Supporting Information

Development of Environmentally Friendly Biocidal Coatings Based on Water-soluble Copolymers for Air-cleaning Filters

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**S1. Experimental**

![Graph showing growth curves of different bacterial strains](image)

**Figure S1.** Growth curves of *S. aureus* (blue), *E. coli MC1061* (pink), *E. coli 9001* (yellow) and *P. aeruginosa* (purple) in LB medium. Cells were grown in 30 mL LB cultures at 80 rpm in 50 mL sterile tubes placed horizontally at 37 °C. Inoculi of 20 μL from overnight cultures at 37 °C were used.

**S2. Results and discussion**

As shown in **Figure S2A**, the peak at 1725 cm\(^{-1}\), corresponding to carbonyl group –C=O, is observed in the spectra of homopolymer PGMA and of copolymer P(SSNa-co-GMAx) as well. Similarly, the peak at 904 cm\(^{-1}\) which corresponds to the epoxy ring stretching vibration, PGMA and copolymer P(SSNa-co-GMAx) spectra, proving the successful copolymerization of the GMA monomer with SSNa. Moreover, the presence of the SSNa unit was confirmed by the peaks at 1037
and 1178 cm\(^{-1}\) which are related to the symmetric and asymmetric vibration absorption of SO\(_3^-\) group, respectively.

Additionally, in the \(^1\)H-NMR spectrum of Figure S2B, the presence of SSNa unit is clearly noticed from the aromatic protons (3, 4) at 6.0–7.8 ppm. The protons (1, 2, a) of the copolymer’s backbone are seen at 1.1–2.1 ppm and the methyl protons of GMA (b) at 0.5 ppm, whereas the protons of the epoxide ring are not shown in the spectrum. This behavior was observed in a previous work\(^1\), where a detailed study on the determination of the GMA content in a series of P(SSNa-co-GMAx) copolymers was carried out. More specifically, it was shown that in some cases the peaks of epoxide in the copolymers with GMA content lower than 30% were not clearly seen in \(^1\)H-NMR spectra, probably due to the low solubility of the hydrophobic GMA unit in the deuterated solvent (D\(_2\)O). Thus, thermogravimetric analysis (TGA) was also applied in order to determine copolymers’ chemical composition, where GMA content was calculated by the weight loss of the copolymers at 500 °C. The results indicated that the calculated content of GMA by TGA analysis was in good agreement with the calculated content by \(^1\)H-NMR using the peak of methyl protons (0.5 ppm). Having this in mind, similarly in this study the content of GMA unit was calculated 20%mol using the peaks of aromatic protons (SSNa) at 6.0–7.8 ppm and the methyl protons (GMA) at 0.5 ppm.
Figure S2. A) ATR-FTIR spectra of the homopolymers PGMA, PSSNa and the copolymer P(SSNa-co-GMA20), and B) $^1$H-NMR spectrum of the synthesized copolymer P(SSNa-co-GMA20) in DMSO-d$_6$.

From the $^1$H-NMR spectrum of Figure S3, we were able to verify the structure of the resulting homopolymer PDMAEMA. Specifically, protons of the methyl group (b) appear at 0.8-1.2 ppm, while protons of the two methyl groups connected to the nitrogen atom (e) are shown at 2.2 ppm. Additionally, the methylene protons (c, d) correspond to the peaks at 4.1 and 2.7 ppm respectively.
Figure S3. $^1$H-NMR spectroscopy of the synthesized PDMAEMA in D$_2$O.

Finally, the obtained terpolymer was characterized by $^1$H-NMR spectroscopy in D$_2$O (Figure S4). More specifically, the protons of the three methyl groups (5) attached to the nitrogen atom corresponded to the peak at 2.7 ppm, while the final methyl group of the cetyl chain (9) appeared at 0.9 ppm. Likewise, the protons of the N-linked methylene group (6) and the next methylene group (7) appeared at 3.4 and 1.7 ppm respectively, while the other -CH$_2$- methylene groups of the aliphatic chain (8) were displayed at the region 1.0-1.6 ppm. From the integrals of the aromatic protons (3,3’ and 4,4’) and the methyl protons (5), the degree of the modification was calculated to be in good agreement with the feed composition (molar ratio of SSAmC$_{16}$: 56 %mol).
**Figure S4.** $^1$H-NMR spectroscopy of the synthesized terpolymer P(SSNax-co-SSAmC$_{16}$y-co-GMAz) in D$_2$O.

**References**

(1) Tzoumani, I.; Lainioti, G. C.; Aletras, A. J.; Zainescu, G.; Stefan, S.; Meghea, A.; Kallitsis, J. K. Modification of Collagen Derivatives with Water-Soluble Polymers for the Development of Cross-Linked Hydrogels for Controlled Release, *Materials*, 2019, 12(24), 4067. DOI: 10.3390/ma12244067.