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Adsorption of tetrodotoxin by flexible shape-memory polymers synthesized from silica-stabilized Pickering high internal phase emulsion

Key words:

Tetrodotoxin; SiO_2; Imidazolium-modlified bromobutyl rubber; Pickering HIPEs; Adsorption

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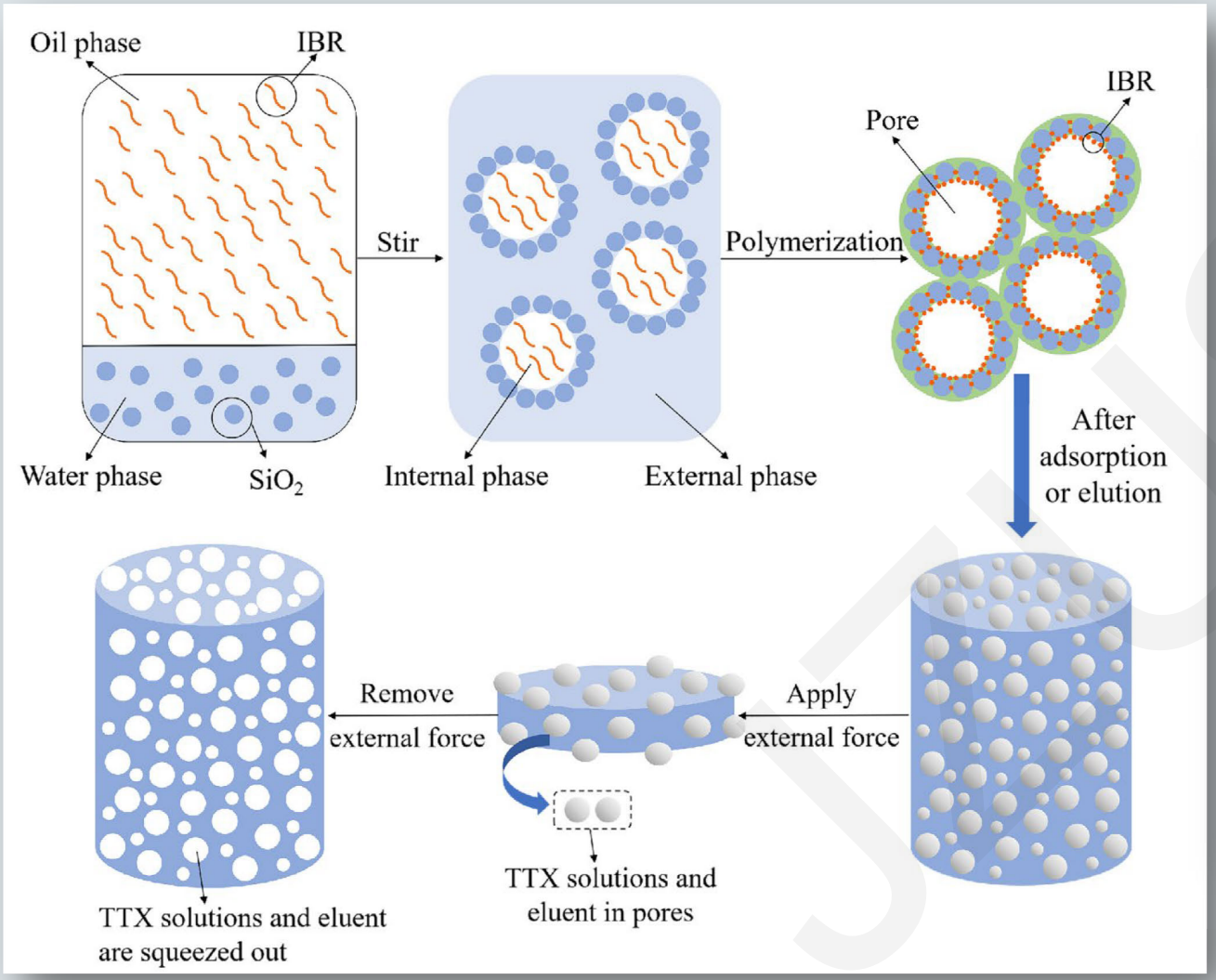
Innovation

- SiO_2 nanoparticles were used as stable particles of the emulsion and joined together by Pickering HIPEs polymerization, which made it convenient to collect the adsorbent after adsorption.

- The highly viscoelastic imidazolium-modlified bromobutyl rubber (IBR) was uniformly distributed on the gap and surface of the polymers, which resulted in polymers with good mechanical properties and shape-memory function.

