UNIVERSITY OF Waterloo

IPR
Institute for Polymer Research

Characterization of Emulsions of Hydrocarbons and Temperature-Responsive Polymeric Surfactants

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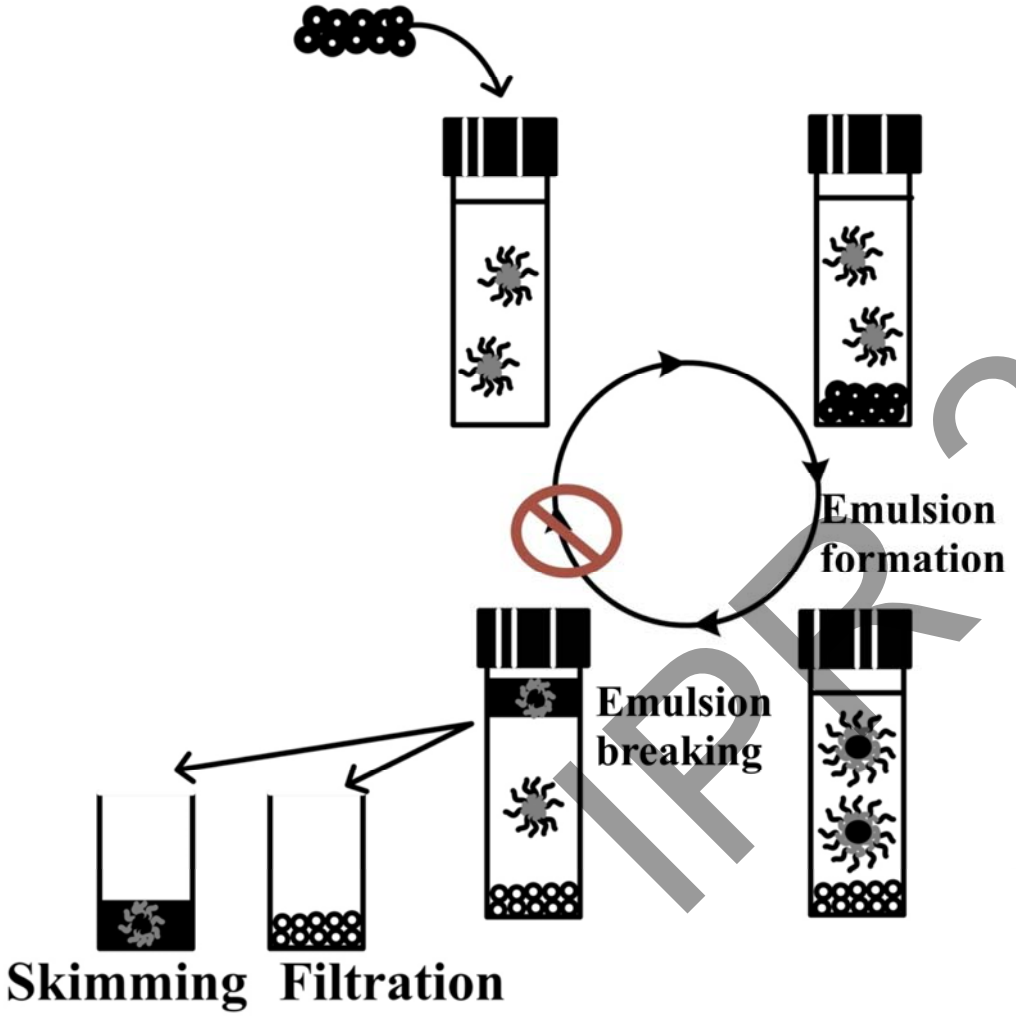
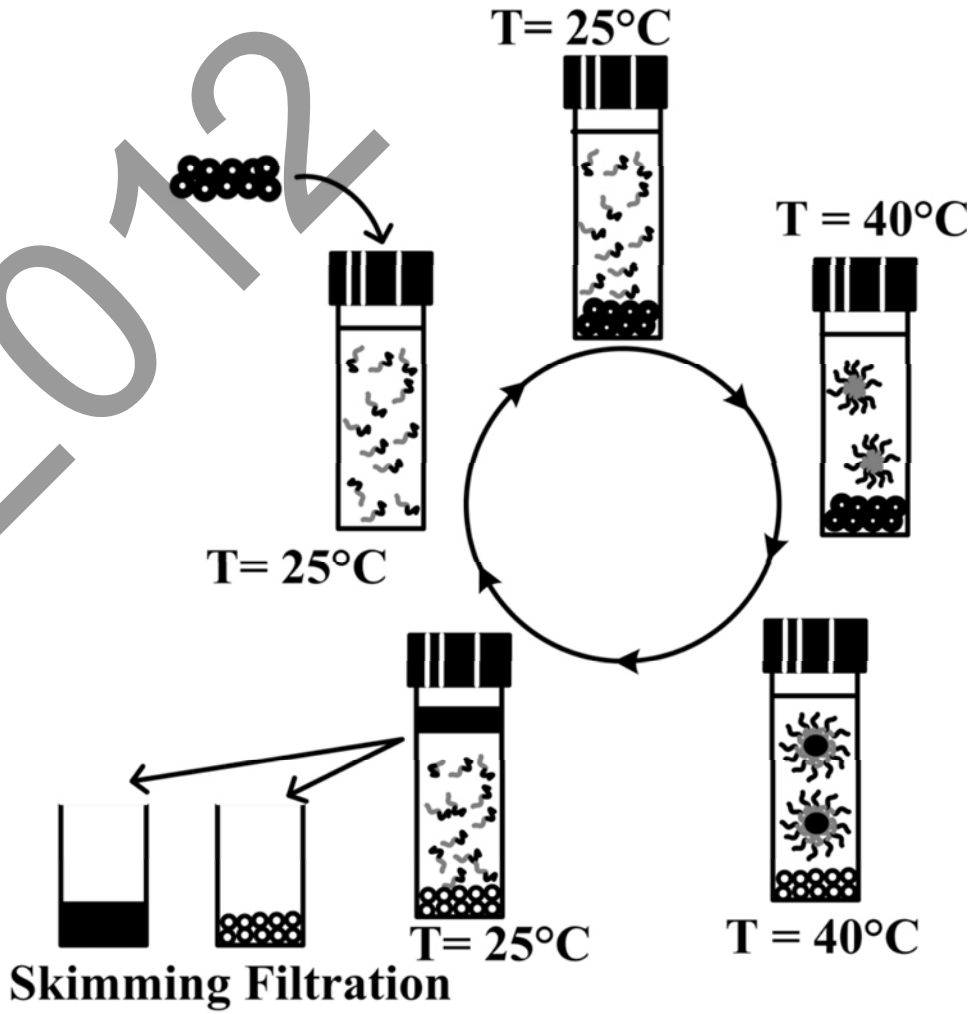
Advantage of using temperature-responsive surfactants

