

Renewable Polymers for the Delivery of Hydrophobic Drugs



Rebekah Hall, Rayeann Saitz, Muhammad Arshad, Aman Ullah

Department of Agricultural, Food & Nutritional Science, University of Alberta



Introduction

- Hydrophobic, or “water hating” drugs present a challenge in therapeutics, as they can be difficult to deliver to the desired location.
- Several methods for solving this problem have been suggested and put into practice, such as that of micelles.
- Unfortunately, the hydrophobic component of these micelles is often made of non-renewable and non-biodegradable polymers.

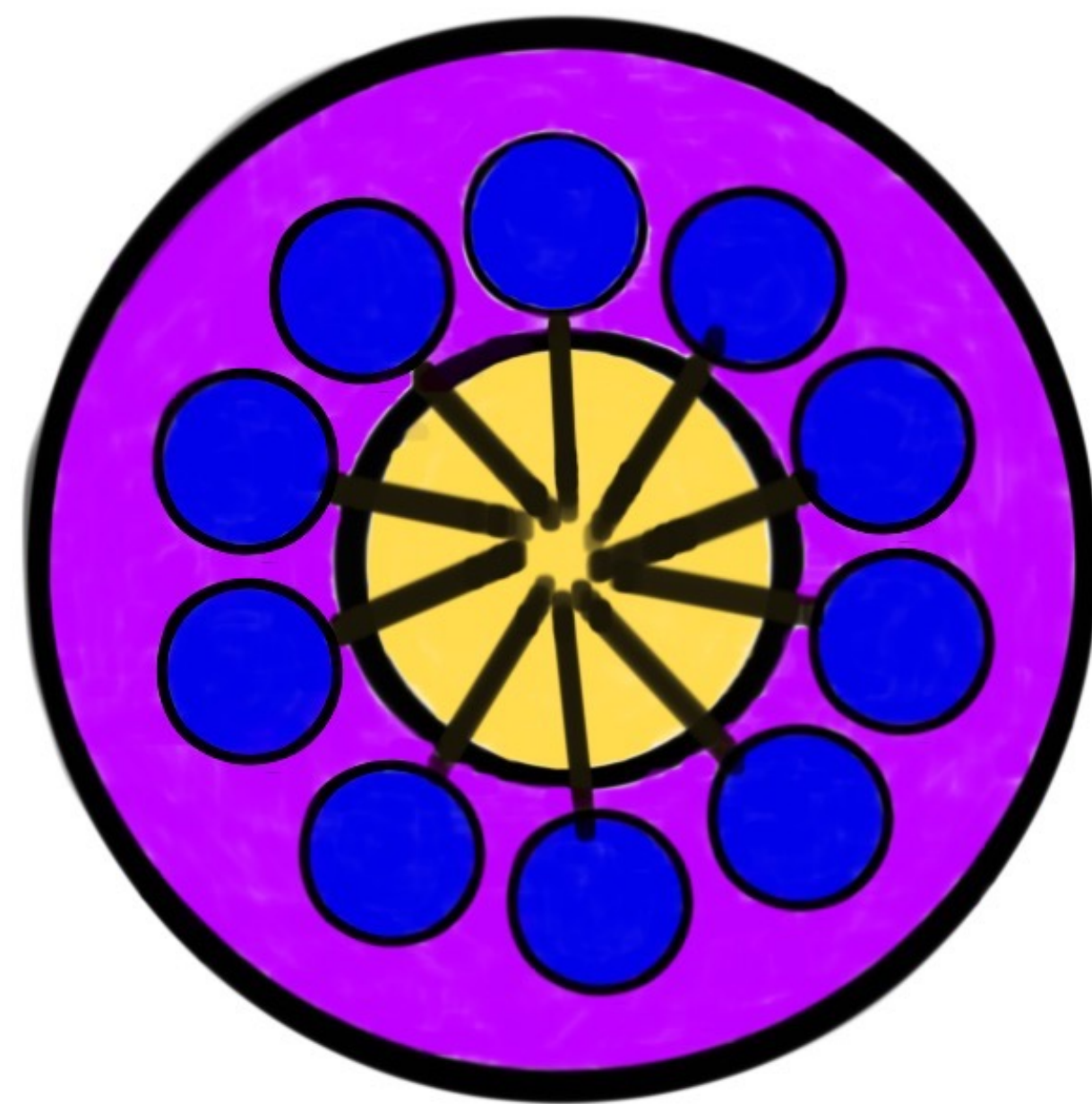


Figure 1: A diagram of a micelle. The blue heads are hydrophilic, attracted to the water, represented by purple. Their tails are hydrophobic, attracted to the hydrophobic drug, represented by the yellow circle.

Purpose

- To synthesise an amphiphilic block copolymer from soybean oil.

Methods

- Pure NiPAM was polymerised using the technique of reversible addition-fragmentation chain-transfer (RAFT) polymerisation.
- A fatty acid monomer was synthesised from high oleic soybean oil via hydrolysis and esterification.
- Using the NiPAM polymer as CTA, it was copolymerised with fatty acid monomer into a block copolymer.
- The characterisation of monomer and polymers was completed by gel permeation chromatography (GPC) and proton nuclear magnetic resonance (¹H NMR) and Fourier transform infrared spectroscopy (FTIR).