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Methodology



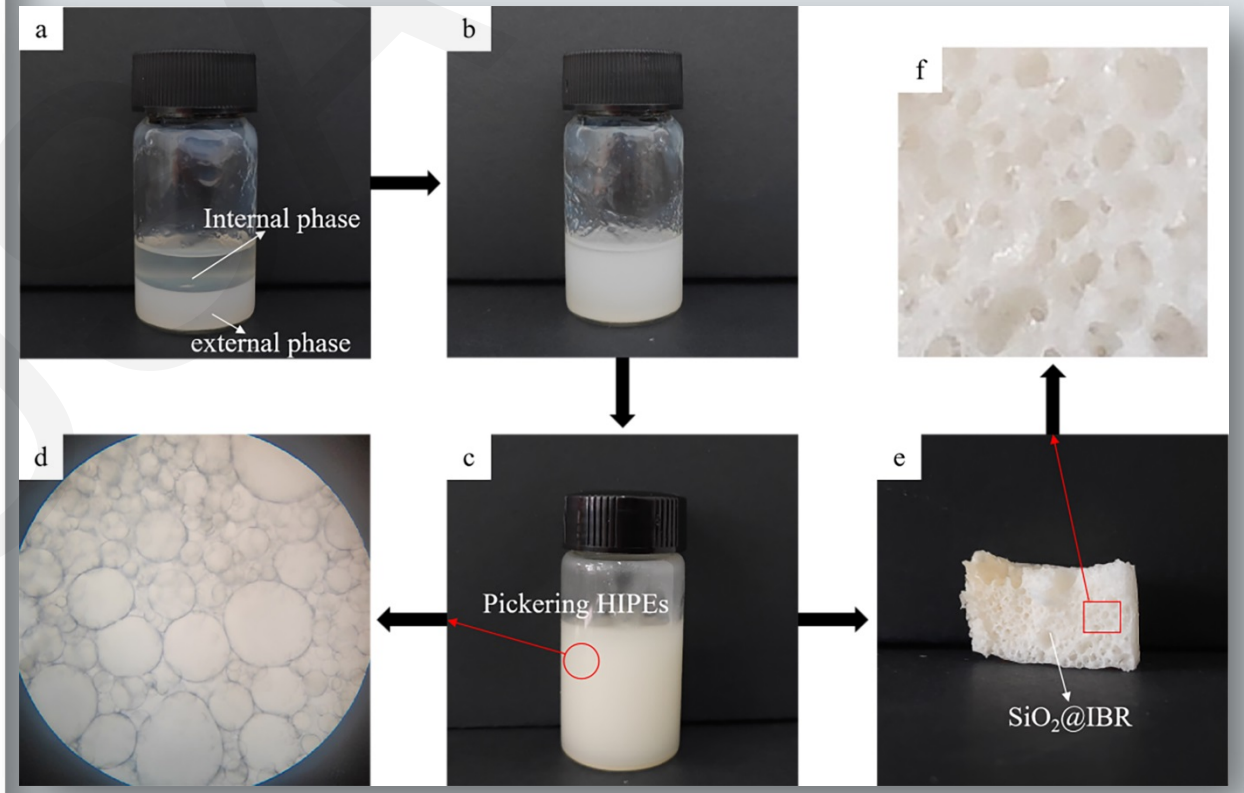


Fig. 1 Formation of SiO_2@IBR with macroporous structure and good flexibility derived from Pickering O/W HIPEs

