Electronic Supplementary Material (ESI) for RSC Advances

Amphiphobic fluorinated polyurethane composite microfibrous membranes with robust waterproof and breathable performances

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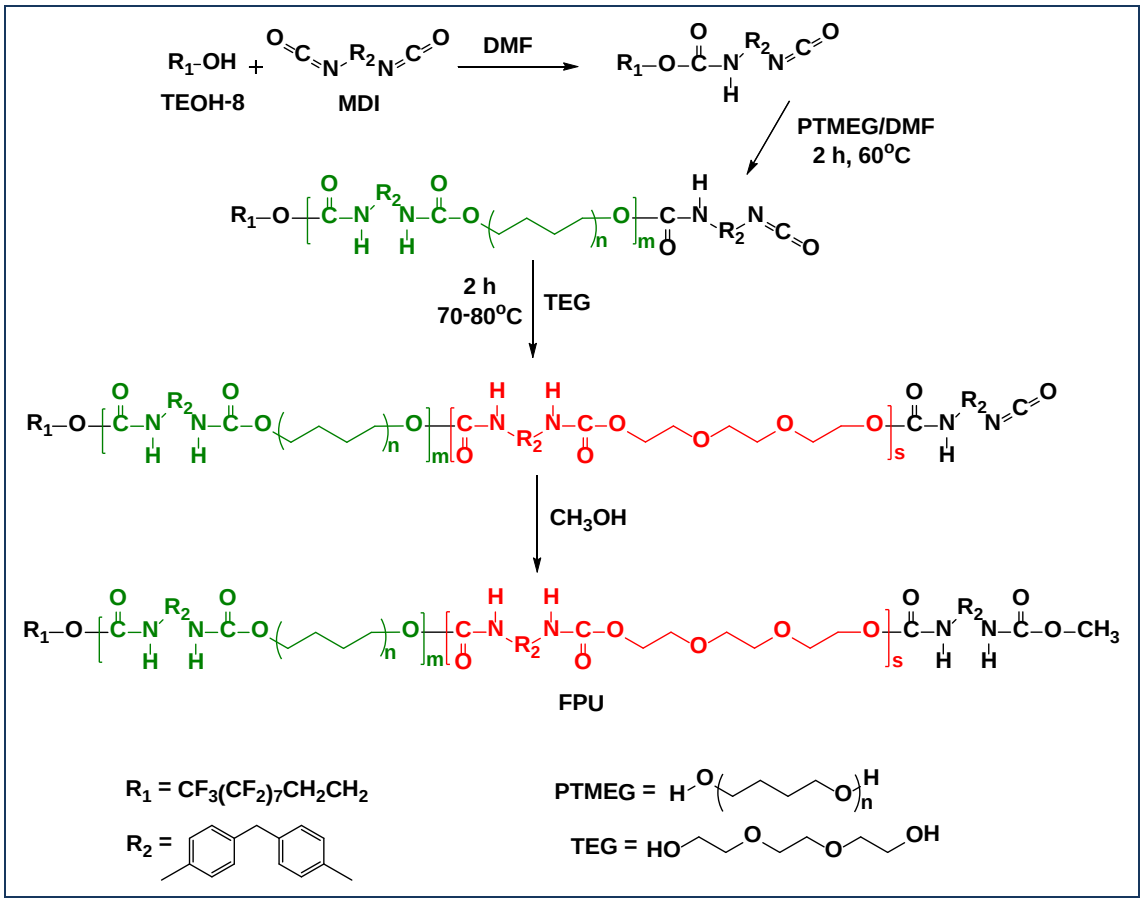


Fig. S1 Chemical synthetic and polymerization routes of FPU.

