**ELECTRONIC SUPPLEMENTARY INFORMATION for**

# Long-lived superhydrophobic colorful surfaces

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## S1 Materials and Methods

### S1.1 Materials

*1H,1H,2H,2H*-perfluorodecyltriethoxysilane (PFDTS) was supplied by Nanjing, China. n-Hexadecyltrimethoxysilane (HDTMS) was purchased from Hangzhou, China. Sodium hydroxide, dodecyl dimethyl benzyl ammonium chloride (1227), acetic acid, plain weave poly(ethylene terephthalate) (PET), and nylon cloth were purchased from local market.

### S1.2 Chemical Etching of PET textiles

#### S1.2.1 Soda-boiling

Firstly, the PET textiles were washed by deionized water to remove the impurities and immersed in sodium hydroxide solution with 2 g/L 1227. The sodium hydroxide concentration was set at 2 g/L~22 g/L with a liquor ratio of 40:1. Then the solution was heated at 90℃ for 50min. At last, the textiles were washed by abundant water until the pH of the textile surfaces reached 7, and dried at 80℃ without any tension.

#### S1.2.2 Soda-decating

The PET textiles were washed by deionized water to remove the impurities and immersed in 380 g/L sodium hydroxide solution for 10 min. Then the soaked textiles were doubled-sided covered in polyethylene film and heated at 120℃ for 4 min. Finally, the textiles were washed by abundant water until the pH of the textile surfaces reached 7, and dried at 80℃ without any tension.

### S1.3 Dyeing of PET textiles

Dyeing of PET textile was processed in an infrared rays dyeing machine (Fig. S1). 0.6 % (on weight of the textile) dye liquor and two drops of acetic acid were added into dyeing containers followed by adding 4 g PET textiles. Then the containers were sealed and heater under 130℃ for 1h. The temperature profile is shown schematically in Fig. S2. After the system was cooled to 40℃, the textiles were taken out, washed by soap and water, and then put into an oven for dry at 80℃ without any tension.

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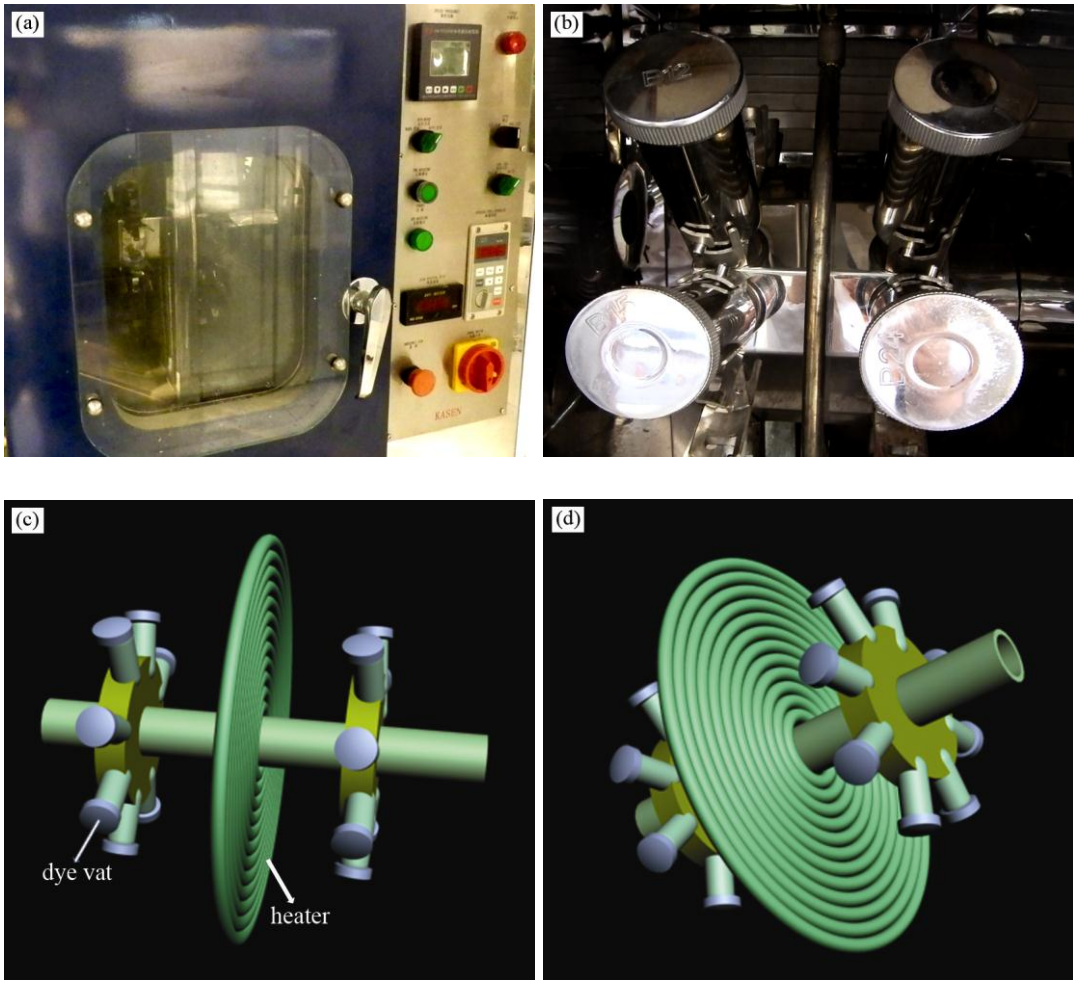