Characterizations: Viscoelasticity and morphology

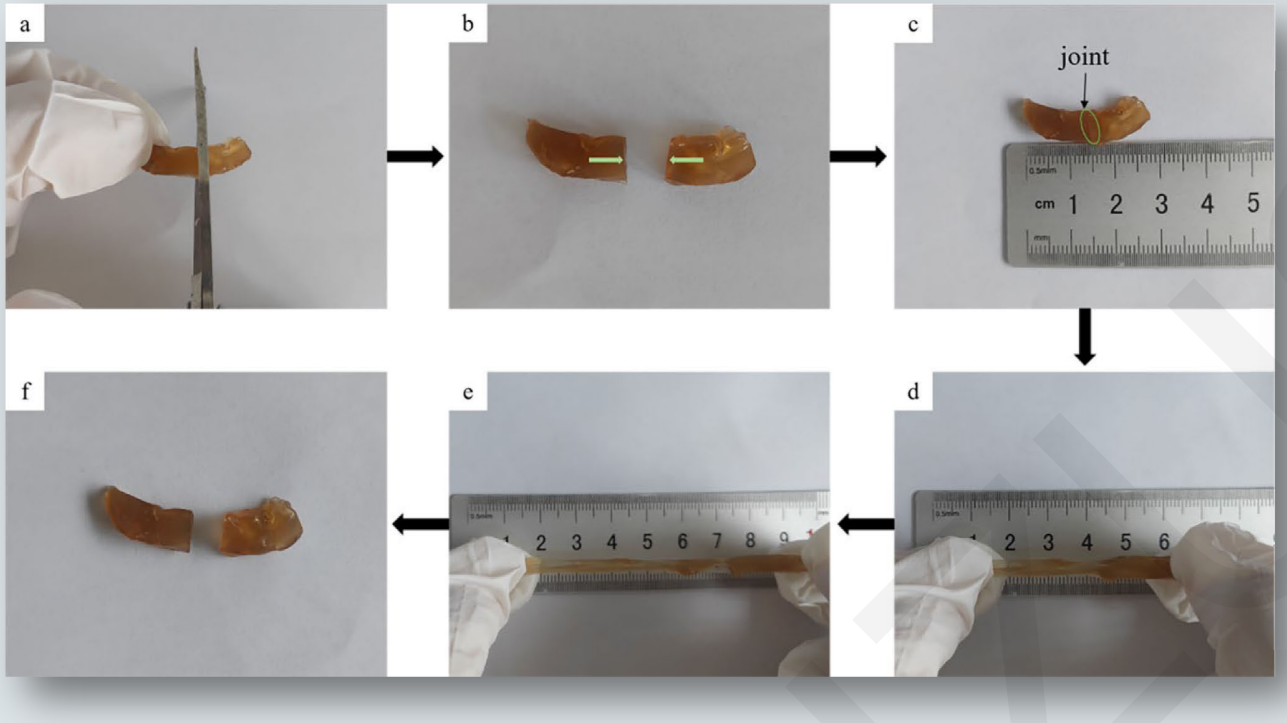


Fig. 2 Viscoelasticity and mechanical properties test

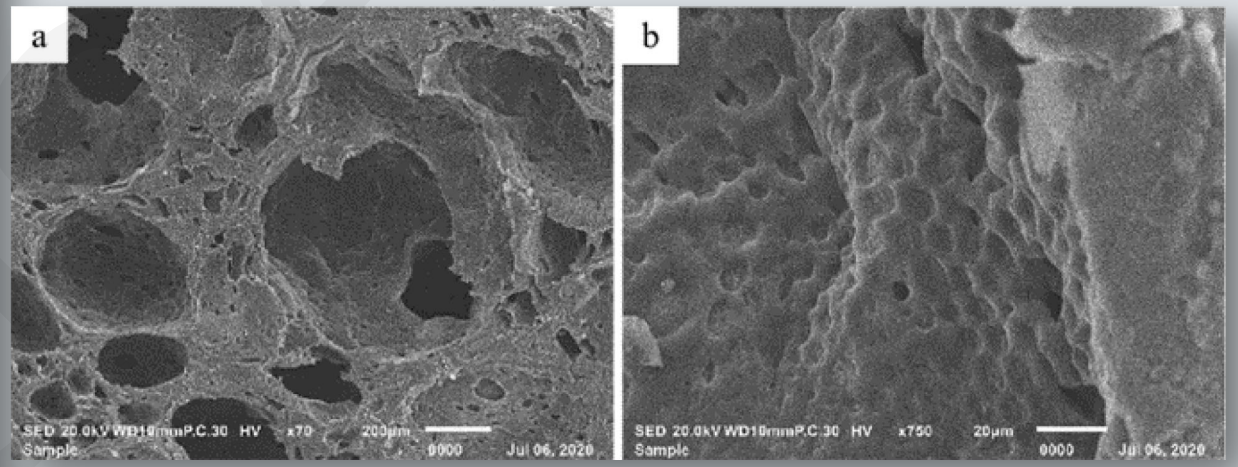


Fig. 3 SEM Images of SiO2@IBR

Characterizations: Shape memory property

