Preparation of Amphiphilic Block Copolymers using Canola Oil Fatty Acids to Incorporate Carbamazepine Drug

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Introduction

Micelles are an important area of study due to their use in pharmaceuticals and their advantages over conventional therapeutics, such as targeted drug-delivery. Micelles have diameters generally between 10 – 200nm[1].

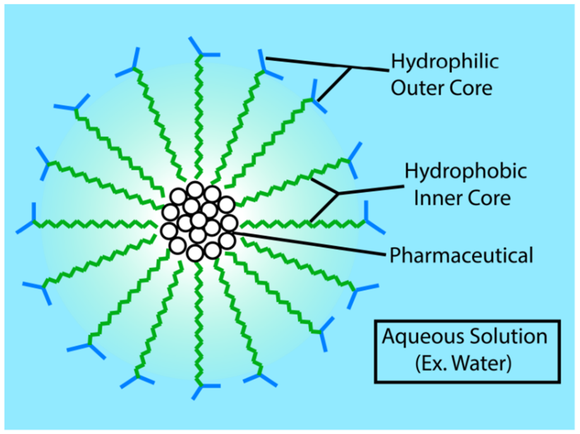


Fig. 1: Diagram of a micelle encapsulating a pharmaceutical within an aqueous medium.

Purpose

~ Produce a drug-carrying micelle
~ Replace the synthetic hydrophobic component within existing micelle designs with Canola Fatty Esters (**CFE**s)
~ Use of CFEs as a hydrophobic component as lipids are :
- Biocompatible
- Biodegradable
- Non-toxic
- Non-allergenic
- Inexpensive

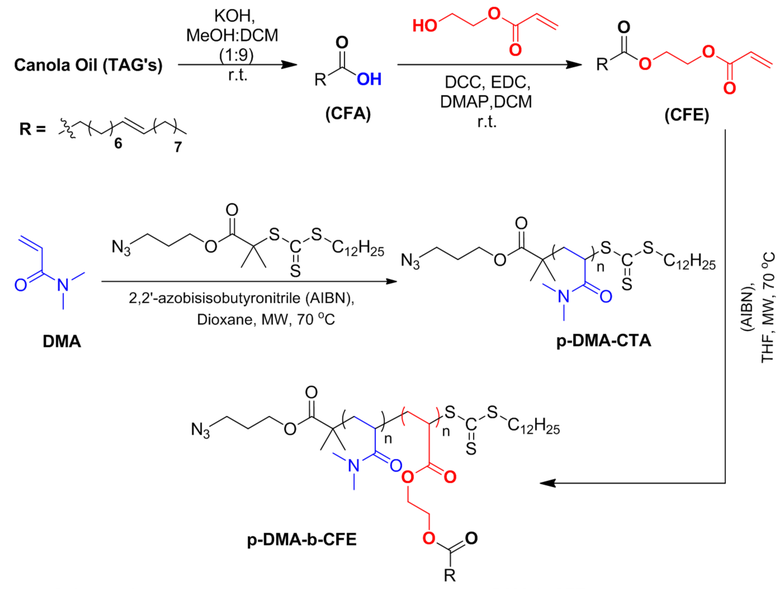
Methods

The micelle in question will be made of two main components:
1. poly(*N, N*'-Dimethylacrylamide) (**p-DMA**)
2. CFEs refined from canola triacylglycerols (**TAG**s)

~ The hydrophobic component was obtained from canola oil by the hydrolysis of TAGs followed by the esterification of carboxylic acid with 2-hydroxyethylacrylate.

~ The hydrophilic component was obtained via RAFT (Reversible Addition–Fragmentation chain Transfer) polymerization using DMA.

Both parts were copolymerized by RAFT method into an amphiphilic bio-conjugate.



Scheme, 1: Preparation of amphiphilic block copolymer **p-DMA-b-CFE** by RAFT polymerization

Results

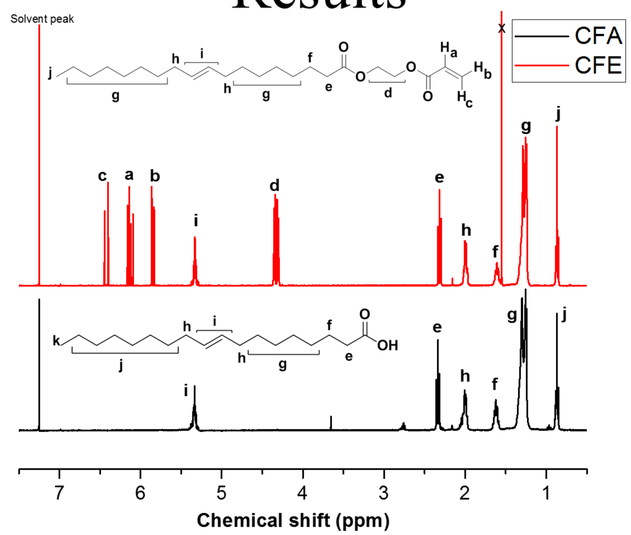


Fig. 2: Proton NMR spectra of canola fatty acid (CFA) and canola fatty esters (CFE) in deuterated chloroform

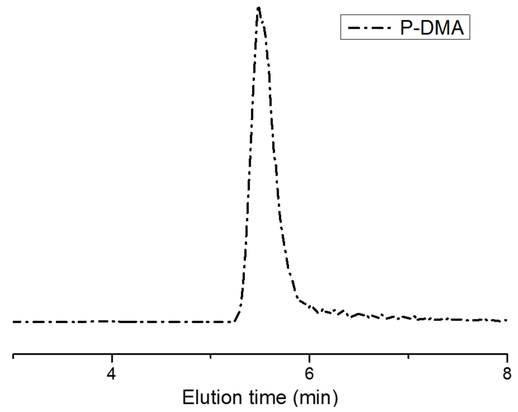


Fig. 3: Gel permeation chromatography (**GPC**) traces of **P-DMA** (Mw = 6200 g/mol, PDI = 1.03)

Conclusion

~ Obtained the monomer CFE, confirmed with HNMR
~ Obtained the DMA polymer, confirmed with GPC
~ Synthesized the bio-conjugate copolymer, HNMR tests required to confirm product has successfully reacted
~ Future research into drug encapsulation and release trials are needed after acquiring the block copolymer

1. Arshad, M., Saied, S., & Ullah, A. (2014, June 6). PEG–lipid telechelics incorporating fatty acids from canola oil: Synthesis, characterization and solution self-assembly. RSC Advances RSC Adv., 4(50), 1. doi:10.1039/c4ra03583f

Acknowledgements: Funding for this project was provided by Stan Blade and John Bell. We would like to thank the Faculty of Agriculture, Life, Environmental Sciences as well as Canada Summer Jobs.