Figure S1 Schematic diagram of preparation of PP-QPDMAEMA-PMPC 5 μm.
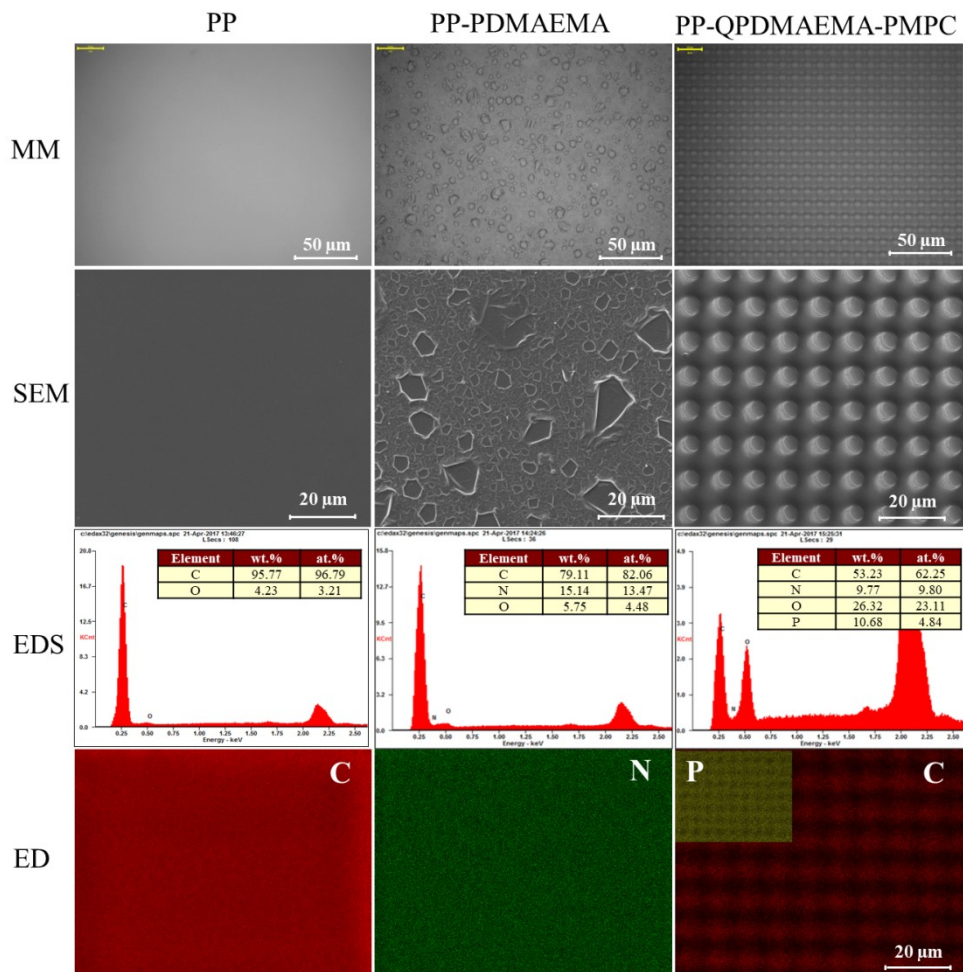
Figure S2 MM images, SEM images, SEM-EDS spectra and ED (element distribution) of the PP, PP-PDMAEMA and PP-QPDMAEMA-PMPC 5 μm samples.

As shown in Figure S2, the PP film has a smooth surface and mainly contains C element (red). Compared with the PP, the surface coating of PP-PDMAEMA was obvious, and the characteristic element N of PDMAEMA molecule was evenly distributed on the surface (green). On the surface of PP-QPDMAEMA-PMPC 5 μm, a regular and patterned distribution of PMPC characteristic element P was found, indicating that a 5 μm schematic microscopic pattern was successfully constructed on the surface.
