

Electronic Supplementary Information

Antimicrobial organic-inorganic composite membranes including sepiolite-supported nanometals

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Fig. S1. TEM micrographs of sepiolites loaded with silver (A: SpAg), silver-copper (B: SpAgCu) and copper (C: SpCu).

Fig. S2. Representative SEM images of composites membranes. Upper view of M(11) (SpAgCu@PSU-PVP-5, A) and cross-sectional SEM micrographs of M(3) (PSU-PVP-5, B), M(7) (SpAg@PSU-PVP-5, C) and M(11) (SpAgCu@PSU-PVP-5, D).

Fig. S3. SEM-EDS micrographs of metal-loaded membranes. A: SpAg- 5@PSU (Ag yellow), B: SpAg@PSU-PVP-5 (Ag yellow); C: SpAgCu@PSU-PVP-5 (Ag yellow, Cu pink) D: SpCu@PSU-PVP-5 (Cu pink).

Fig. S4. Membrane porosity and surface ζ -potential for all tested specimens.

Fig. S5. ATR-FTIR spectra of PSU, PSU-PVP and irradiated membranes.

Fig. S6. XRD spectra of SpAgCu@PSU-PVP-5, SpAg@PSU-PVP-5, SpCu@PSU-PVP-5 and PSU-PVP-5 membranes, and metal loaded sepiolites SpAg, SpCu and SpAgCu.

Table S1. Rate constants for CFU decay in cultures in contact with different membranes during first and second use (inoculum: 10^6 cell/mL).

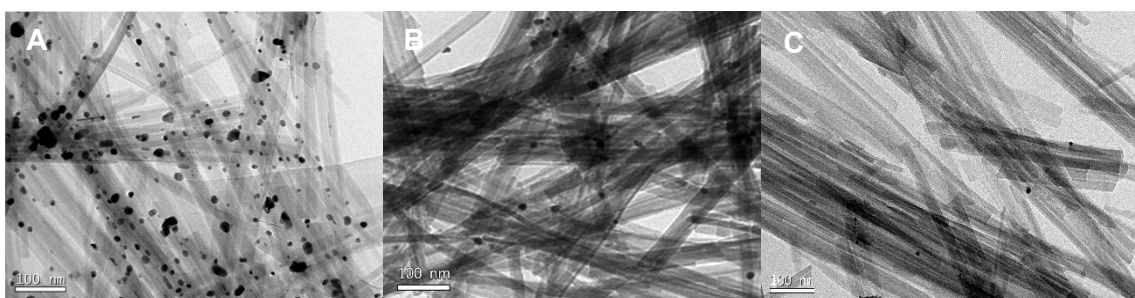


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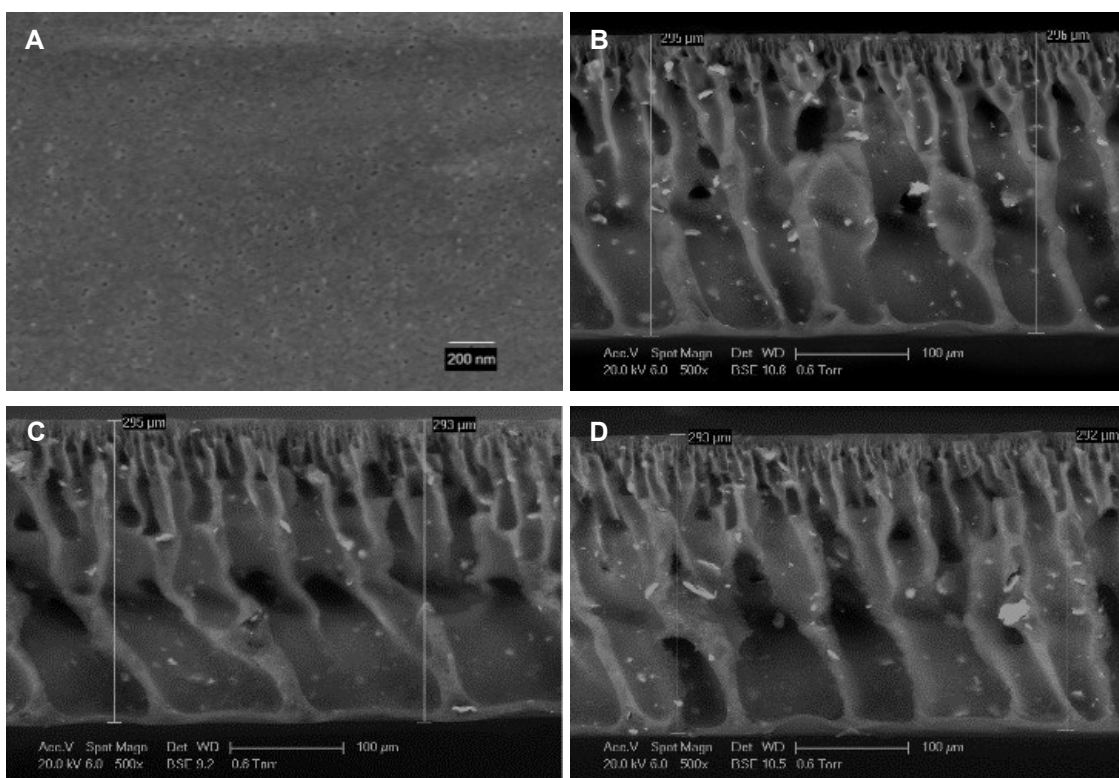


