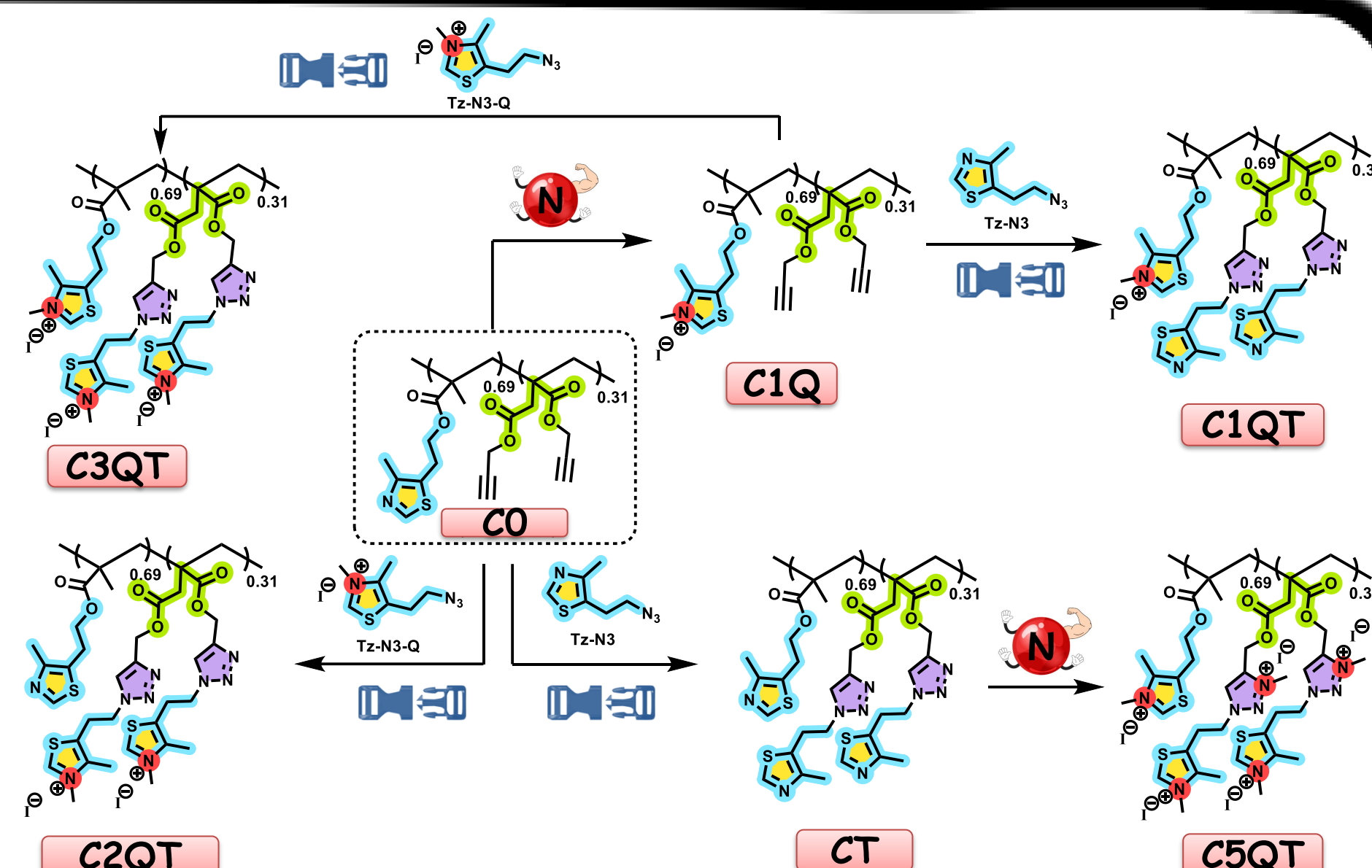
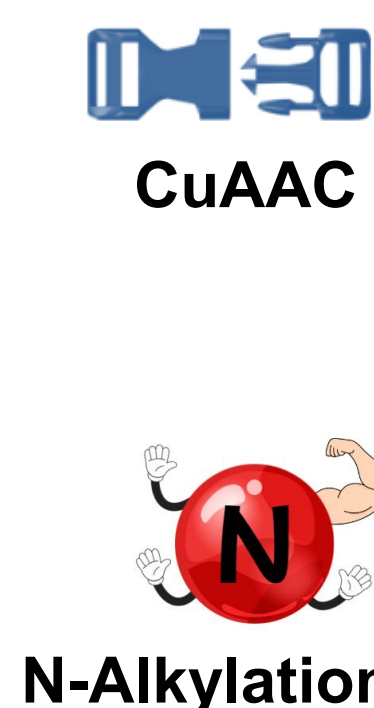