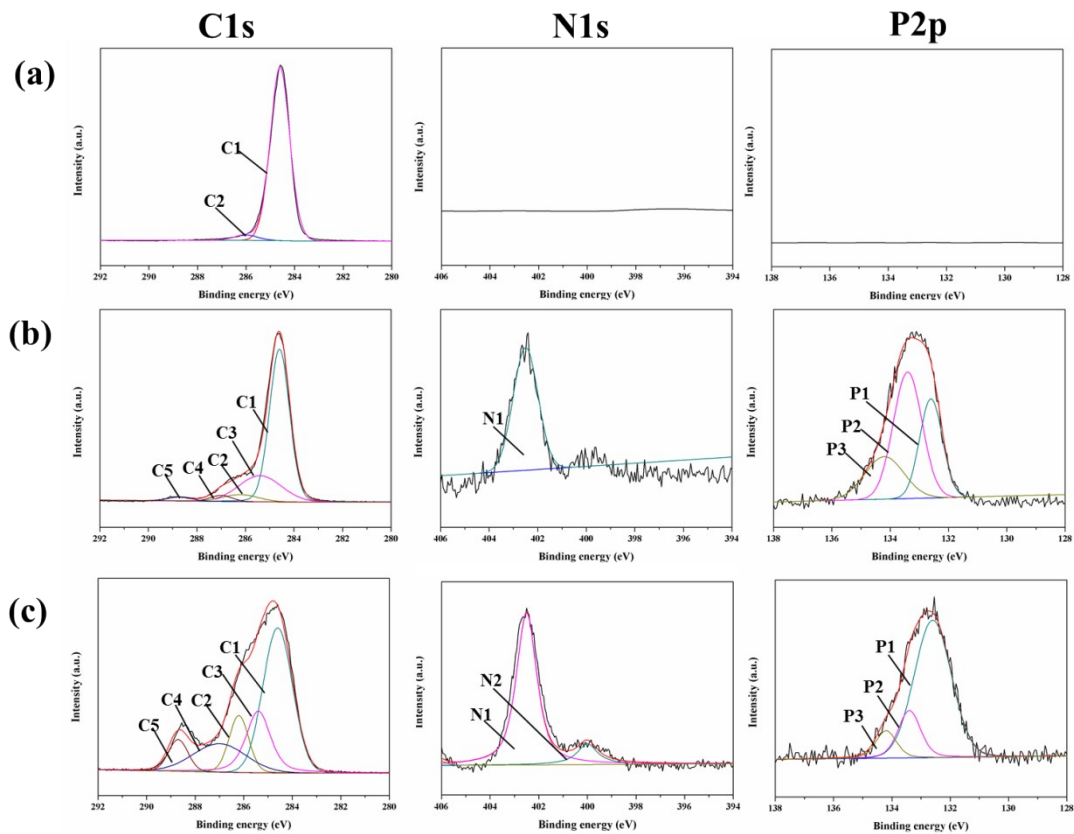
Figure S3 XPS core-level spectra of characteristic elements for (a) PP, (b) PP-PMPC and (c) PP-PMPC-QPDMAEMA 5 μm.

Split the peaks of C, N, and P in the XPS full spectrum of each sample, and obtain the XPS core-level spectra as shown in Figure 3S. The C1s spectrum of the pristine PP contains a large amount of C-C/C-H (284.6 eV) (C1 in Figure S3 (a)) and a small amount of C-O (286.2 eV) (C2 in Figure S3 (a)). The PP-PMPC sample (Figure S3 (b)) has obvious peaks at 284.6 eV (C1), 286.2 eV (C2), 285.4 eV (C3), 287.0 eV (C4), 288.7 eV (C5), of which 284.6 eV corresponds to C-C/C-H, and 286.2 eV corresponds to C-O. And 285.4 eV, 287.0 eV, 288.7 eV correspond to C-N, C=O and O-C=O in the MPC molecule, respectively. The N1s spectrum shows a clear peak at 402.5 eV (N1), which corresponds to the C-N$^+$ in the MPC molecule. The P2p spectrum has obvious characteristic peaks at 132.6 eV (P1), 133.4 eV (P2), and 134.2

eV (P3), which correspond to P=O, P-O and O-P-O in the MPC molecule, respectively. The above results fully indicate that the PMPC molecular layer was successfully grafted on the surface of PP. The peak intensities of PP-PMPC-QPDMAEMA sample (Figure S3(c)) at 285.4 eV, 286.2 eV, 287.0 eV and 288.7 eV in the C1s spectrum increased significantly, because QPDMAEMA also contains the corresponding C-N, C-O, C= O and O-C=O. In addition, the N1s of PP-PMPC-QPDMAEMA not only retains the C-N^+ at 402.5 eV, but also has a relatively small peak at 400.0 eV, which is attributed to the C-N in PDMAEMA. This is because when PDMAEMA is quaternized, the degree of quaternization cannot be guaranteed to be 100%, so the surface layer of the sample still contains a small amount of unquaternized C-N.