^{1}H nuclear magnetic resonance (NMR) spectroscopic analysis

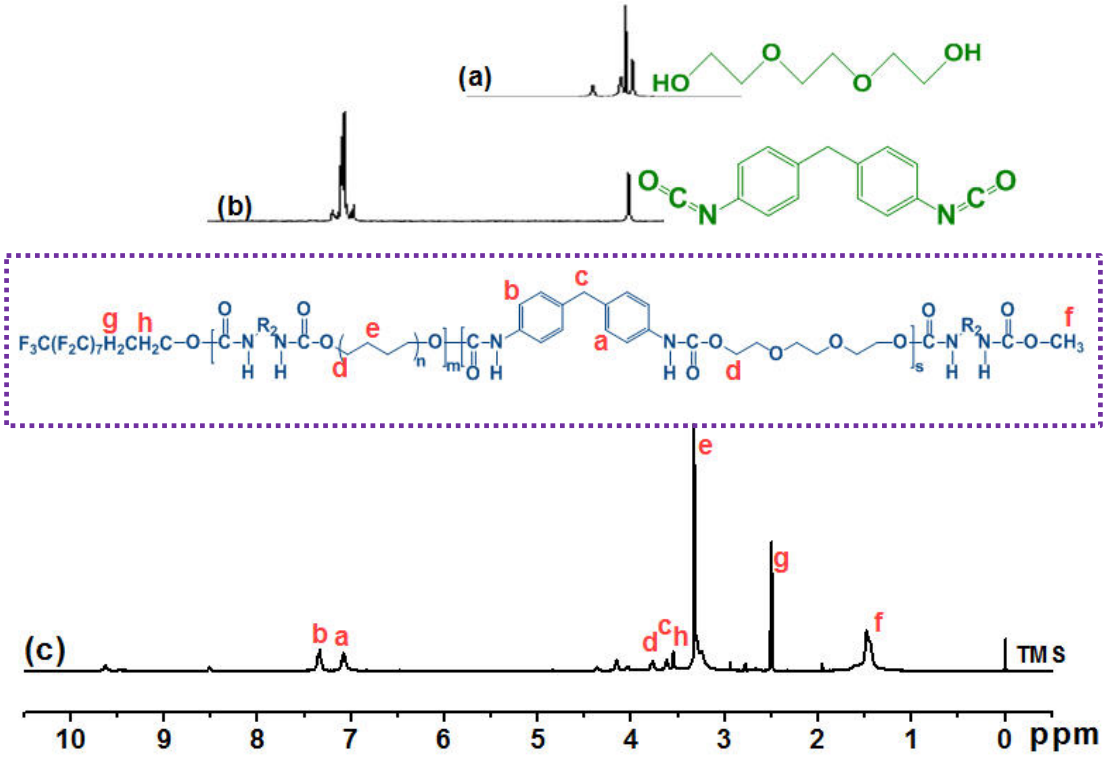


Fig. S2 ^{1}H NMR spectrograph of (a) TEG, (b) MDI and (c) FPU.

The as-synthesized FPU after purification and crystallization was subjected to nuclear magnetic resonance (NMR) spectroscopic analysis. Figure S1 illustrates the ^{1}H NMR spectrum of FPU. For pure TEG, the chemical shifts for -CH_2- and −OH appeared between 3.60 to 3.72 ppm and around 4.01 ppm, respectively. In case of pure MDI the signals for aromatic protons appeared between 6.90 to 7.16 ppm and for -CH_2- appeared at 3.89 ppm (Fig. S2a and b). For FPU, the chemical shift for terminal -CH_3, -CF_2-CH_2- and -CH_2-CH_2-O appeared at 1.45, 2.53 and 3.52 ppm, respectively. The aromatic protons of the MDI in FPU have given their chemical shift between 7.13 to 7.48 ppm. Comparing to the ^{1}H NMR of TEG the protons of O-CH_2-CH_2-O

have given their signal at 3.78 ppm, and protons of PTMEG have given a sharp signal at 3.34 ppm.