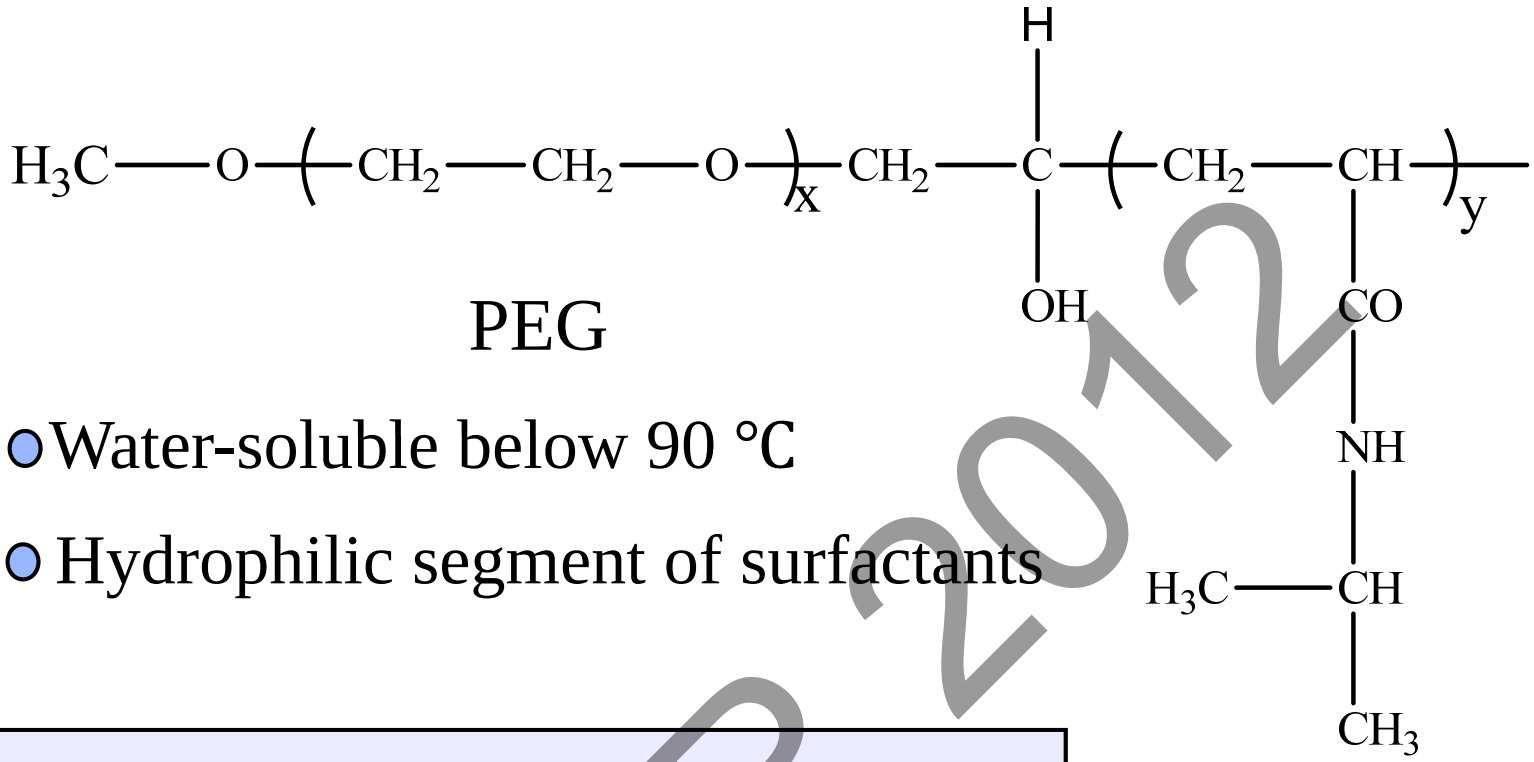
Traditional oil-extraction surfactants



Temperature-responsive surfactants



Poly(ethylene glycol)-*b*-poly(N-isopropylacrylamide)