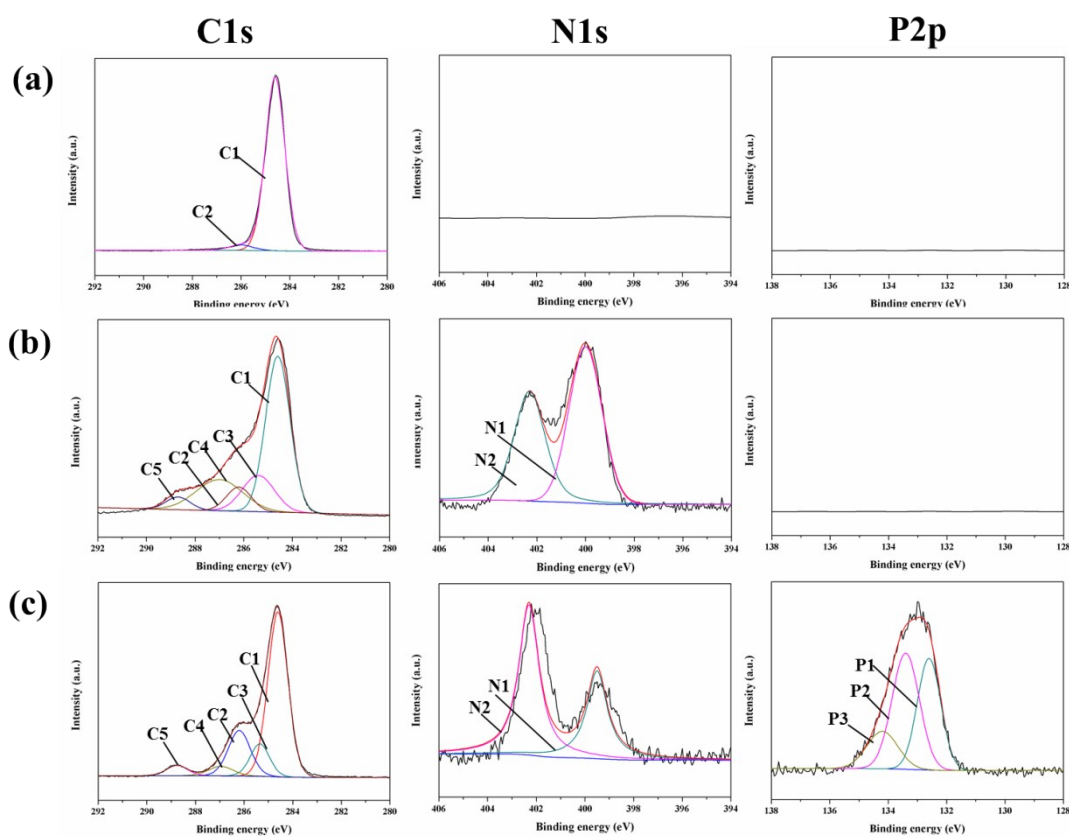
Figure S4 XPS core-level spectra of characteristic elements for (a) PP, (b) PP-PDMAEMA and (c) PP-QPDMAEMA-PMPC 5 μm.

The C, N, and P peaks in the XPS full spectrum of the PP-QPDMAEMA-PMPC 5 μm sample are split, and the resulting XPS single spectrum is shown in Figure S5. The C1s spectrum of the pristine PP contains a large amount of C-C/C-H (284.6 eV) (C1 in Figure S5(a)) and a small amount of C-O (286.2 eV) (C2 in Figure S5(a)). The C1s spectrum of the PP-PDMAEMA sample showed obvious peaks at 284.6 eV (C1), 286.2 eV (C2), 285.4 eV (C3), 287.0 eV (C4), 288.7 eV (C5), of which 284.6 eV corresponds to for C-C/C-H, 286.2 eV corresponds to C-O, while 285.4 eV, 287.0 eV, and 288.7 eV correspond to C-N, C=O, and O-C=O in the DMAEMA molecule, respectively. For the N1s spectrum, an obvious peak appears at 400.0 eV, which corresponds to the C-N in the DMAEMA molecule. The C1s spectrum of the PP-QPDMAEMA-PMPC sample still shows peaks at 286.2 eV, 287.0 eV and 288.7 eV, because PMPC also contains the corresponding C-O, C=O and O-C=O. The P2p spectrum has obvious characteristic peaks at 132.6 eV (P1), 133.4 eV (P2), and 134.2 eV (P3), which correspond to P=O, P-O and O-P-O in the MPC molecule, respectively. In addition, the N1s of the PP-QPDMAEMA-PMPC sample showed an obvious peak at 402.5 eV (N2), which corresponds to the C-N$^+$ in the MPC molecule, and there was also a relatively small peak at 400.0 eV, which was attributed to the C-N in PDMAEMA. The above results indicate that the PP-QPDMAEMA-PMPC 5 μm bifunctional patterned microstructure was successfully grafted onto the PP surface.