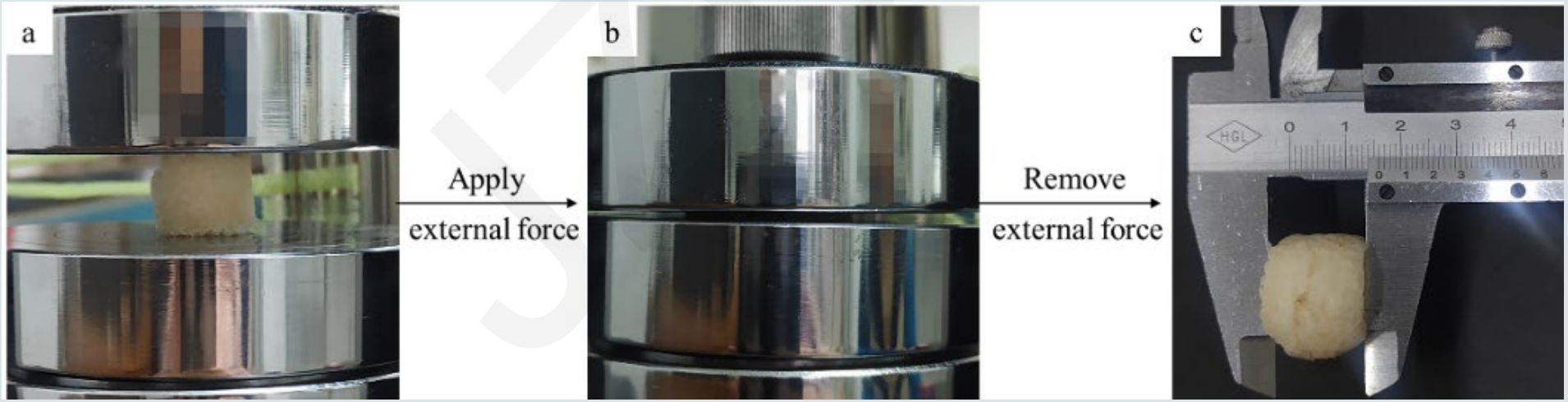


Fig. 4 Compression testing of SiO_2@IBR

Adsorption Performance

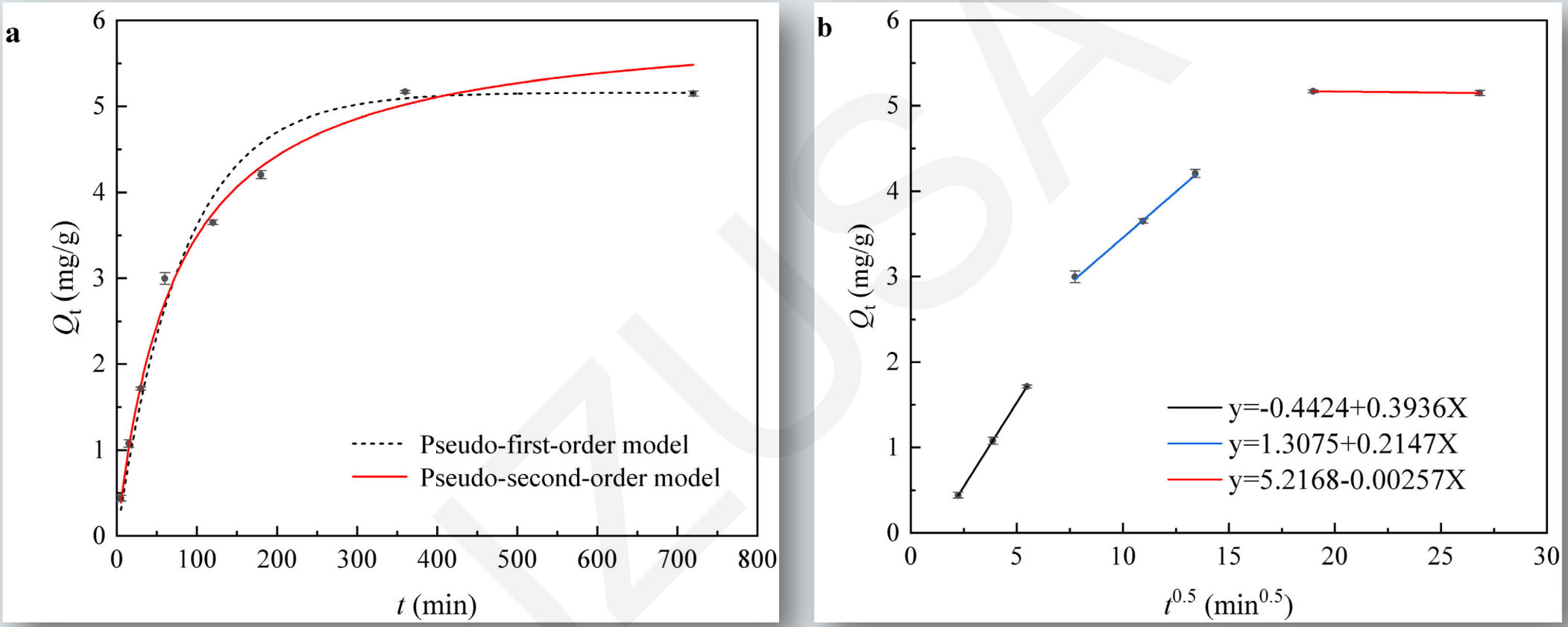


Fig. 5 Kinetic data and modeling for adsorption of TTX onto SiO_2@IBR (a) and Intra-particle diffusion modeling for adsorption of TTX onto SiO_2@IBR (b)