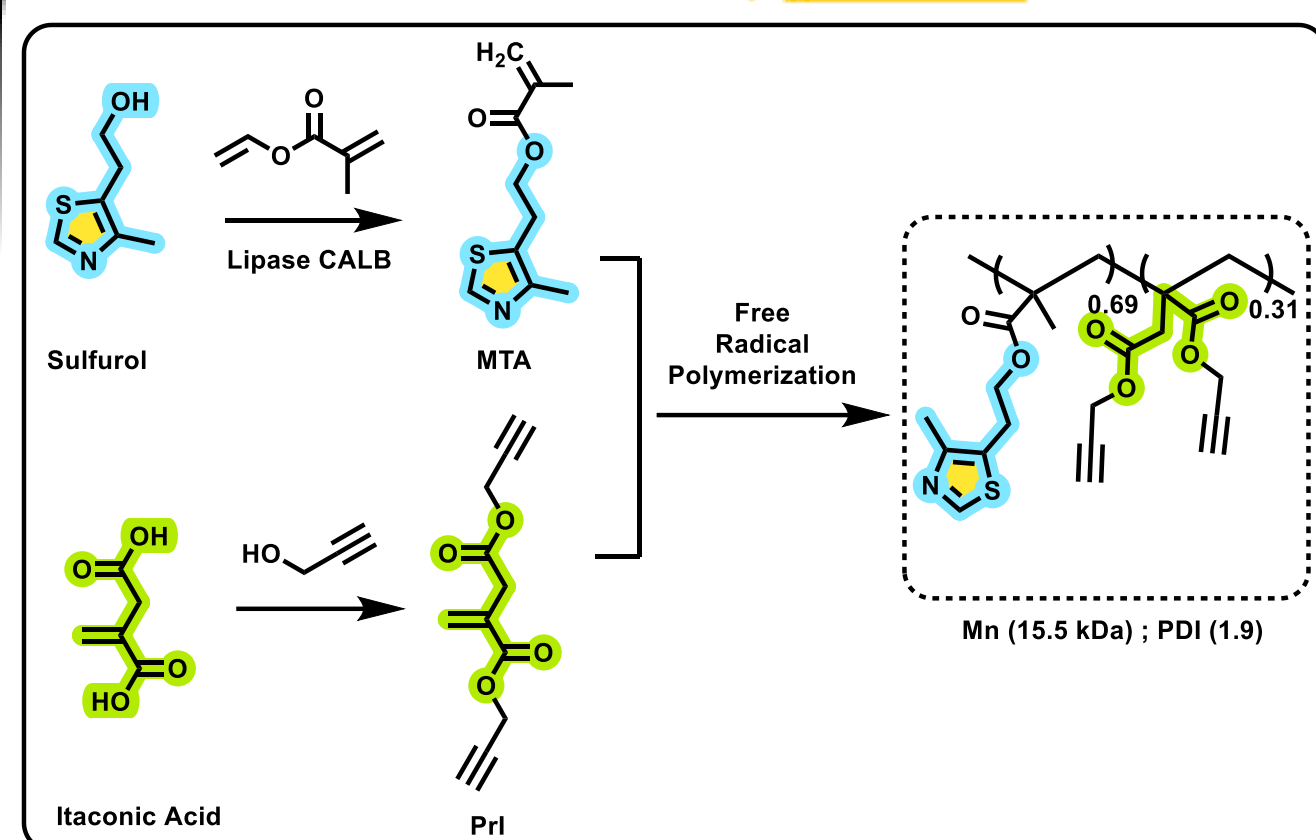


