Electronic Supplementary Material (ESI) for New Journal of Chemistry.


# Supporting Information

## Preparation of Edible Superhydrophobic Fe Foil with Excellent Stability and Durability and Its Applications in Food Containers for Low Residue

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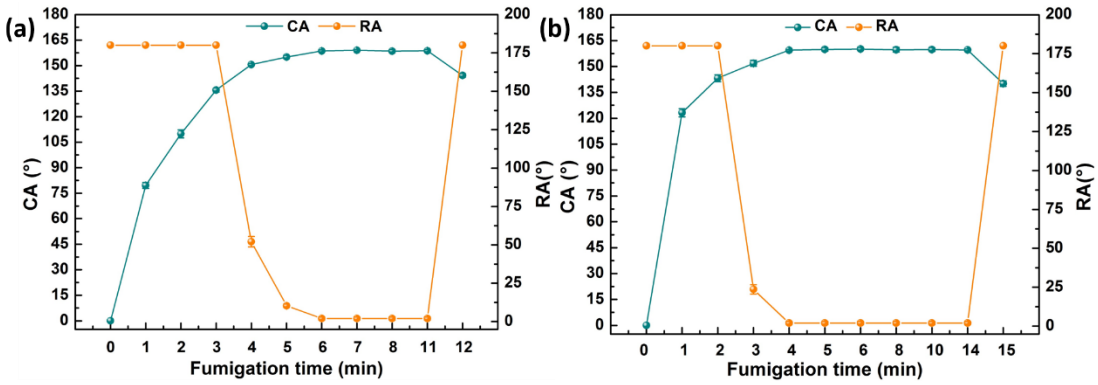


**Fig. S1.** Effect of fumigation time on CA of ESFF modified with: (a) beeswax, (b) lard.

As shown in **Fig. S1**, the best fumigation time for obtained food grade paraffin-modified ESFF was determined to range from 6 to 11 min. For lard-modified ESFF, the best fumigation time was range from 5 to 14 min. This significant difference in the optimal fumigation time may be due to the different condensation rate of modifier vapor on the micro-nanostructure of Fe foil.

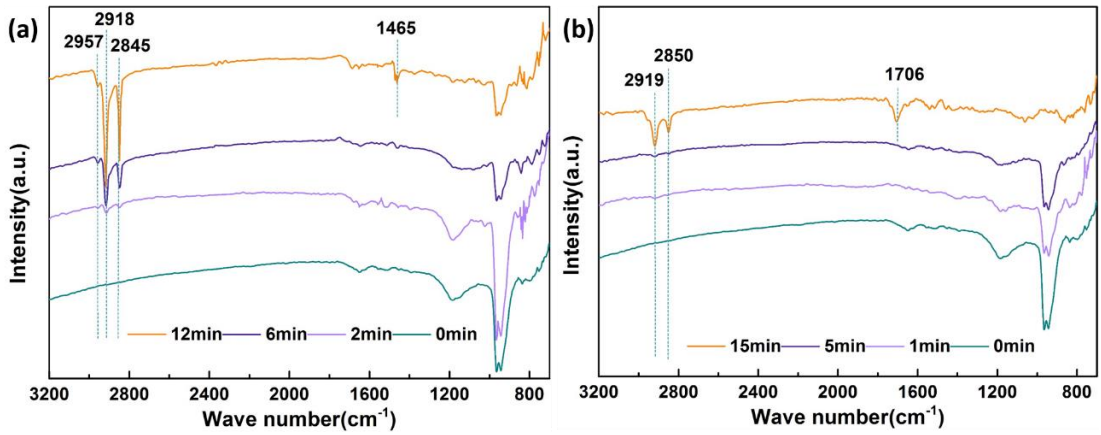


**Fig. S2.** The FT-IR results of ESFF with different fumigation time: (a) Beeswax, (b) Lard.

The characteristic peaks at 2845, 2918 and 2957 $cm^{-1}$ (C-H stretching vibration of CH3 and CH2) significantly increased with longer fumigation time for beeswax, and the new peaks appeared at 1465 $cm^{-1}$ ($COO^-$ stretching vibration) after excessive fumigation. For lard-modified ESFF, the peaks at 2850, 2919 $cm^{-1}$ also increased with longer fumigation time, and the new peaks appeared at 1706 $cm^{-1}$ (typical C=O stretching vibration of lard ) after excessive fumigation (**Fig. S2**).