**Fig. S1** (a) photo of the dyeing machine; (b) photo of the inside of the dyeing machine; (c) and (d) are models of (b).

### S1.4 Hydrophobization of the chemically etched PET textiles

Hydrophobization of the chemically etched PET textiles by fluorinated alkyl silane was accomplished in an infrared rays dyeing machine (Fig. S1). A certain amount (0.5 mL, 0.1 mL, or 0.02 mL) of PFDTS was dropped into dyeing containers followed by adding the PET textiles (2 g). Then the containers were sealed and heated under 130℃ for 1h. The temperature profile is shown schematically in Fig. S2. After the system was cooled to 40℃, the textiles were taken out and put into an oven for drying at 70℃ without any tension for 1h. This process is similar to the dyeing process of PET with disperse dyes.

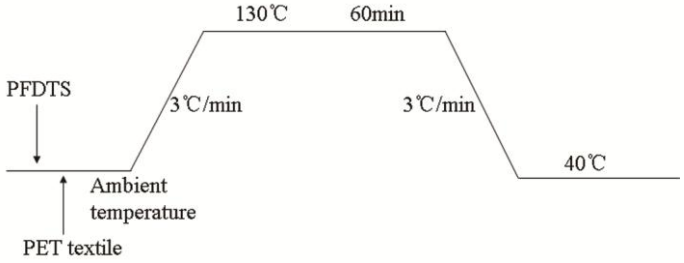


**Fig. S2** Temperature profile of the liquid in the containers.

## S2 Characterization and Tests

### S2.1 Characterization

Surface imaging and SEM-EDX mapping were performed on a field emission scanning electron microscope (S4800, Hitachi, Japanese). Water contact angles (WCAs) of the samples were measured at ambient temperature on a video optical contact angle system (OCA 20, Dataphysics, Germany). All the contact angles angles were determined by averaging values measured at 5–6 different points on each sample surface. Fourier transform Infrared (FTIR) spectra were measured on an FTIR spectrophotometer (VERTE70, PE, Germany).

### S2.2 Durability against soap boiling

For measuring the durability of superhydrophobicity of PET textiles against soap boiling, the samples were immersed in a boiling solution of 5 g/L soap powder for certain time. And then the samples were washed by abundant water to move the residual detergent, and dried at 35℃ without any tension for CA test.

### S2.3 Washing durability test

The washing durability of treated PET textiles were evaluated by a standard procedure according to AATCC Test Method 61-2003 test No 1A. Samples were washed using a laundering machine (SW-12 AII, Da Rong, China) at 40℃ in presence of 10 stainless steel balls (diameter 6mm) with the existence of 0.38% soap powder. One washing cycle (45min) is approximate to five times of commercial laundering. The washed textiles were rinsed by abundant water to remove the residual detergent, and dried at 35℃ without any tension. The laundering machine was showed in Figure S3.

### S2.4 Abrasion resistance test

The abrasion resistance was evaluated using a modified procedure based on the AATCCA Test Method 8-2001. Figure S4 schematically depicts the basic test setup. The PET sample was fixed and rubbed across a 100% nylon fabric cloth in the dry state. The testing was performed with loaded pressures of 45 KPa with moving path of 100 mm. One cycle was two moving paths. After certain cycles abrasion, the CA on the rubbed area of the sample was tested.

