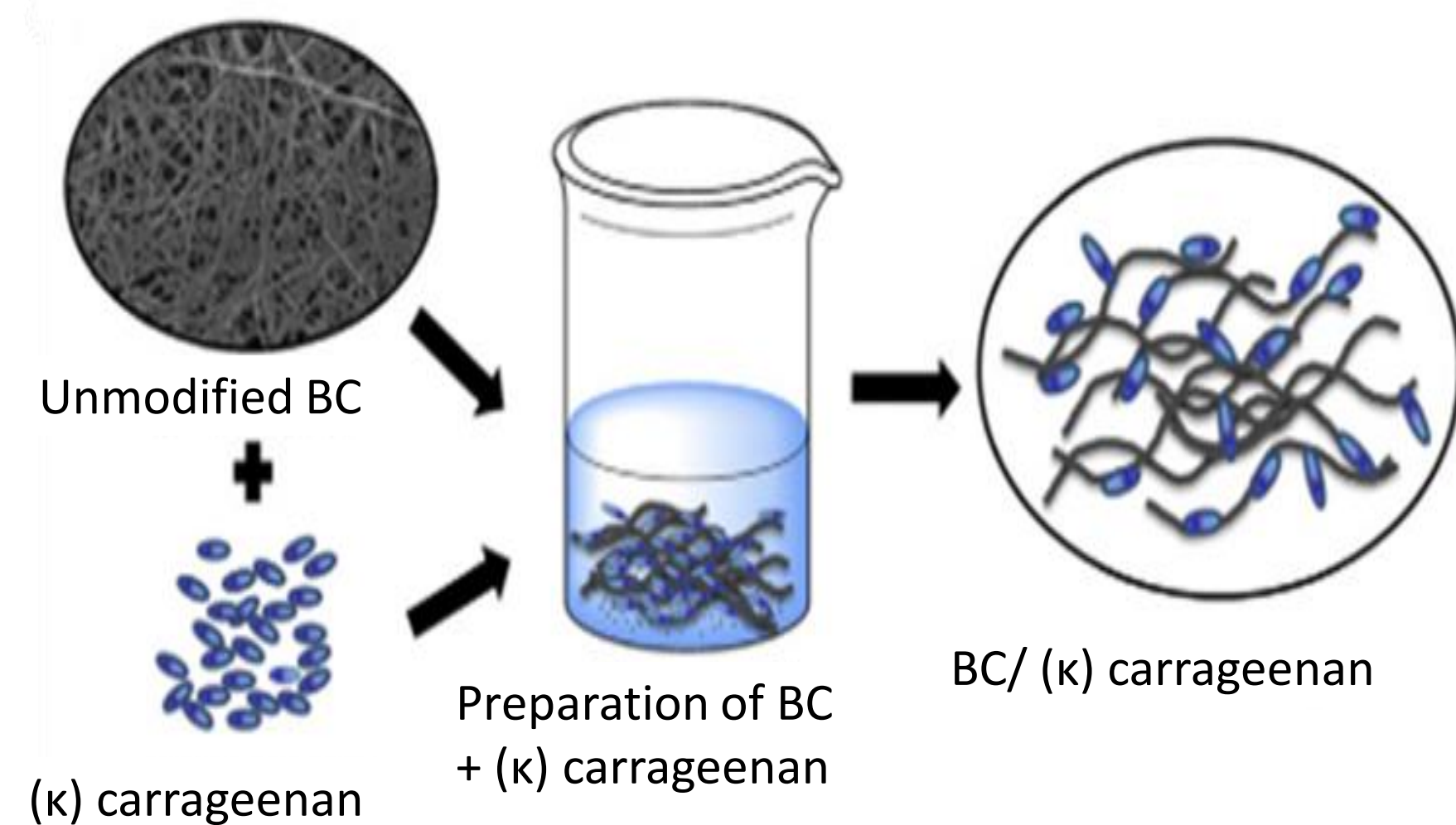


Introduction

Biomaterial in the use of drug delivery have become a groundbreaking approach in the medical and pharmaceutical disciplines. These biomaterials utilize the unique properties of biocompatibility and tunable degradation, transportation and release of drugs in a specific manner in the human body. Biomaterials encapsulating pharmaceutical agents may enhance drug efficacy, reduce side effects and maximize treatment results. This research delves into tuning the biomaterials; bacterial cellulose and κ carrageenan into tailormade drug release systems.