Fig. S2. Representative SEM images of composite membranes. Upper view of M(11) (SpAgCu@PSU-PVP-5, A) and cross-sectional SEM micrographs of M(3) (PSU-PVP-5, B), M(7) (SpAg@PSU-PVP-5, C) and M(11) (SpAgCu@PSU-PVP-5, D).

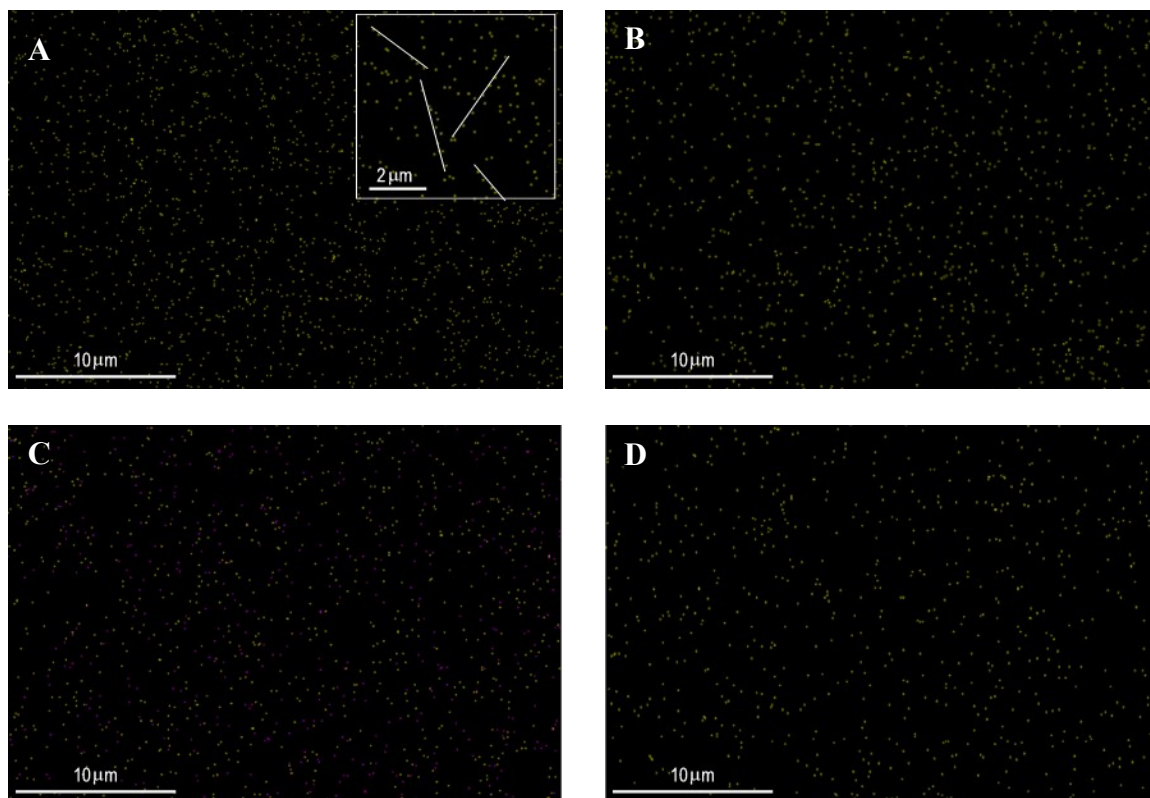


Fig. S3. SEM-EDS micrographs of metal-loaded membranes. A: SpAg-5@PSU (Ag yellow), B: SpAg@PSU-PVP-5 (Ag yellow); C: SpAgCu@PSU-PVP-5 (Ag yellow, Cu pink) D: SpCu@PSU-PVP-5 (Cu yellow). The inset in Fig S2-A highlights the alignment of spots.