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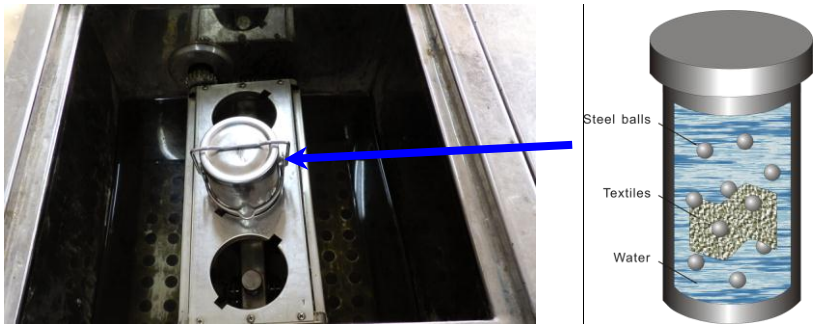


**Fig. S3** Photo of the inside of the laundering machine (left) and the illustration of the washing container.

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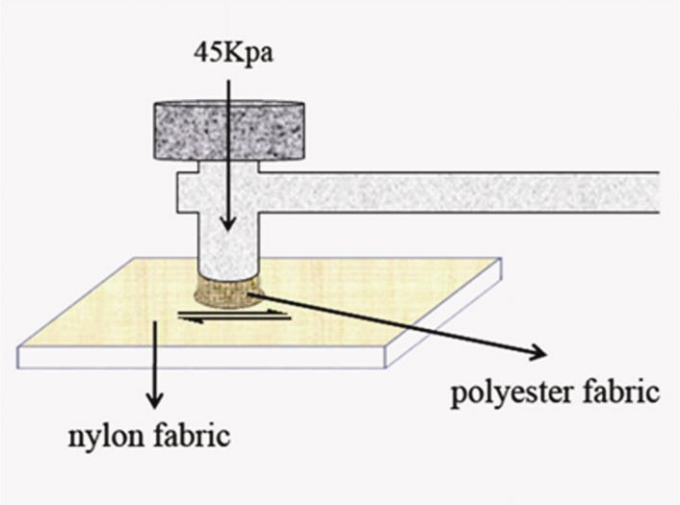


**Fig. S4** Schematic illustration of the abrasion resistance test.

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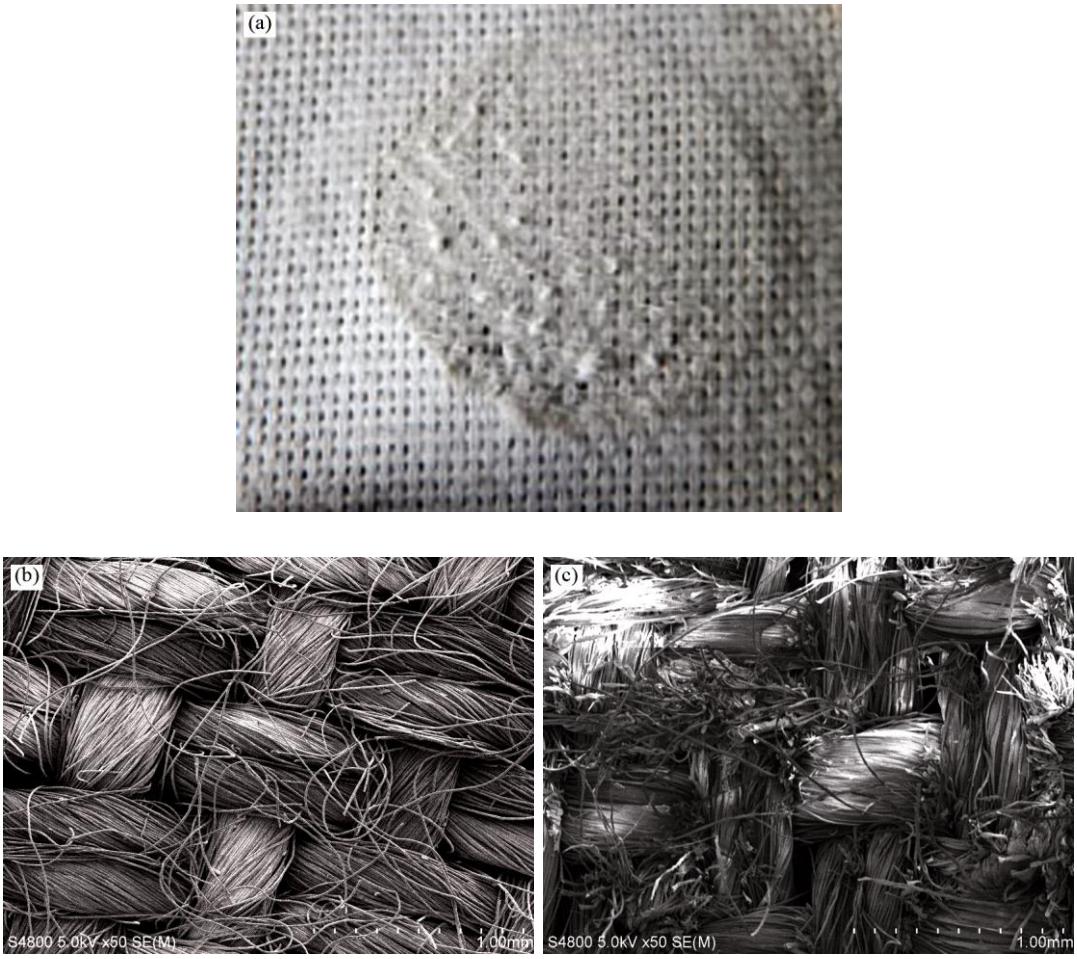