PEG

- Water-soluble below 90 ℃
- Hydrophilic segment of surfactants

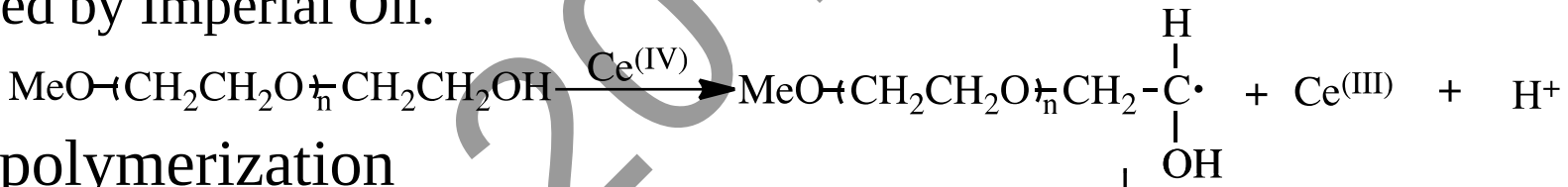
PNIPAM

The behavior of PEG-*b*-PNIPAM in aqueous solution has been widely studied, but the application of such block copolymers to stabilize hydrocarbon emulsions remains unexplored.

Water-insoluble above its lower critical solution temperature (LCST) (~32 ℃)

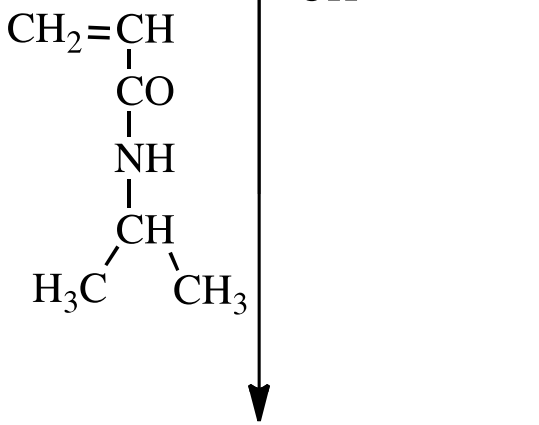
How ?

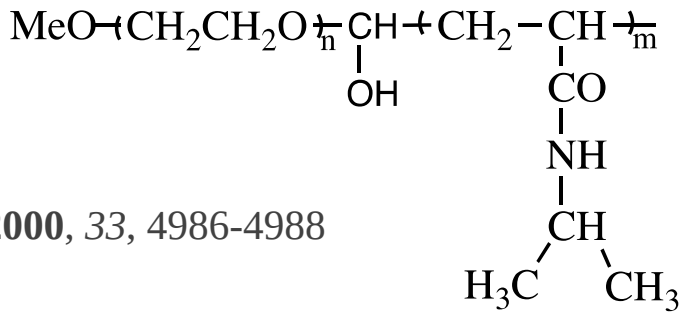
1. Synthesis and purification of a series of PEG_x-*b*-$PNIPAM_y$ block copolymers.
2. Determination of the chemical composition of each copolymer.
3. Physical characterization of the copolymers by measuring their CMC and LCST.
4. Study of emulsions of hydrocarbons and aqueous solution of the copolymers.
5. Determination of the efficiency of the copolymers to extract oil from the oil sands provided by Imperial Oil.



Quasi-living polymerization

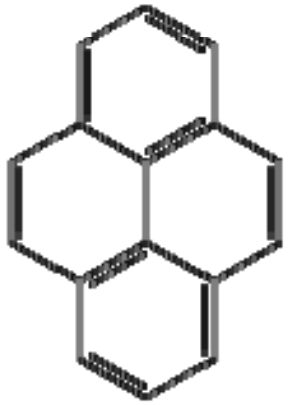
- Radicals form at the beginning of the reaction.
- Additional amounts of monomer polymerize one day after the first polymerization is complete.