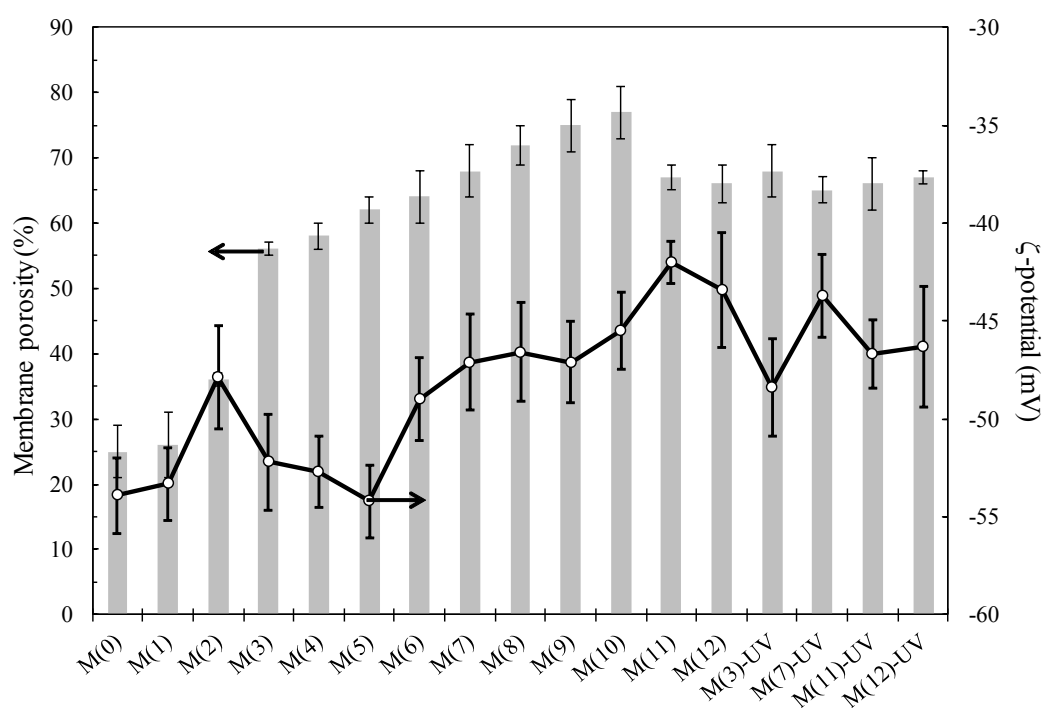


Fig. S4. Membrane porosity and surface ζ -potential for all tested specimens.

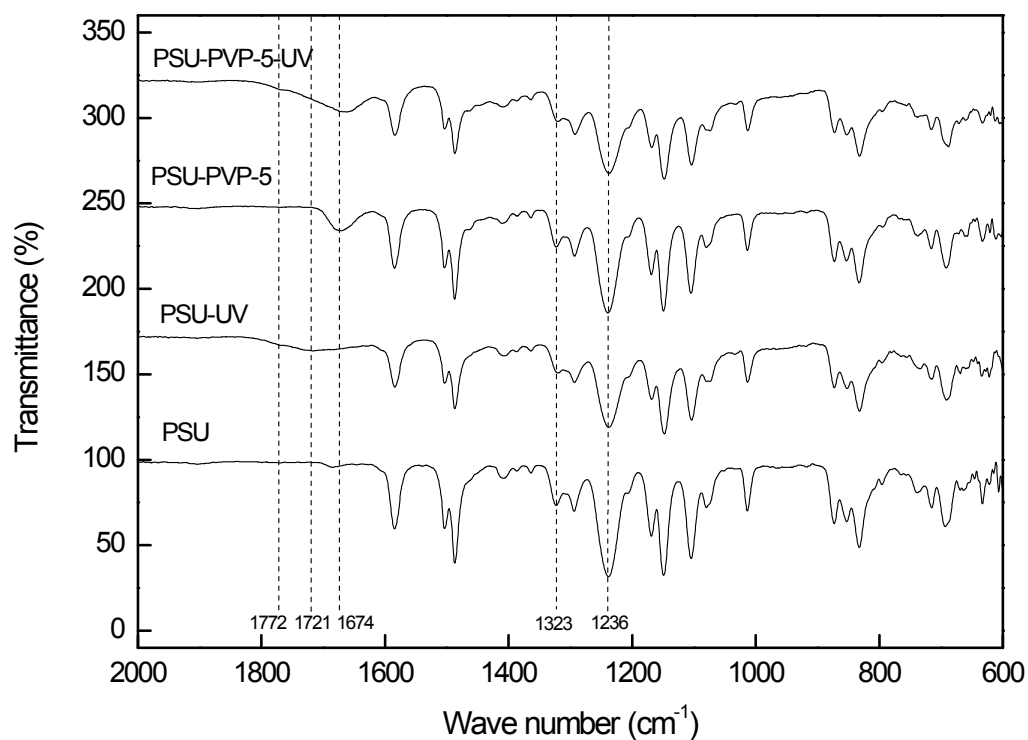


Fig. S5. ATR-FTIR spectra of PSU, PSU-PVP and irradiated membranes.