**Fig. S5** (a) photograph of the sample after 3000 cycles abrasion, and SEM images of (b) the original superhydrophobic sample and (c) the abraded part of the superhydrophobic sample after 3000 cycles abrasion.

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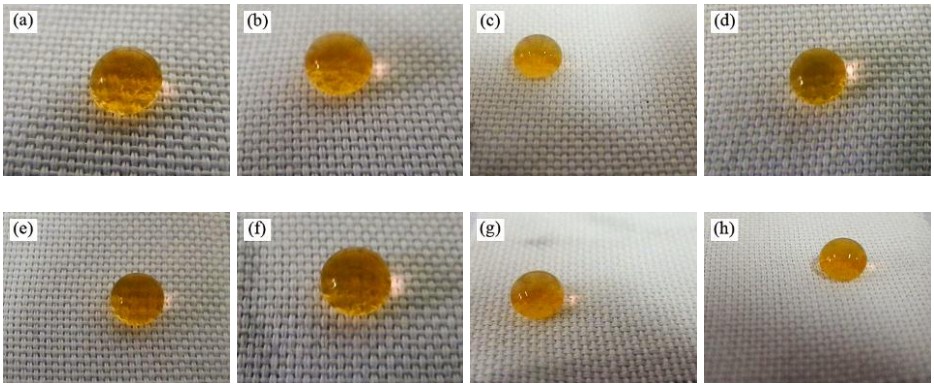


**Fig. S6** the photographs of water on the samples of etched PET textiles treated by PFDTS after immersing in different solutions for 24h of (a) NaOH (pH 14), (b) $H_2SO_4$ (pH 1), (c) 30 g/L NaCl + 5 g/L $MgCl_2$, (d) methanol, (e) ethanol, (f) n-propanol, (g) toluene, and (h) acetone.