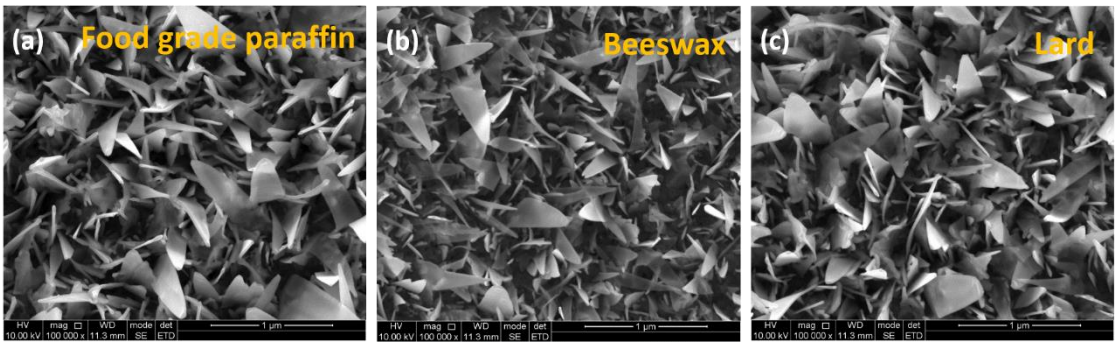


**Fig. S3.** The SEM graphs of the ESFF in air: (a) Food grade paraffin, (b) Beeswax, (c) Lard.

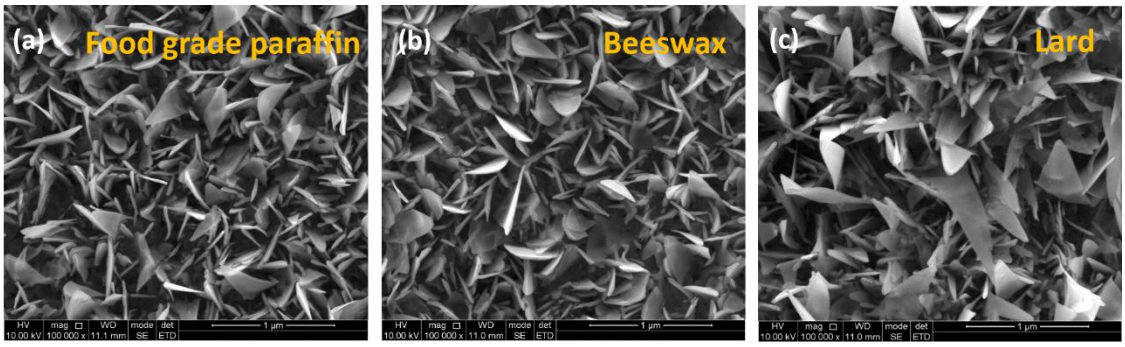


**Fig. S4.** The SEM graphs of the ESFF washed by water with flow rate of 2.5m/s: (a) Food grade paraffin, (b) Beeswax, (c) Lard.