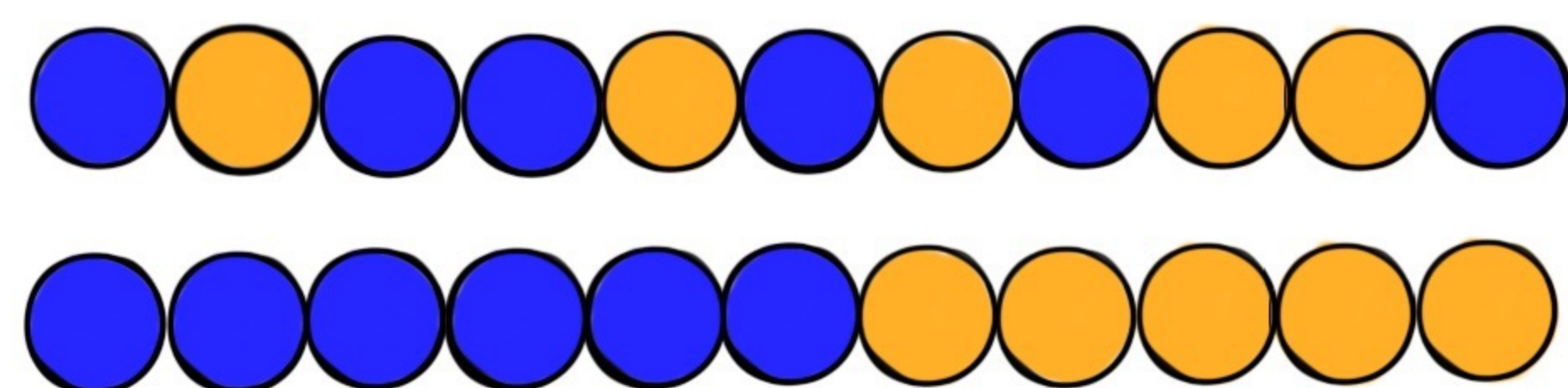
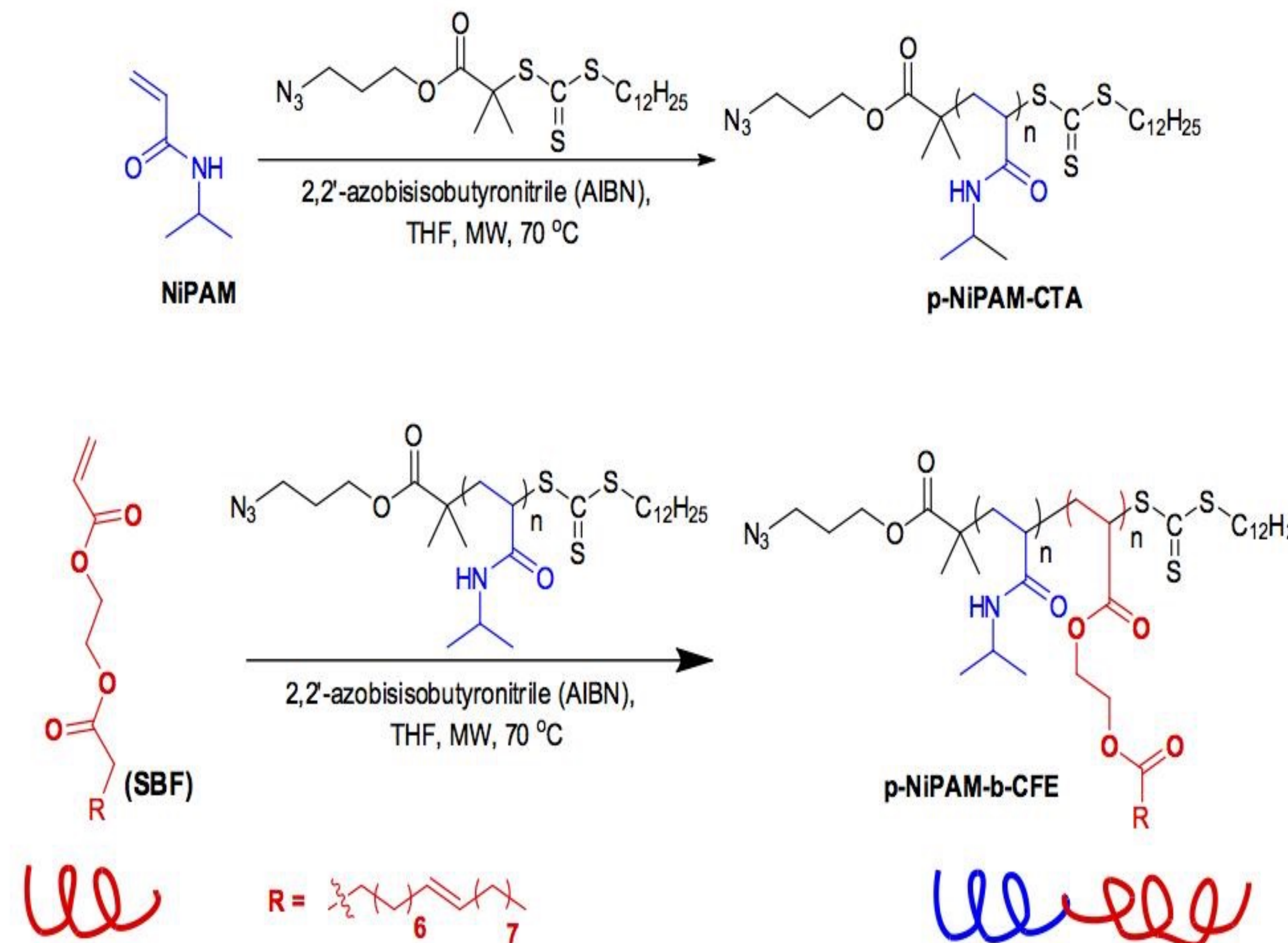


Figure 2: A diagram showing the difference between a random copolymer (top) and a block copolymer (bottom)



Scheme-1: Synthesis of amphiphilic block copolymer p-NiPAM-b-SBF via RAFT polymerisation.

Results

¹H-NMR:

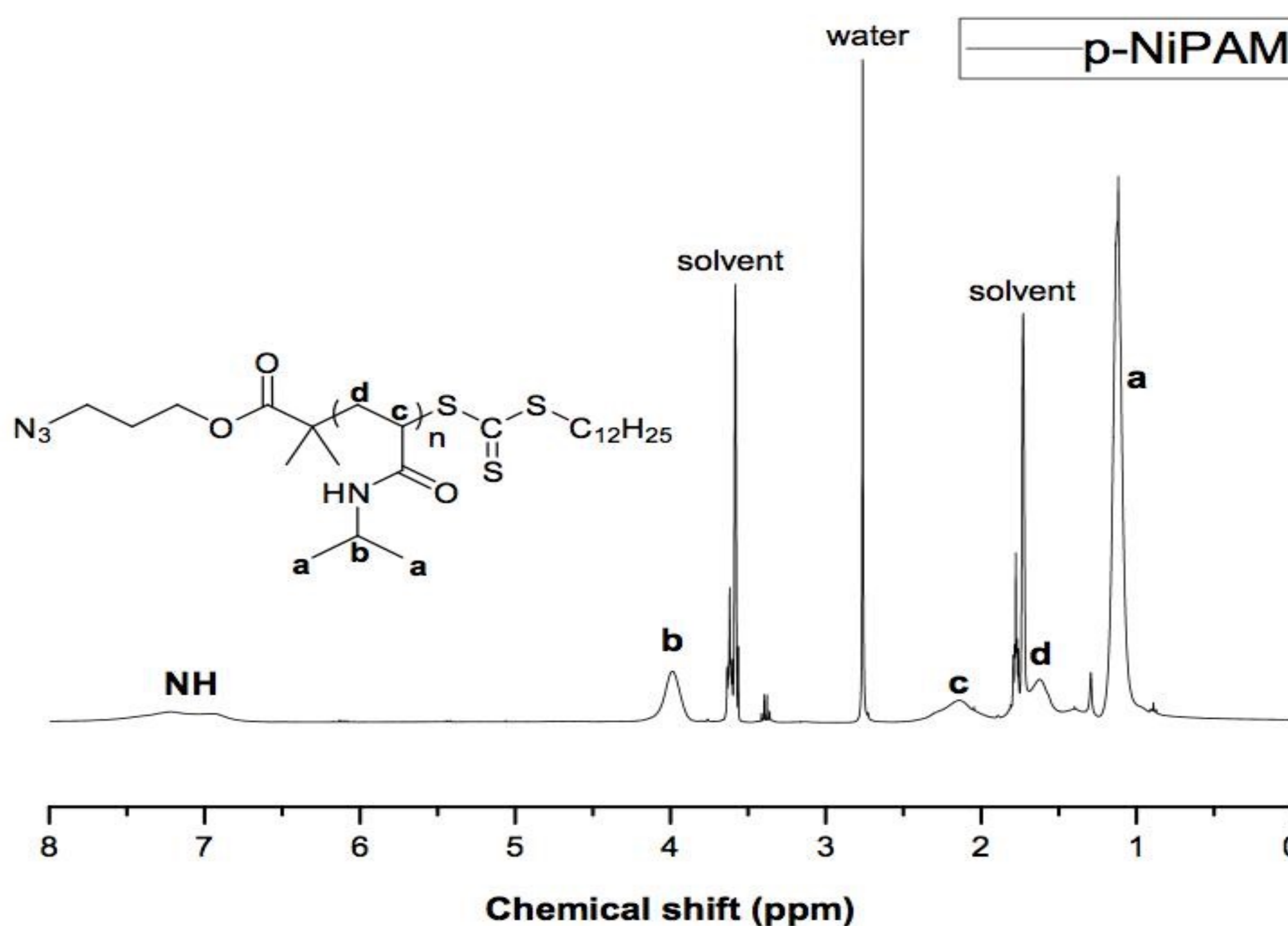


Figure 3: ¹H NMR of P-NiPAM-CTA in deuterated tetrahydrofuran

Gel Permeation Chromatography:

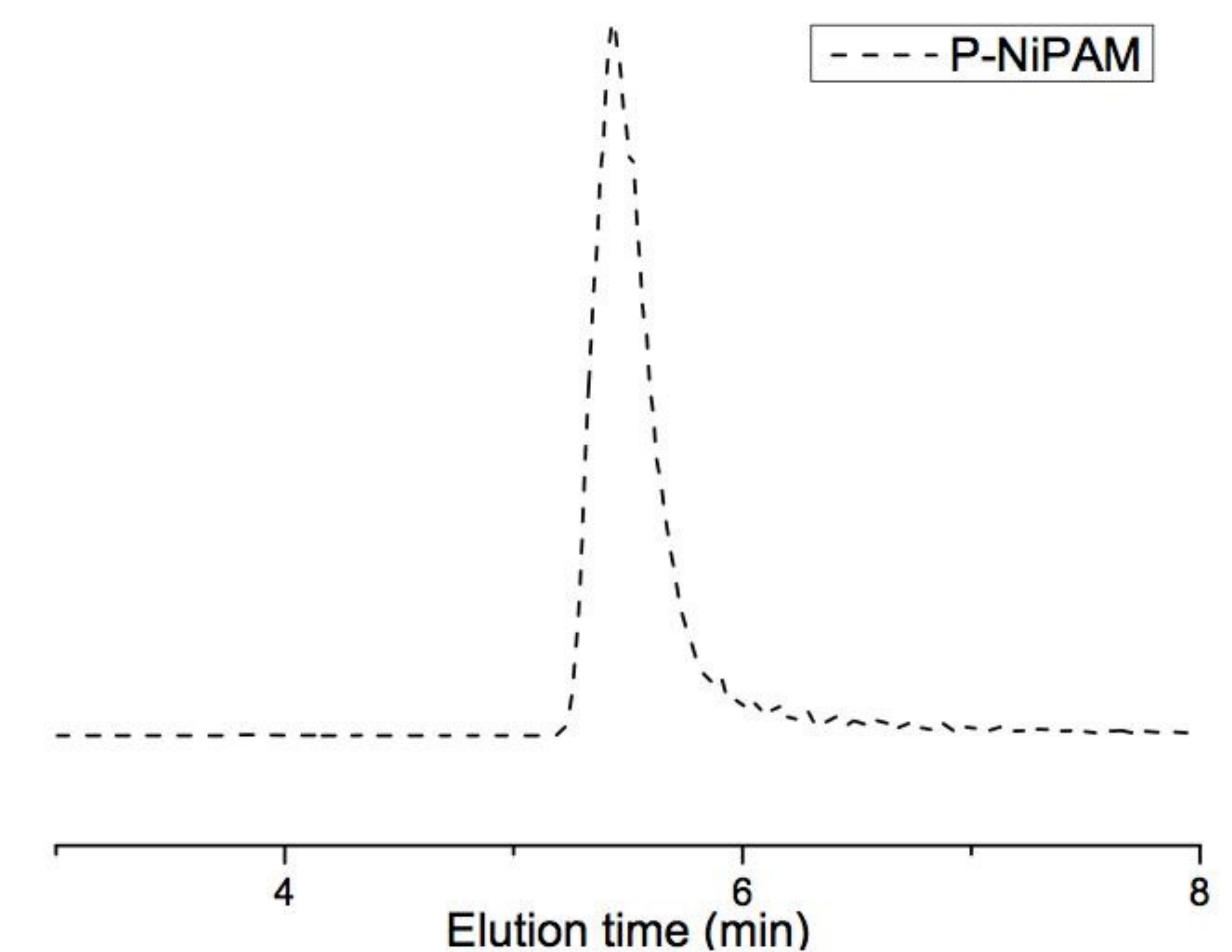


Figure 4: Gel permeation chromatography (GPC) traces of P-NiPAM (Mw = 6650, PDI = 1.02)

Conclusions

- A successful synthesis of soybean oil fatty acids monomer was carried out via hydrolysis followed by esterification.
- P-NiPAM polymer was also synthesised successfully via RAFT polymerisation.
- The fatty acid monomer and P-NiPAM synthesis was confirmed by ¹H NMR and GPC analysis.
- Amphiphilic block copolymer preparation is in process, which will be used for drug delivery application.

Acknowledgements

- Thank you for the financial support of Canada Summer Jobs and the Alberta Women's Science Network.
- Thank you Dr. Aman Ullah and his lab for allowing me this experience in their lab.
- Thank you to Dr. Muhammad Arshad for his guidance during the project.