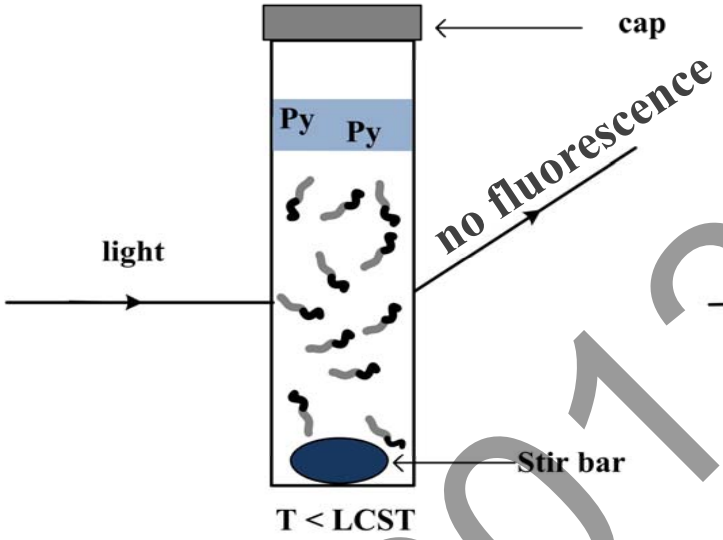


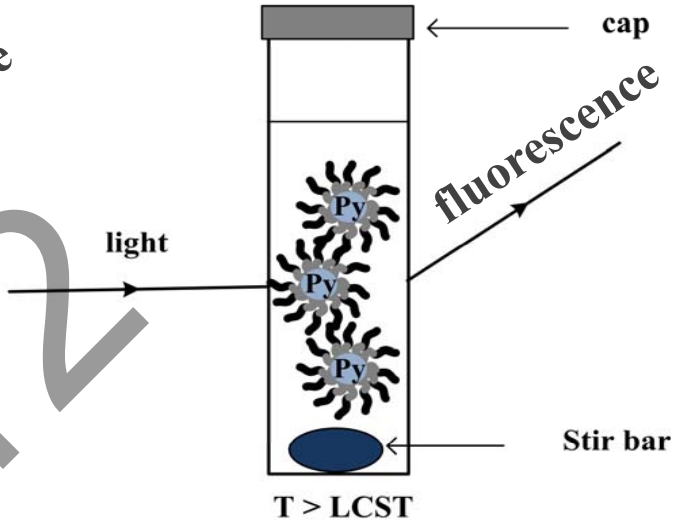
Topp, M. D. D.; Leunen, H. I.; Dijkstra, P. J.; Feijen, J. *Macromolecules* **2000**, *33*, 4986-4988

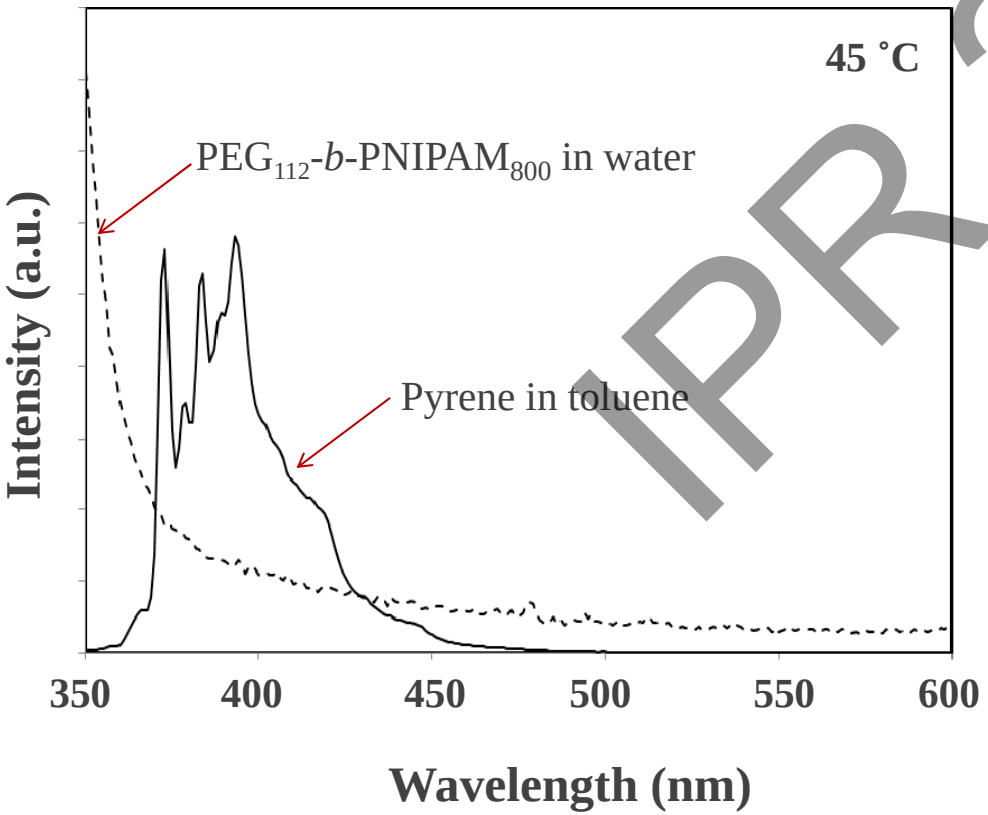
Determination of emulsion stability by steady-state fluorescence