^{19}F NMR spectroscopic analysis

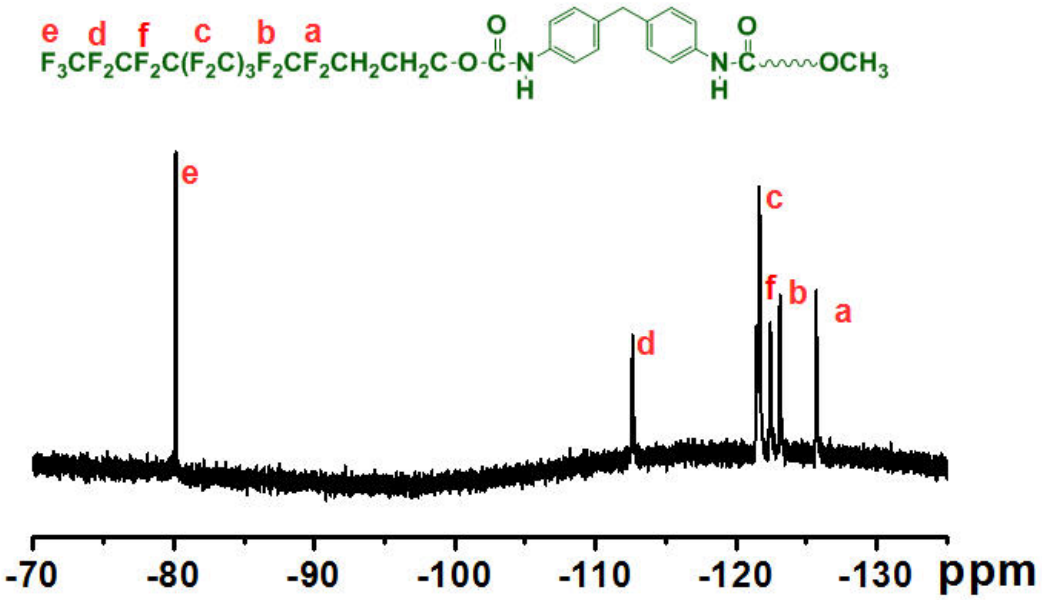


Fig. S3 ^{19}F NMR spectrograph of FPU.

^{19}F NMR has given further structural affirmation of FPU (Fig. S3). The chemical shift for terminal -CF_3 appeared at 80.13 ppm, while for -CF_2-CH_2- appeared at 125.67 ppm. The remaining -CF_2- has given their chemical shift between 112.61 to 123.10 ppm. Acquisition of quantitative results from NMR analysis has confirmed the chemical structure of FPU.

Functional group affirmation of FPU by FT-IR spectroscopy analysis

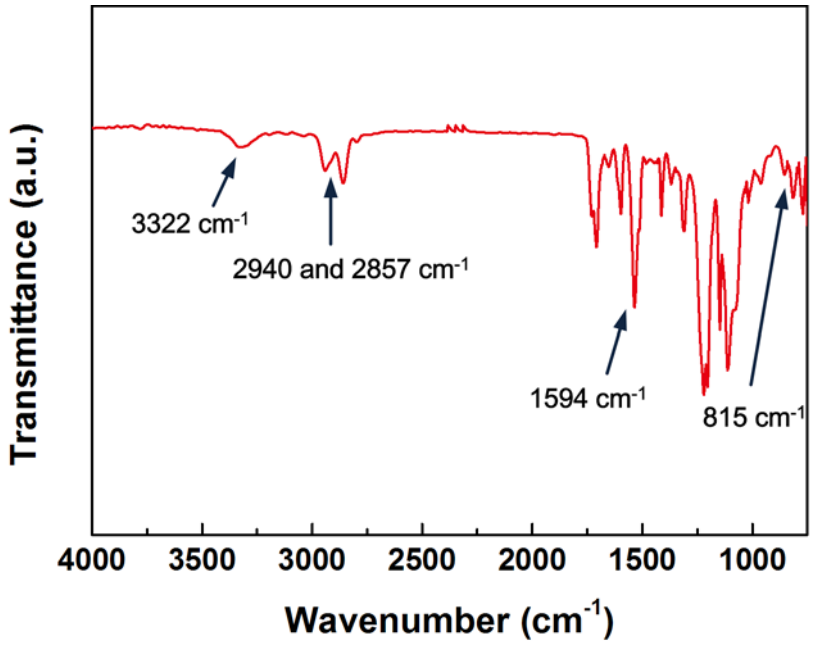
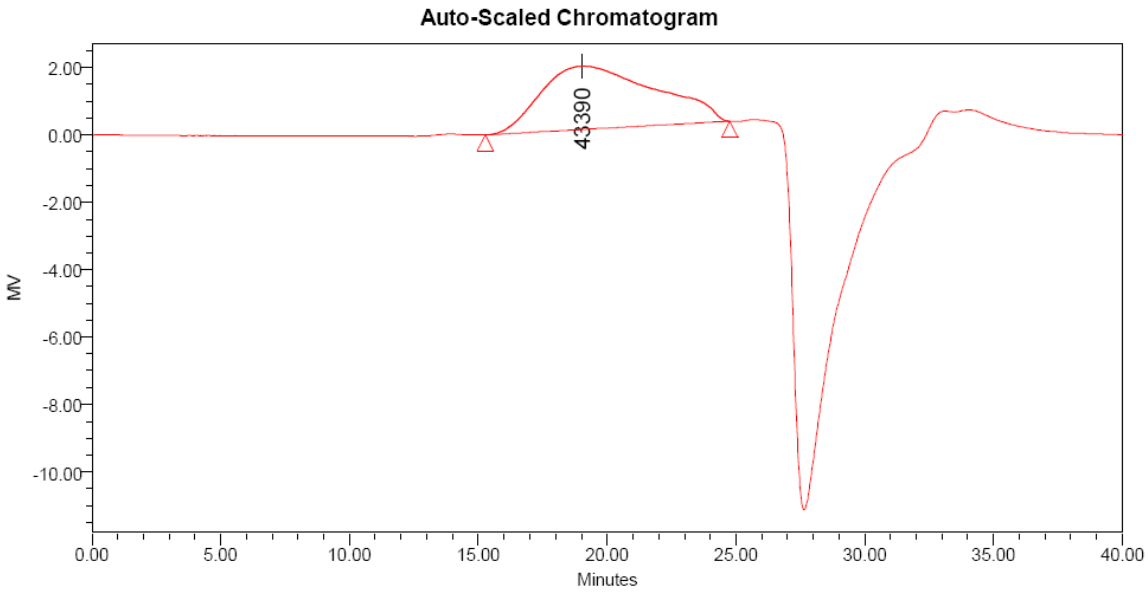