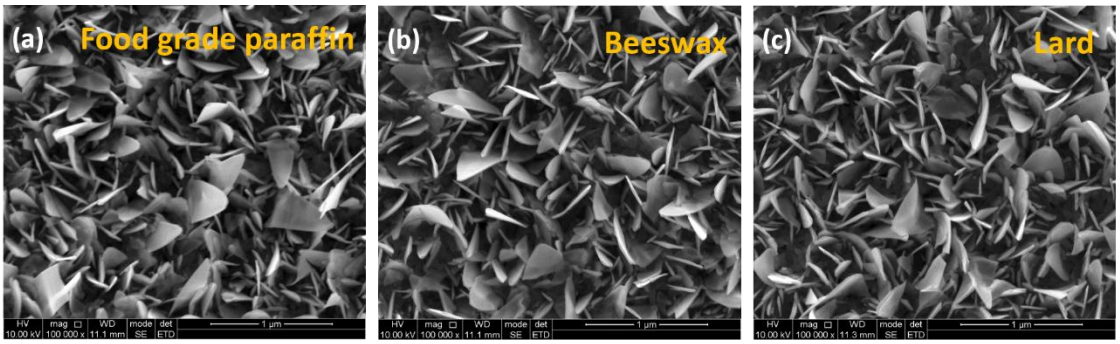


**Fig. S5.** The SEM graphs of the ESFF heated at 200℃: (a) Food grade paraffin, (b) Beeswax, (c) Lard.

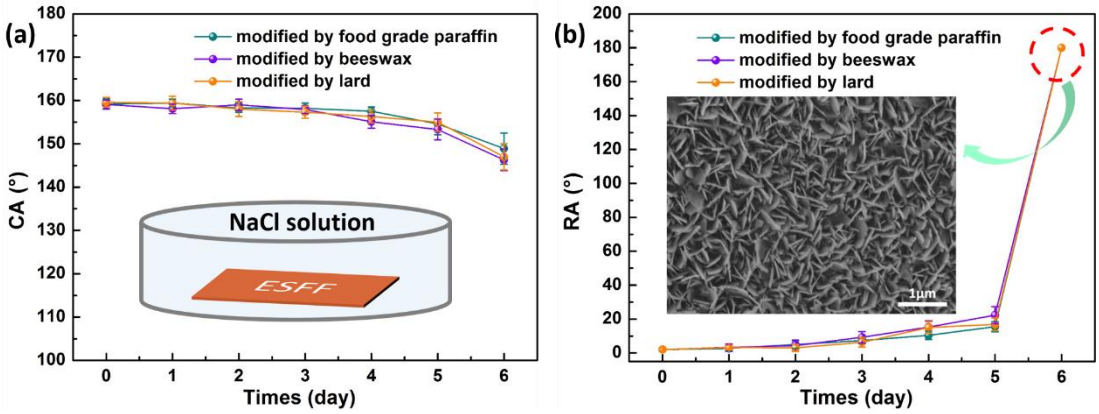


**Fig. S6.** The chemical stability of the three ESFF immersed in 3.5 wt% NaCl solution. (a) The changes in CA and Schematic diagram of immersion process. (b)The changes in RA, inserted SEM image of ESFF.

The results of the chemical stability of the ESFF were shown in **Fig. S6**. It can be seen that with the increase of immersing time, the CA value of ESFF decreases obviously after 6 days, while the RA value shows the opposite trend. SEM results also confirmed that the nanostructures on the ESFF surface were not corroded, which showed excellent chemical stability.

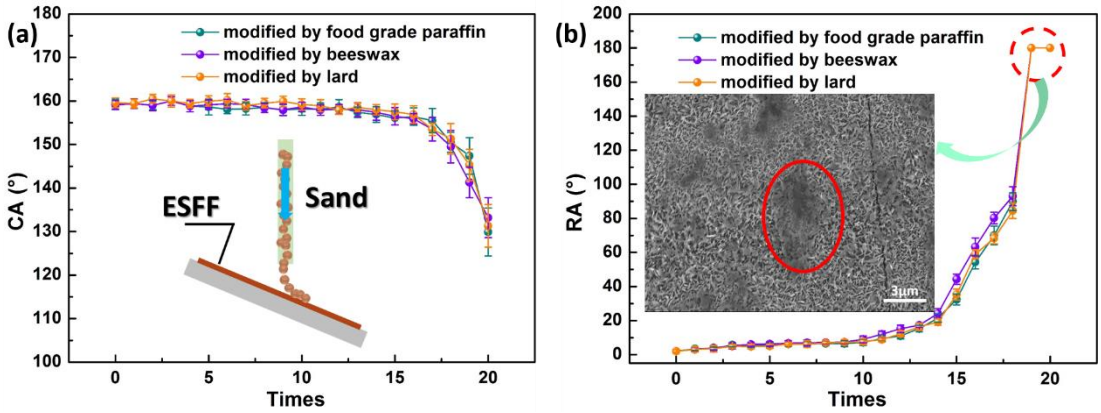


**Fig. S7.** The mechanical stability of ESFF scouring with flowing sand (200g). (a) The changes in CA and schematic diagram of scouring process. (b)The changes in RA, inserted SEM image.

The results of the mechanical stability of the ESFF were shown in **Fig. S7**. The results show that ESFF can maintain good mechanical stability under 200g sand scouring, and only lose superhydrophobicity after 18 times. The SEM image of ESFF with loss of superhydrophobicity confirmed that serious damage of the nanostructures resulted in irreversibility attenuation.

**Table S1.** Surface tension of liquid mixed by different volume ratio of water/ethanol.

| Volume ratio of ethanol to water | surface tension (mN/m) |
|---|---|
| 0:100 | 72.19 |
| 1:100 | 70.95 |
| 2:100 | 68.56 |
| 3:100 | 64.15 |
| 4:100 | 63.15 |
| 5:100 | 61.62 |
| 6:100 | 59.8 |
| 7:100 | 58.06 |
| 8:100 | 56.06 |
| 9:100 | 54.76 |
| 10:100 | 53.04 |