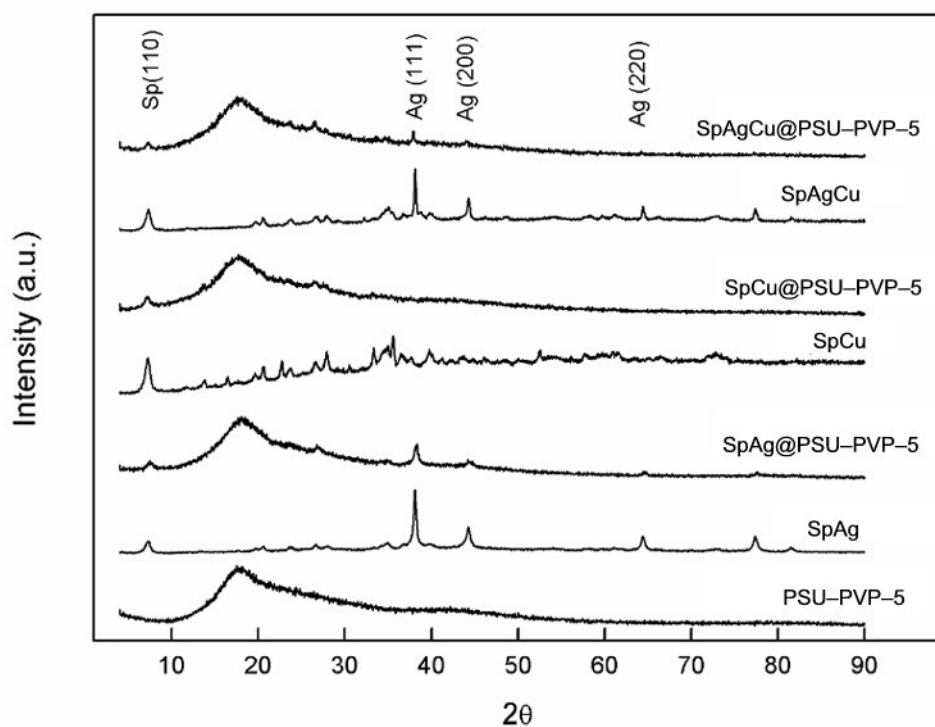


Fig. S6. XRD spectra of SpAgCu@PSU-PVP-5, SpAg@PSU-PVP-5, SpCu@PSU-PVP-5 and PSU-PVP-5 membranes, and metal loaded sepiolites SpAg, SpCu and SpAgCu.

Table S1. Rate constants for CFU decay in cultures in contact with different membranes during first and second use (inoculum: 10^6 cell/mL).

Membrane	Bacteria	Rate constant (h^{-1})	
		1st use	2nd use
M(7)	<i>E. coli</i>	5.4 ± 0.6	3.60 ± 0.39
SpAg@PSU-PVP-5	<i>S aureus</i>	1.4 ± 0.6	0.36 ± 0.12
M(11)	<i>E. coli</i>	3.5 ± 0.5	2.2 ± 0.1
SpAgCu@PSU-PVP-5	<i>S aureus</i>	0.52 ± 0.20	0.26 ± 0.08
M(12)	<i>E. coli</i>	2.43 ± 0.5	2.1 ± 0.1
SpCu@PSU-PVP-5	<i>S aureus</i>	0.88 ± 0.17	0.42 ± 0.26
M(7)-UV	<i>E. coli</i>	6.3 ± 0.2	2.4 ± 0.2
SpAg@PSU-PVP-5	<i>S aureus</i>	1.0 ± 0.1	0.08 ± 0.02
M(11)-UV	<i>E. coli</i>	6.9 ± 0.2	2.3 ± 0.1
SpAgCu@PSU-PVP-5	<i>S aureus</i>	1.1 ± 0.1	0.11 ± 0.03
M(12)-UV	<i>E. coli</i>	6.4 ± 0.3	2.5 ± 0.1
SpCu@PSU-PVP-5	<i>S aureus</i>	1.3 ± 0.1	0.13 ± 0.08