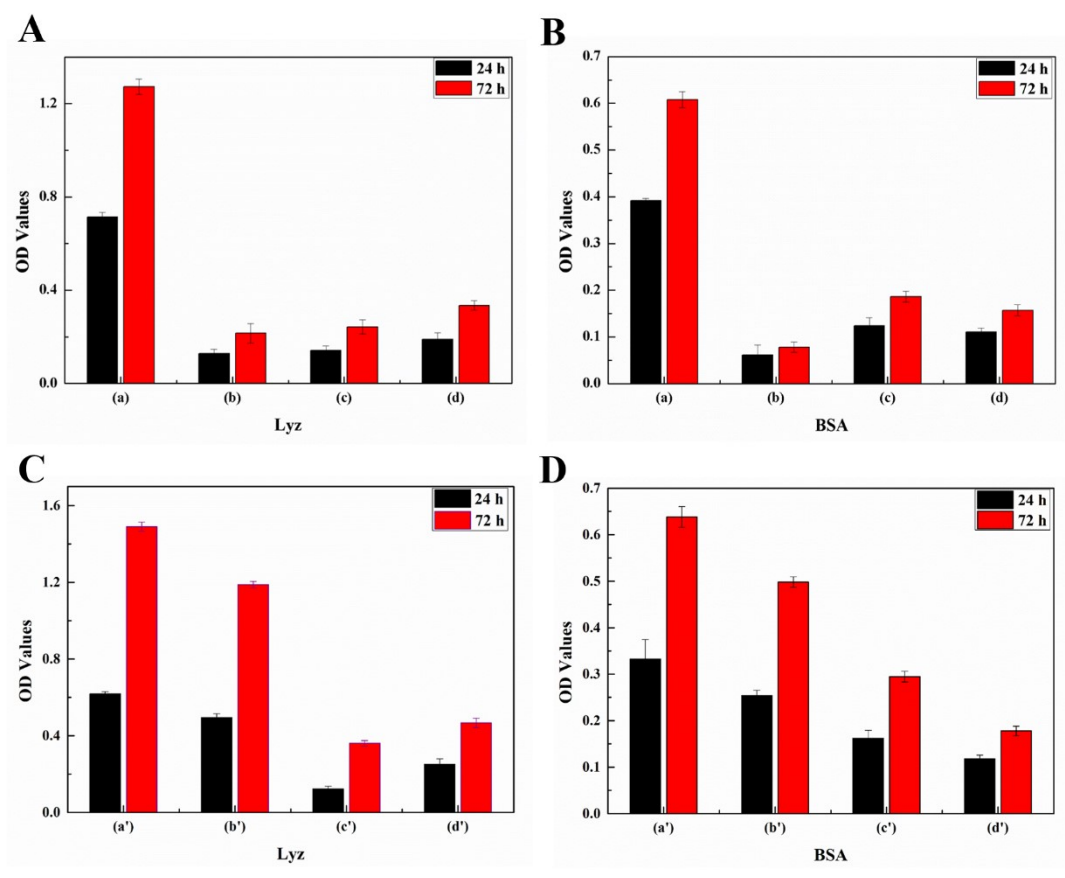
Figure S5 OD values of protein adsorption of Lyz (A, C) and BSA (B, D) on different PP samples after 24 h and 72 h. (a) PP, (b) PP-PMPC, (c) PP-PMPC-QPDMAEMA 5 μm, (d) PP-PMPC-PDMAEMA 5 μm. (a') PP, (b') PP-PDMAEMA, (c') PP-QPDMAEMA-PMPC 5 μm, (d') PP-PDMAEMA-PMPC 5 μm. Each data point stand for the mean and standard deviation of three parallel samples.
