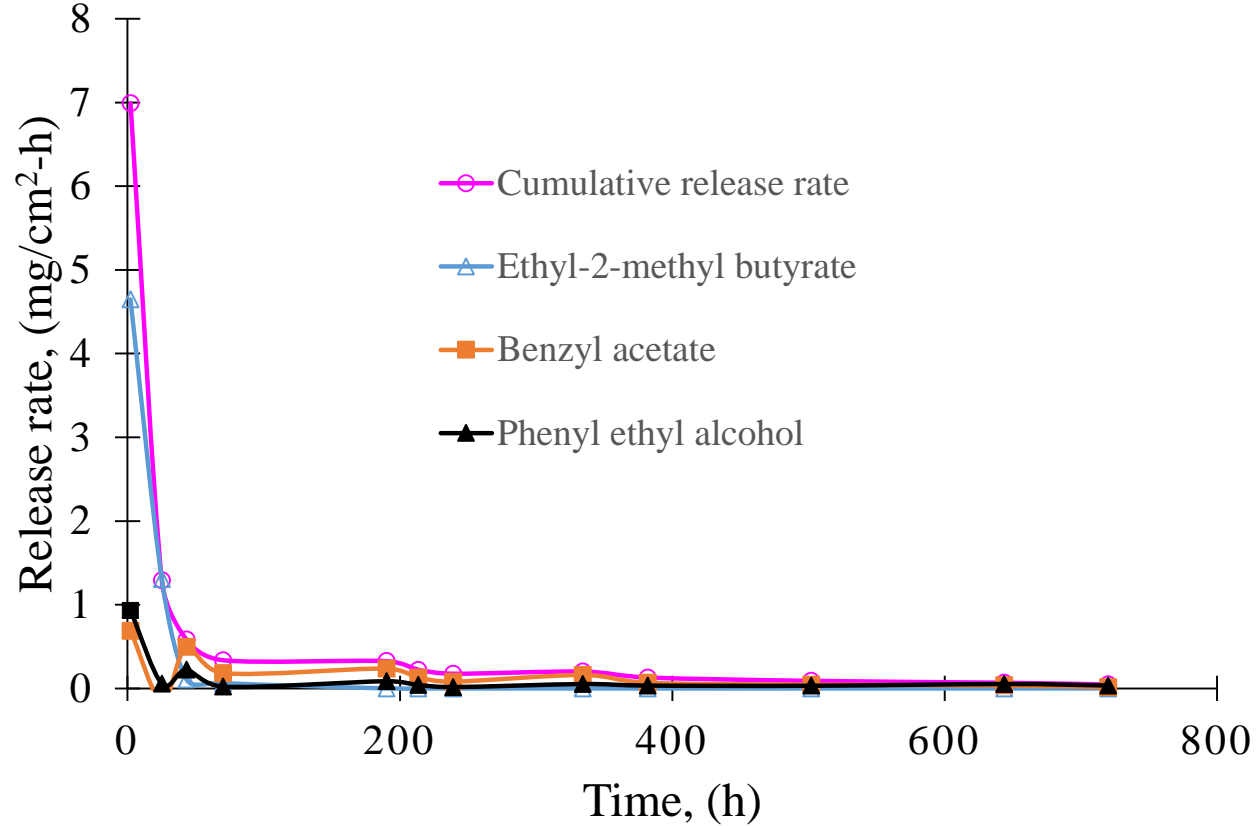
Fig. S3. Calculated individual perfume release rates of a model perfume (a mixed solvent comprising 25 wt% each) from its weight loss and perfume reservoir compositions in the membrane air freshener (testing conditions: air velocity: 0.1 ± 0.02 m/s, temperature: 25 ± 1°C).