Bioinspired Antimicrobial Glass Coatings for Clear and Infection-Resistant Surfaces

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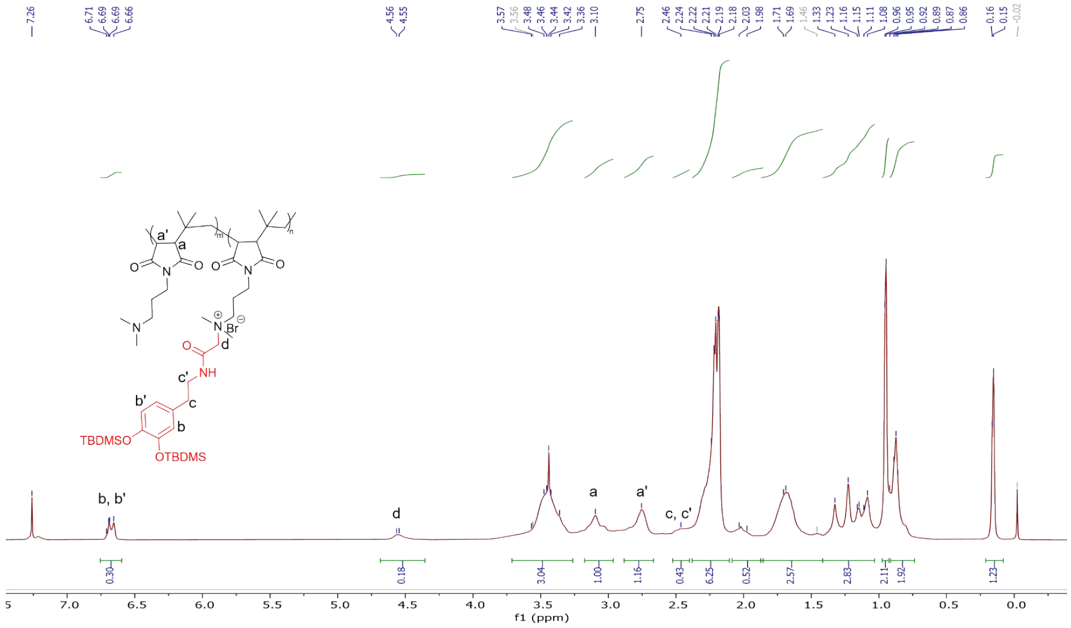
Antimicrobial activity of the polymers: Briefly, bacteria from the frozen stock (stored at -80 °C) were streaked over nutrient broth agar plates and incubated for 24 hours at 37 °C to promote bacterial growth. Consequently, for this experiment, bacteria were grown in nutrient broth for 6 hours to attain mid-log phase cells ($\sim 10^8$-10^9 CFU/mL). The cultures were then further diluted in minimum essential media (MEM) (for Gram-positive) and M9 (for Gram-negative) to obtain bacterial suspensions at $\sim 10^5$ CFU/mL. Stock solutions of DQP were prepared in autoclaved Millipore water. 20 µL of the solutions were then added to a 96-well plate, followed by the addition of 180 µL of previously prepared bacterial suspensions. After incubation for 24 hours at 37°C, O.D. was recorded at 600 nm by using a TECAN Spark® plate reader. The experiment was conducted at least twice, with each concentration being examined in triplicate. Visual turbidity was used to determine antibacterial activity (MIC).

Hemolytic activity of the polymers: The compounds were serially diluted by 2-fold in the 96-well plates in Millipore water. As the negative control, the same volume of water was placed instead of the compound, and as a positive control, the same volume of Triton X-100 (1 vol% solution in IX PBS) was placed. Freshly collected heparinized human blood was then centrifuged down, and plasma was discarded to collect the red blood cells. It was then suspended to 5 vol% in 1X PBS (pH = 7.4), and 150 µL of the suspension was added to 96-well plates containing 50 µL compound. After that, the plates were incubated at 37 °C for 1 h. In the end, the plates were centrifuged at 3500 rpm for 5 min and 100 µL of the supernatant was transferred to the new 96-well plates. The absorbance (OD) at 540 nm was then measured to determine the percentage of hemolysis. The following formula was used: $(A_t - A_{nt})/(A_{TX} - A_{nt})\times 100$, where A_t is the OD of the compound-treated wells, A_{nt} is the OD of the negative control, and A_{TX} is the OD of the Triton X-100-treated sample. Each concentration had triplicate values, and the average percentage of hemolysis was plotted with standard deviation for each concentration.

Activity of the coated surface after multiple challenges: The polymer-coated surfaces were placed in a 50 mL centrifuge tube containing 5 mL of MRSA (ATCC 33591) at $\sim 10^4$ CFU/mL and incubated for 24 h. The surfaces were then removed and placed in a fresh MRSA solution of the same concentration. This process was repeated 5 times. On days 1st, 3rd, and 5th, the surfaces were removed, gently tapped to remove excess bacterial solution, and incubated for 1h. Then it was dragged across agar plates and incubated at 37 °C for 18-24 h before imaging.