Bio-Based Copolymers with Tunable Cationic Charge Densities for Antimicrobial Applications

A. Funes-López, M. Fernández-García and A. Muñoz-Bonilla

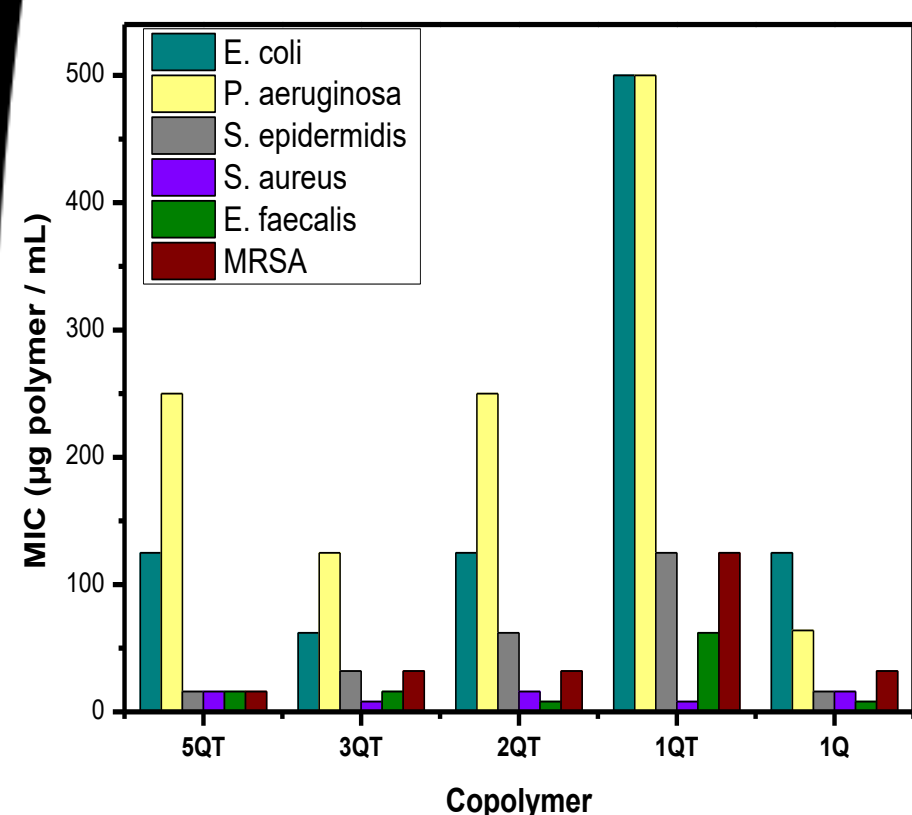
Instituto de Ciencia y Tecnología de Polímeros (ICTP-CSIC) C/Juan de la Cierva 3, 28006, Madrid.

Experimental Part



Antimicrobial assay

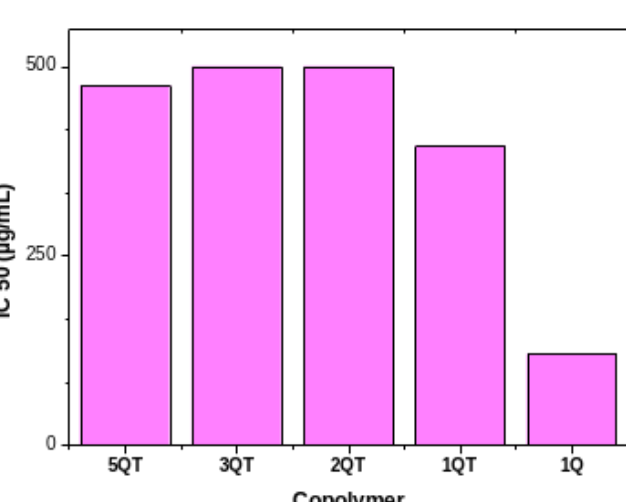
The evaluation was carried out using the Minimal Inhibitory Concentration test



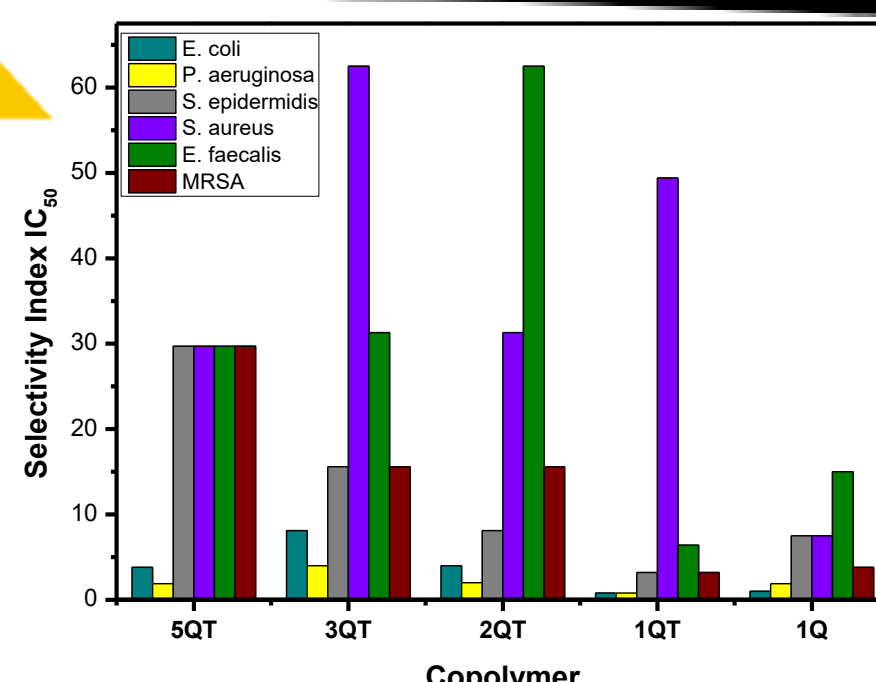
- Copolymers with lower surface charge (1QT and 2QT) exhibited reduced efficacy against bacteria
- Copolymers with higher surface charge density (1Q, 3QT, and 5QT) showed improved interaction with the bacterial membrane
- The 1Q copolymer, which contains a higher proportion of hydrophobic moieties (alkyne groups), demonstrated enhanced antibacterial efficiency