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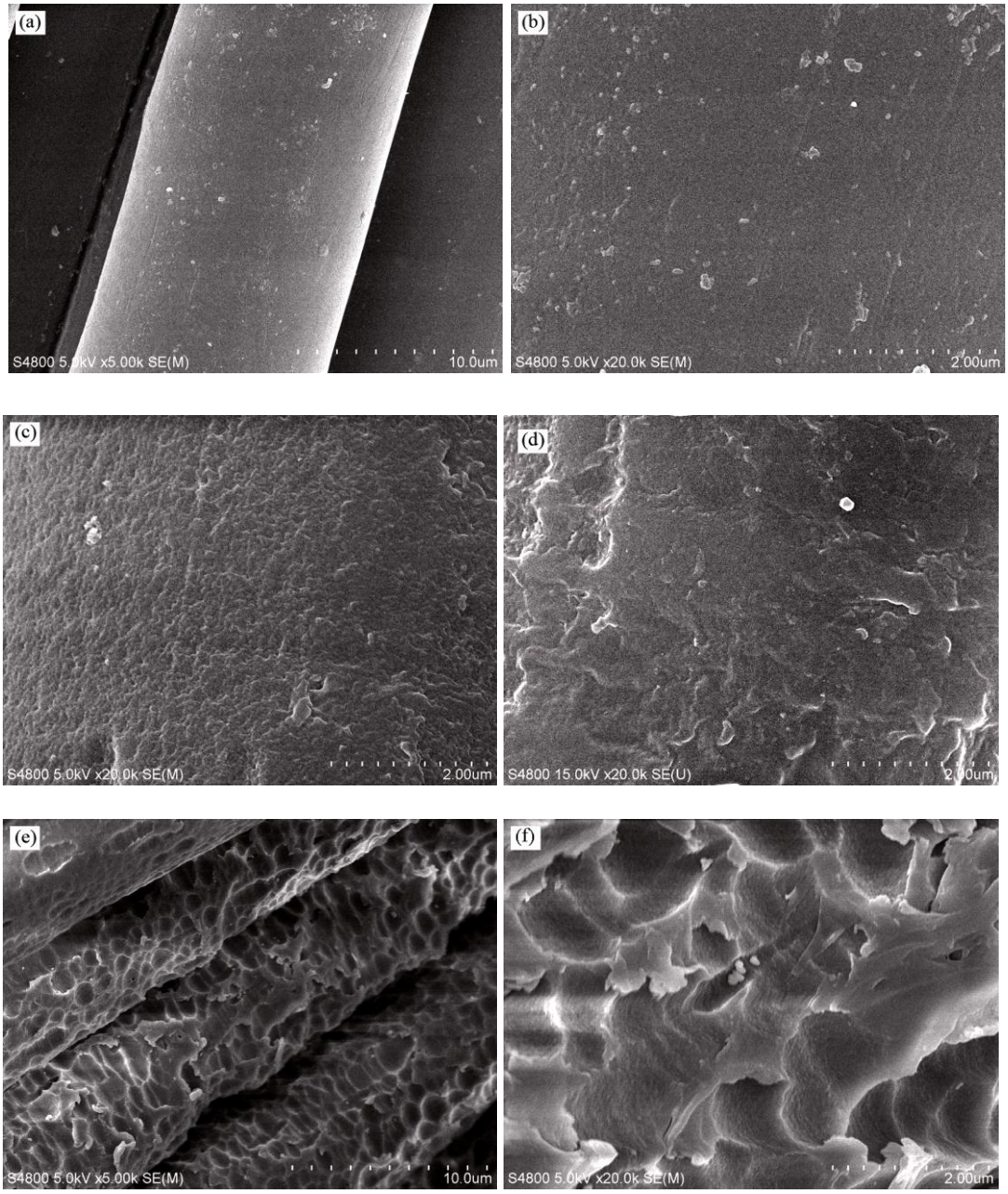


**Fig. S7** SEM images of: (a) pristine PET fibers, (b) the higher magnification of (a), (c) PET fibers soda-boiled with 10 g/L NaOH, (d) PET fibers soda-boiled with 22 g/l NaOH, and (e) PET fibers soda-decated with NaOH; (f) the higher magnification of (e).

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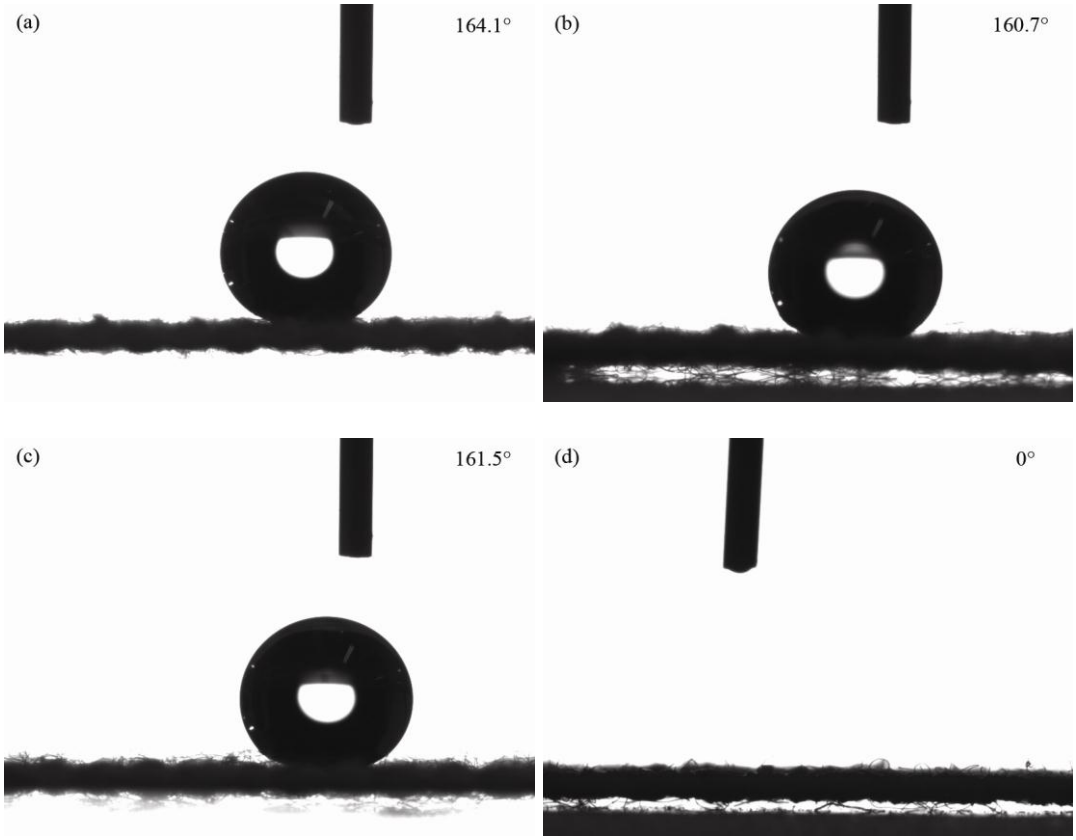