Zone of inhibition: 200 µL of $\sim 10^5$ CFU/mL MRSA (ATCC 33591) was spread over a nutrient agar plate. The polymer-coated glass surface was then placed on the inoculated plates and incubated at 37 °C for 18-24 h before imaging.

A. ^{1}H NMR of 3c



B. ^{1}H NMR of DQP_{Pr}

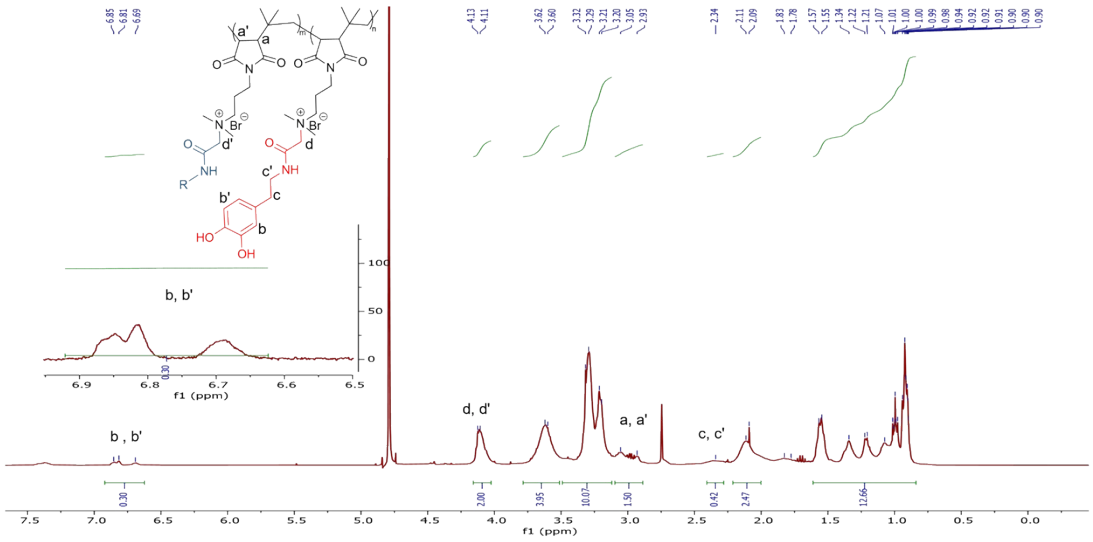


Figure S1: NMR spectra of (A) 3c and (B) DQP_{Pr}

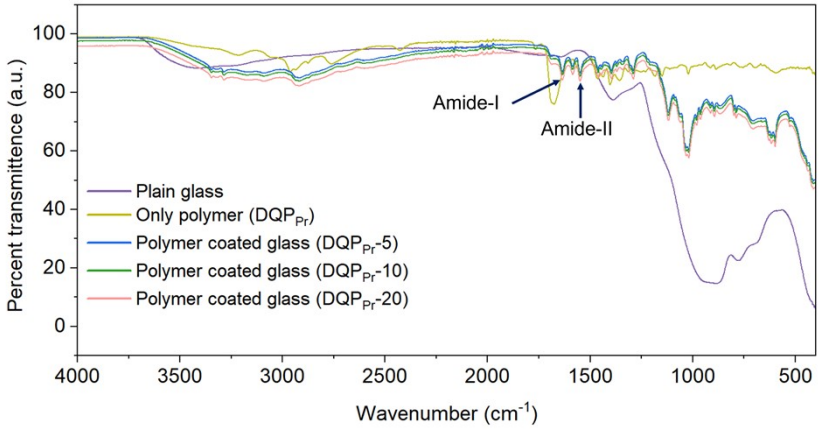


Figure S2: Infrared spectrum of plain glass, polymer (DQP_{Pr}), and polymer-coated glass ($GDQP_{Pr}$-5, $GDQP_{Pr}$-10, and $GDQP_{Pr}$-20)

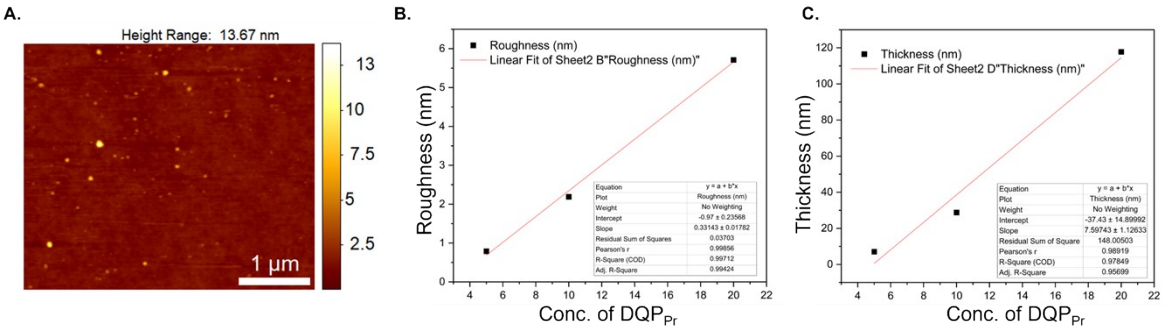


Figure S3: (A) Topography of uncoated glass substrates (roughness 0.20 nm); Coating concentration dependent variation of (B) roughness of the coated surfaces, and (C) thickness of the coating. The red line is a guide for the eye.