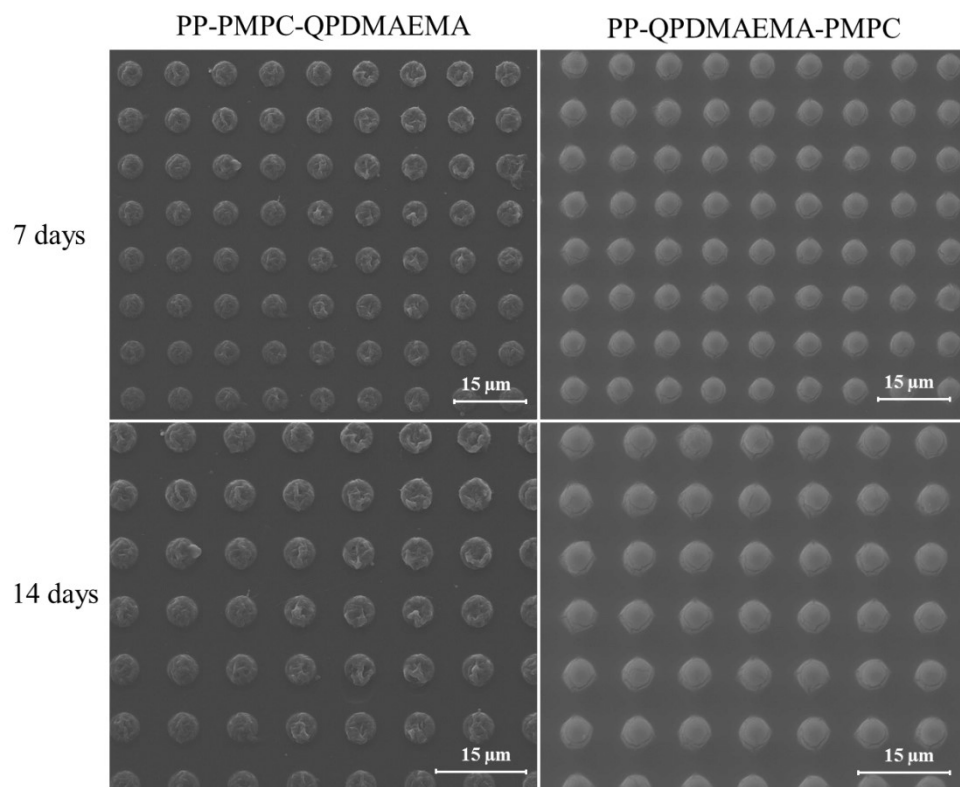
Figure S6 SEM images of PP-PMPC-QPDMAEMA 5 μm and PP-QPDMAEMA-PMPC 5 μm soaked in PBS at 37°C for different times.
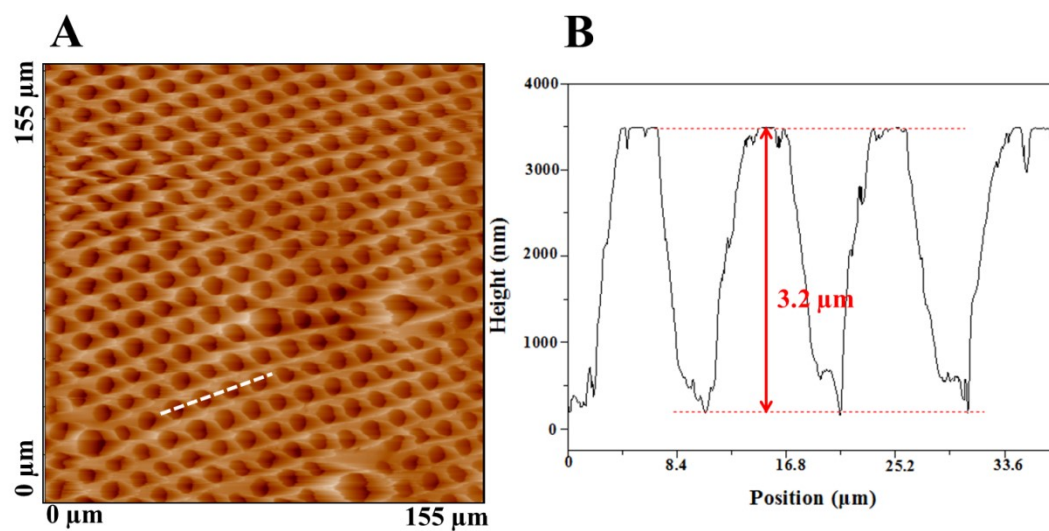

Figure S7 AFM image (A) and the corresponding height profile (B) of PP-PMPC-QPDMAEMA 5 μm.