

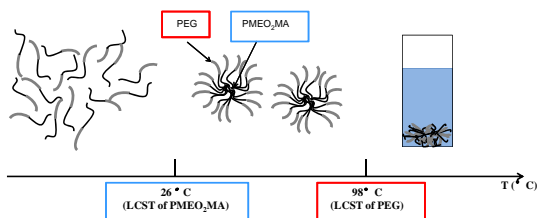
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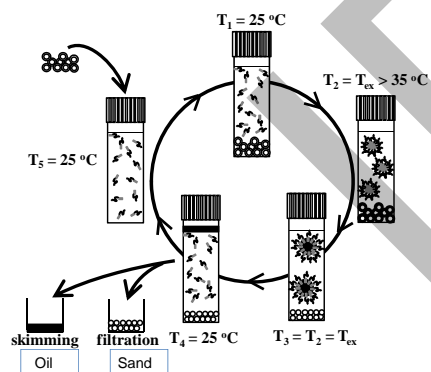
Introduction

Polymeric surfactants are among the most important additives that are used in the extraction of oil from oil sands. However, a fraction of these surfactants can enter the oil phase and are difficult to recover. The use of stimuli-responsive surfactants is one approach around this problem. This research intends to study the efficiency of temperature-responsive polymeric surfactant poly(ethylene glycol)-block-poly[2-(2-methoxyethoxy) ethyl methacrylate] (PEG-*b*-PMEO₂MA) at stabilizing oil-in-water emulsions.

Temperature-Responsive Polymer Surfactant: PEG-*b*-PMEO₂MA

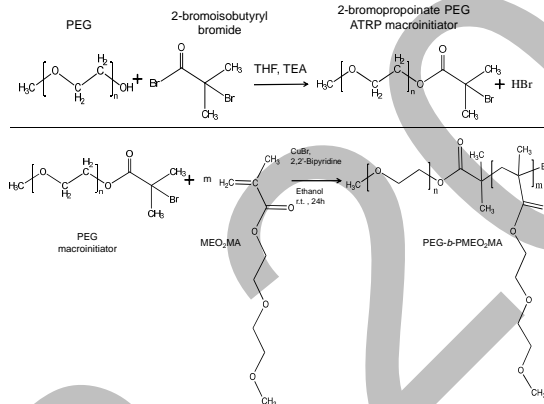


Proposed Application to Oil Extraction



Synthesis of PEG-*b*-PMEO₂MA

Atom Transfer Radical Polymerization (ATRP)



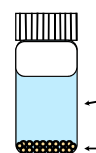
Summary of the Polymer Synthesized by ATRP

Polymer	M _n , NMR (g/mol)	PDI	LCST ¹ (°C)	Diameter ² (nm)
PMEO ₂ MA ₁₃₈	26000	1.8	26.0	-
PEG ₁₁₃ - <i>b</i> -PMEO ₂ MA ₆₄	17000	1.1	33.0	26.3 ± 0.3
PEG ₁₁₃ - <i>b</i> -PMEO ₂ MA ₈₀	20000	1.2	34.0	27.1 ± 0.4
PEG ₁₁₃ - <i>b</i> -PMEO ₂ MA ₇₇	19000	1.5	35.0	36.6 ± 0.3

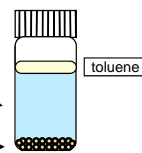
¹ Lower Critical Solution Temperature (LCST) was measured by turbidimetry.
² Measured by dynamic light scattering.

Application in Oil Extraction

Protocol #1



Protocol #2

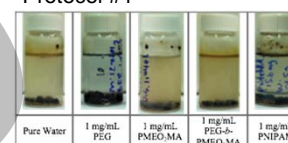


The samples were left in the shaker for 24 hrs at 45 or 50 °C.

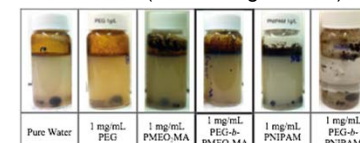
Application in Oil Extraction (Con't)

Optimal Conditions of Oil Extraction

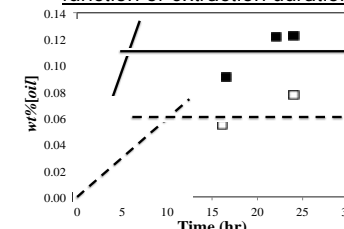
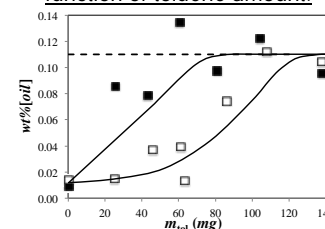
- A 1 mg/mL PEG-*b*-PMEO₂MA aqueous solution extracts extract oil efficiently.



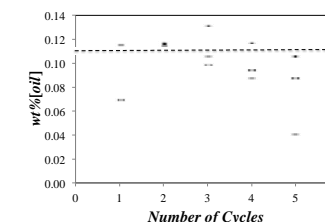
Protocol #2 (with 60 mg toluene)



- Extraction efficiency as a function of toluene amount.
- Extraction efficiency as a function of extraction duration.



Reusability of TRPS



- This TRPS was proven to be reusable for at least 5 extraction cycles.
- The recovery of the copolymer after one oil extraction cycle was found to equal 78% by using GPC instrument.

References

- Topp, M. D. D.; Dijkstra, P. J.; Talsma, H.; Feijen, J. *Macromolecules* **1997**, *30*, 8518-8520.
- Hong, J.; Wang, Q.; Lin, Y. Z.; Fan, Z. Q. *Macromolecules* **2005**, *38*, 2691.

Acknowledgements

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