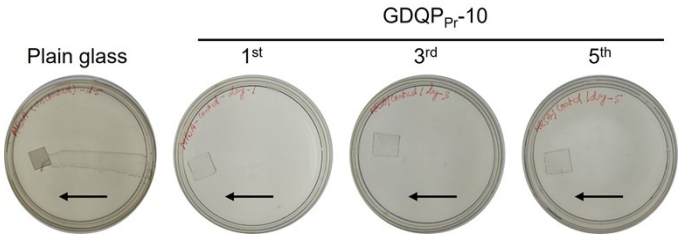


Figure S4: Antimicrobial activity after multiple challenges.

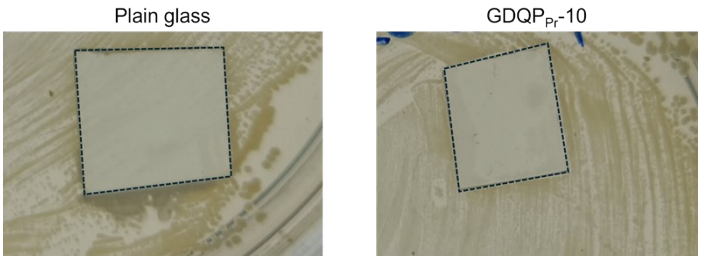


Figure S5: Digital picture of the zone of inhibition of the polymer-coated glass surface GDQP$_{Pr}$-10. The uncoated surface has been taken as control

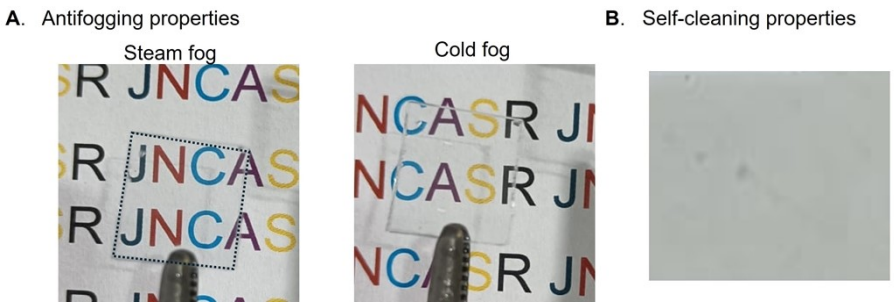


Figure S6: Digital image of (A) antifogging property; (B) self-cleaning properties of GDQP$_{Pr}$-10 after 10th wash.

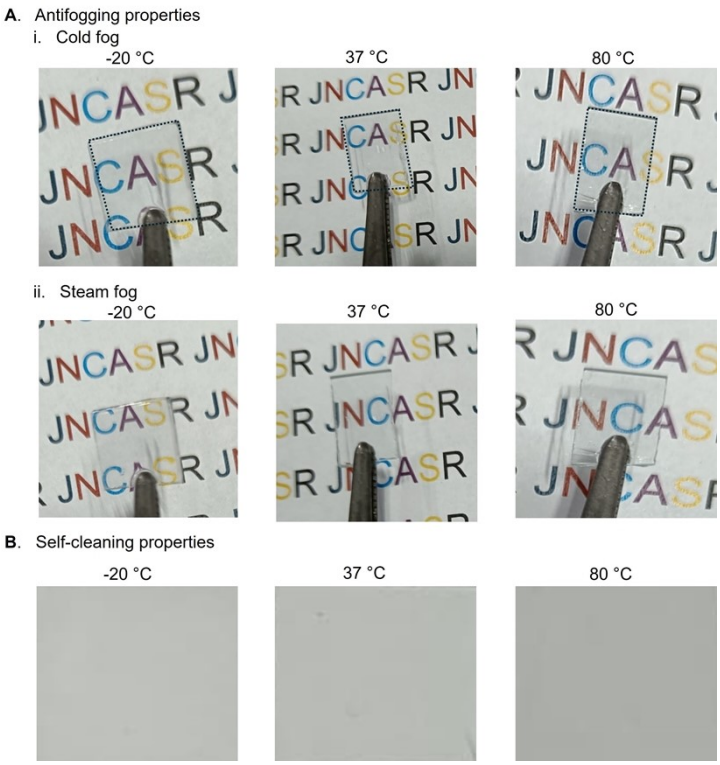


Figure S7: Digital image of (A) antifogging property; (B) self-cleaning properties of GDQP$_{Pr}$-10 surfaces after exposure to different temperatures: -20 °C, 37 °C, and 80 °C.