Adsorption Performance

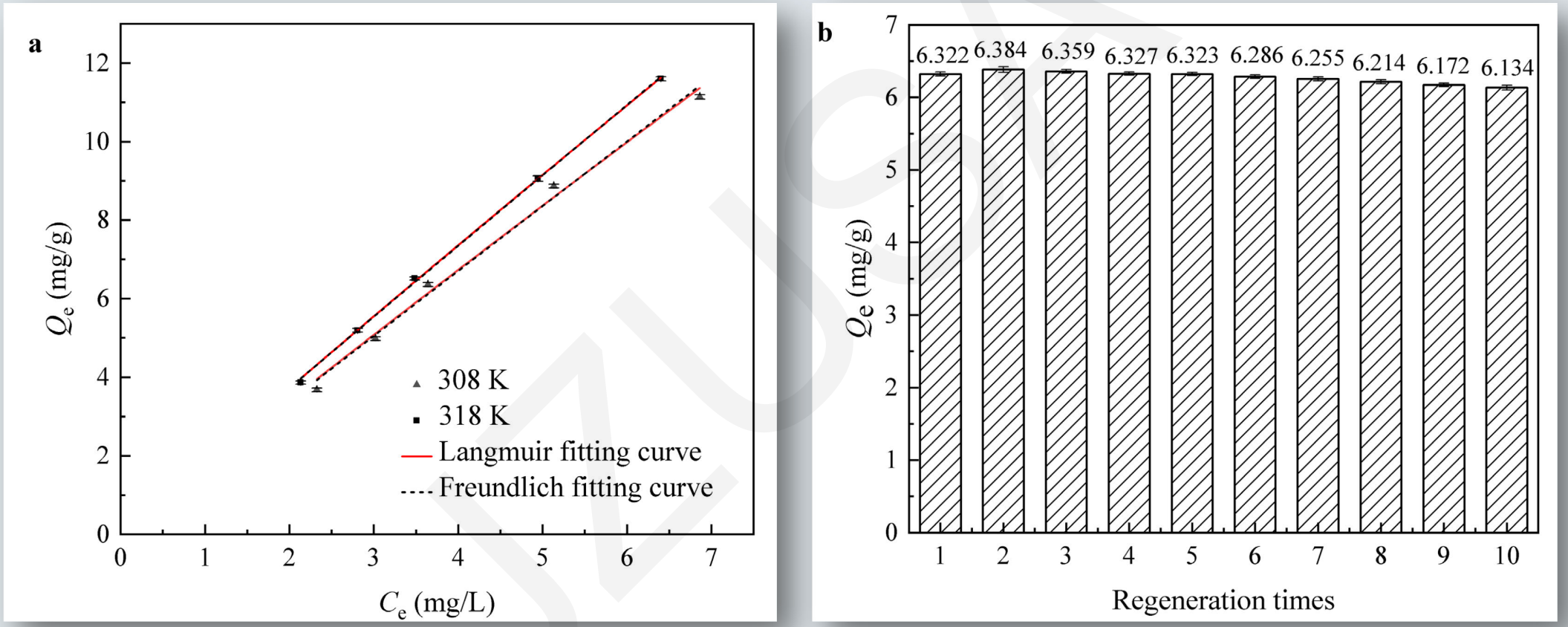


Fig. 6 Equilibrium data and modeling for adsorption of TTX onto SiO_2@IBR (a) and Regeneration of SiO_2@IBR for ten cycles (b)

Conclusions

- The SiO_2@IBR polymers have well-defined macroporous structure and good flexibility. The particular shape memory of SiO_2@IBR is beneficial to the adsorption and regeneration process.
- SiO_2@IBR is an effective and promising adsorbent with good adsorption capacity for TTX. The results of the pseudo-first-order and pseudo-second-order kinetic models indicated that there was chemical bonding accompanied by physical adsorption.
- The regeneration experiments results demonstrated that SiO_2@IBR has good adsorption regeneration performance. After 10 regeneration experiments, the adsorption capacity decreased less than 0.03%.