Fig. S4 FT-IR spectrum of FPU.

Fig. S4 shows the comparative FT-IR spectrum of FPU. The typical absorption features for carbamate group were found at 3322 cm^{-1} (-N-H), 1708 cm^{-1} (C=O), and 1112 cm^{-1} (C-O-C), respectively. The $-CH_2-$ specific for PTMEG has given their absorption band around 2940 and 2857 cm^{-1}. The stretching vibrations for aromatic ring of MDI and terminal CF_3 and deformation vibration for $-CF_2-$ appeared at 1594 and 815 cm^{-1}, respectively.



GPC Results

	Dist Name	Mn	Mw	MP	Mz	Mz+1	Mv	Polydispersity	MW Marker 1	MW Marker 2
1		22712	38904	43390	57336	73234		1.712917		

Fig. S5 GPC curve of as-synthesized FPU and relevant molecular weight and distribution results.

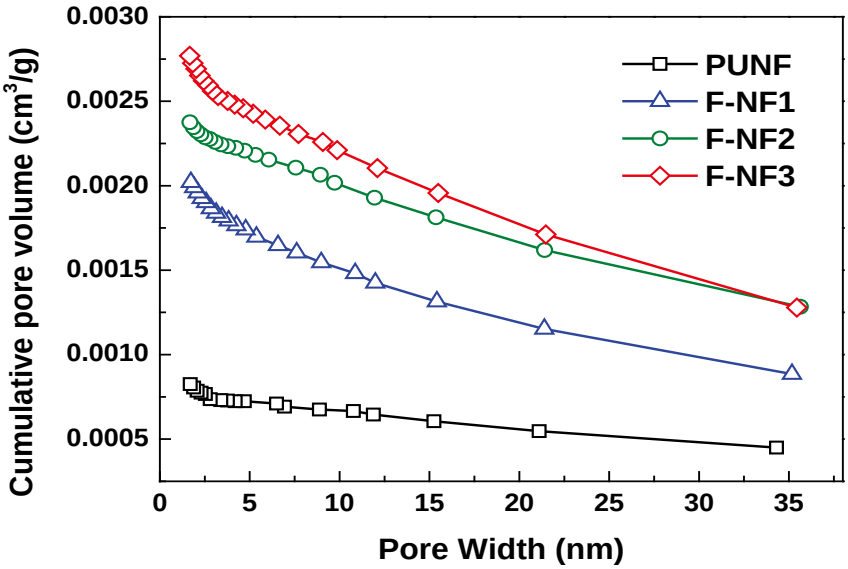


Fig. S6 The BJH desorption cumulative pore volume curves of relevant PUNF, F-NF1, F-NF2 and F-NF3 membranes.