Cell viability assay

The cytotoxicity was evaluated in human dermal fibroblasts using the alamarBlue assay.

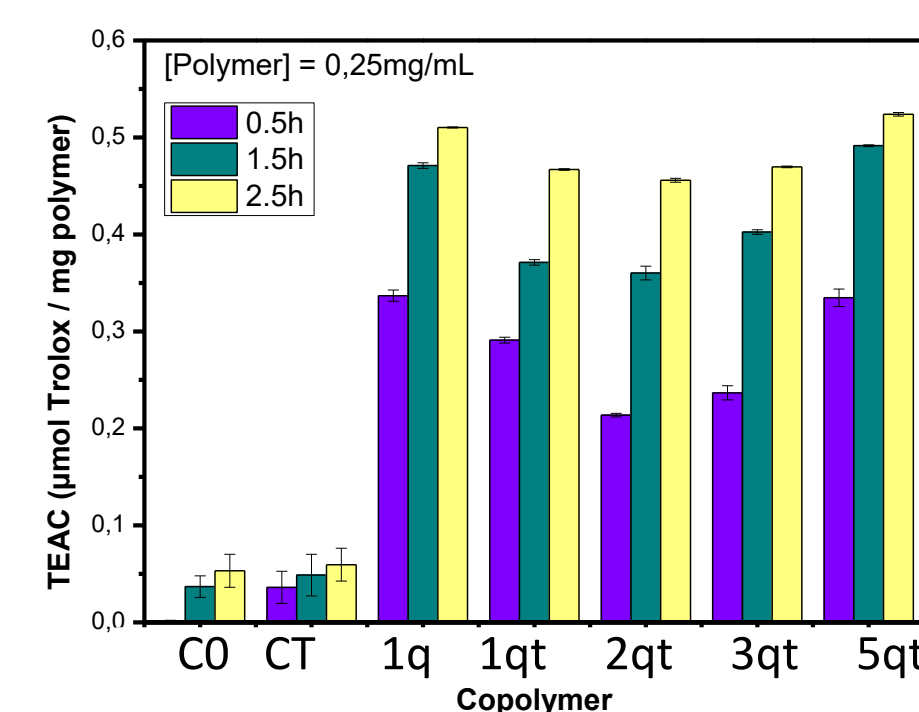


- Copolymers with higher charge density and higher hydrophobic content exhibit higher toxicity
- Balance between high surface charge and moderate hydrophobic groups allows high selectivity to bacterial



Antioxidant assay

The study was performed by the DPPH assay using Trolox as the reference standard to calculate the Equivalent Antioxidant Capacity (TEAC)



- The [copolymers] = 0.25 mg/mL, a condition under which no saturation was observed
- Copolymers containing thiazole and triazole units exhibited moderate antioxidant activity, which was notably improved by the introduction of positive charges
- The thiazolium ring significantly enhanced the antioxidant capacity compared to the triazolium ring

Conclusions

- A variety of biobased copolymers with different densities and arrangements of positive charges within the polymeric structure were synthesized
- The incorporation of positive charges into the copolymer structure significantly enhances their antioxidant capacity
- The copolymers exhibit low toxicity toward human dermal fibroblasts and show notable selectivity index values

References

- [1] Eur. Polym. J. 2023, 186, 111875
- [2] Polym. Chem., 2021, 12, 3190-3200;
- [3] Biol. Macromol., 2023, 233, 123470.

Acknowledgements

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