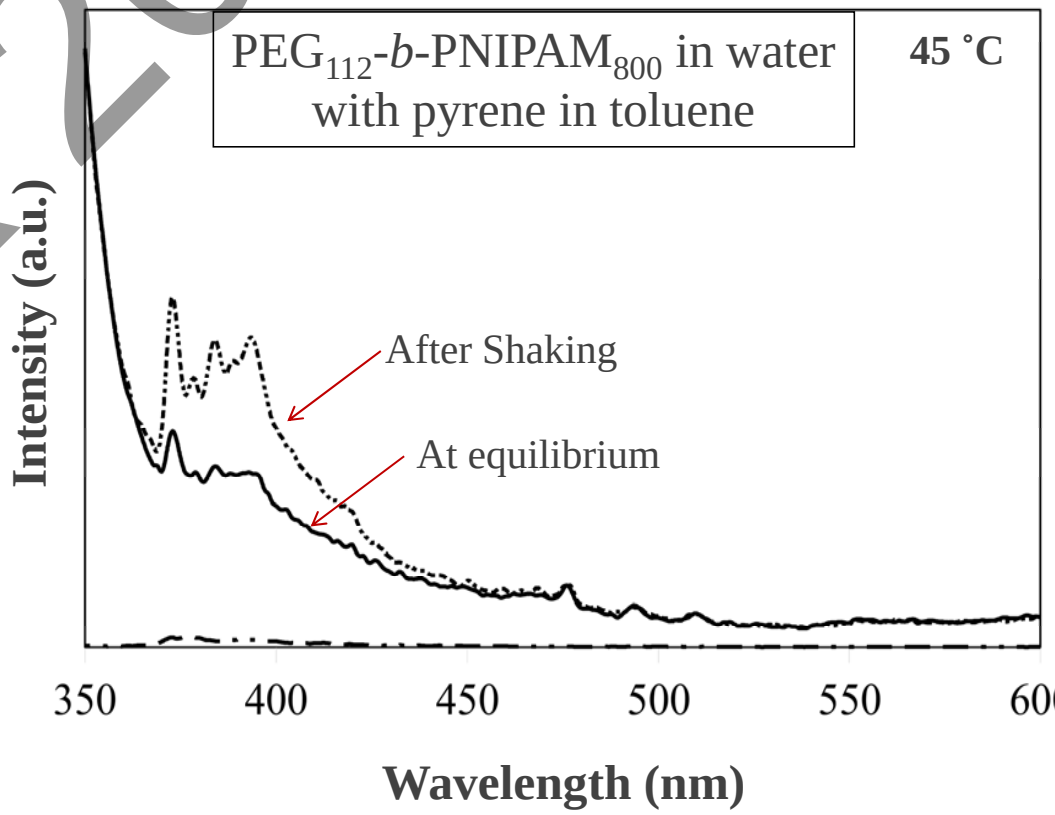


Pyrene









Acknowledgements

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Lab members: Duhamel group Gauthier group