**Fig. S8** Water droplets and the corresponding CA on the PET textiles with a weight reduction of 20 wt.% hydrophobized by PFDTS of (a) 0.5 mL, (b) 0.1 mL, (c) 0.02 mL and (d) 0 mL.

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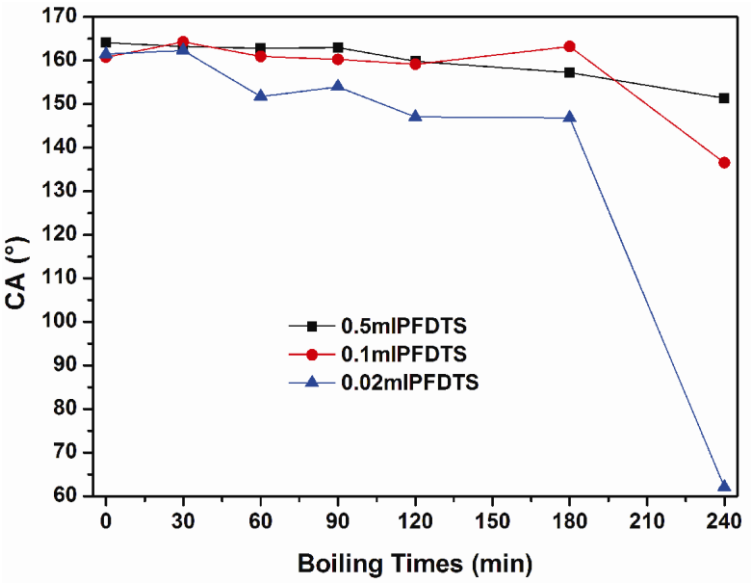


**Fig. S9** The CA change with boiling times for PFDTS treated PET textiles with a weight reduction of 20 wt. %.

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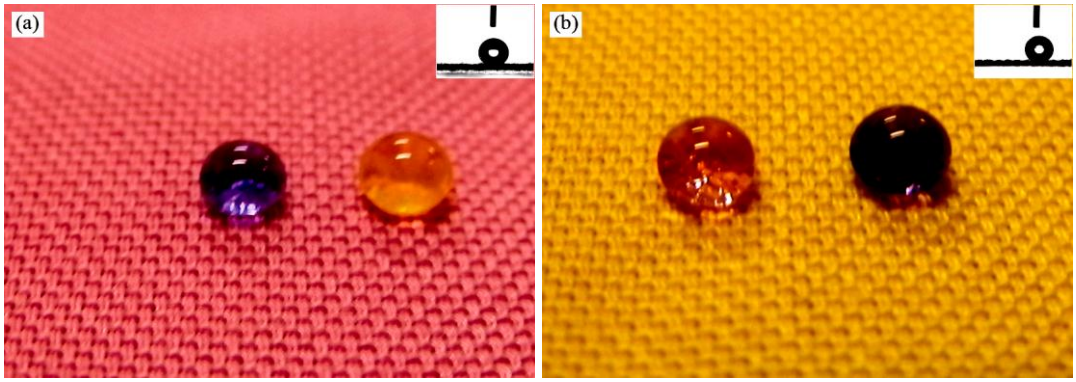


**Fig. S10** Photographs of the water droplets on colorful PET textiles treated by (a) PFDTS and (b) HDTMS.