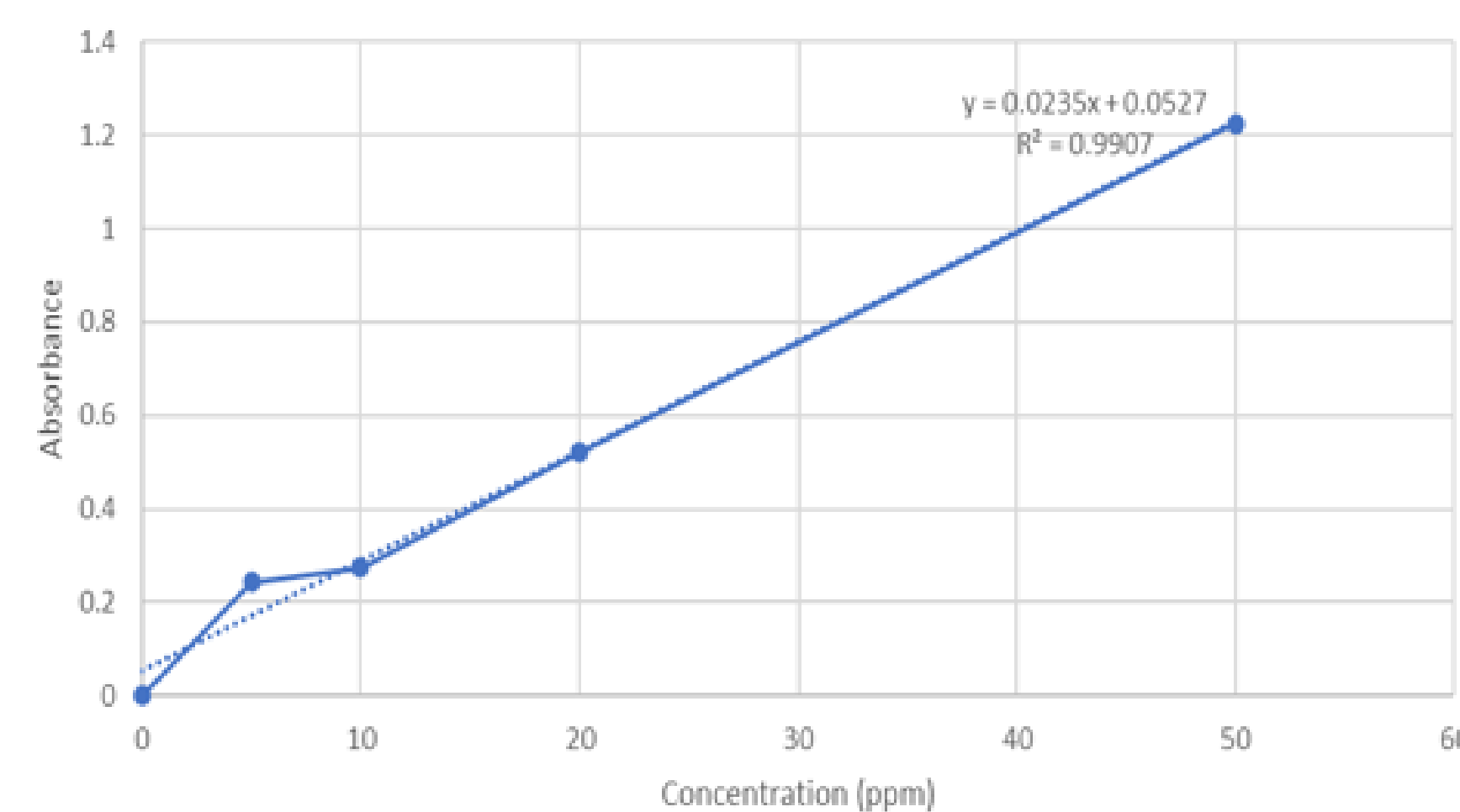
Method

Bacterial Cellulose (BC) was synthesized in the laboratory via static fermentation (Salari et al., 2019) and kappa (κ) carrageenan was extracted using conventional method (Gereniu et al., 2018) from seaweed, *Kappaphycus alvarezii*. Ex-situ modification of BC was carried out by mixing BC and (κ) carrageenan solutions forming a network. The BC and (κ) carrageenan network had been formed via free radical polymerization, the H-bonds on the cellulose nanofibers form intermolecular H-bonds with the (κ) carrageenan free chains (mainly C-O-C, -OH and sulfonic groups).

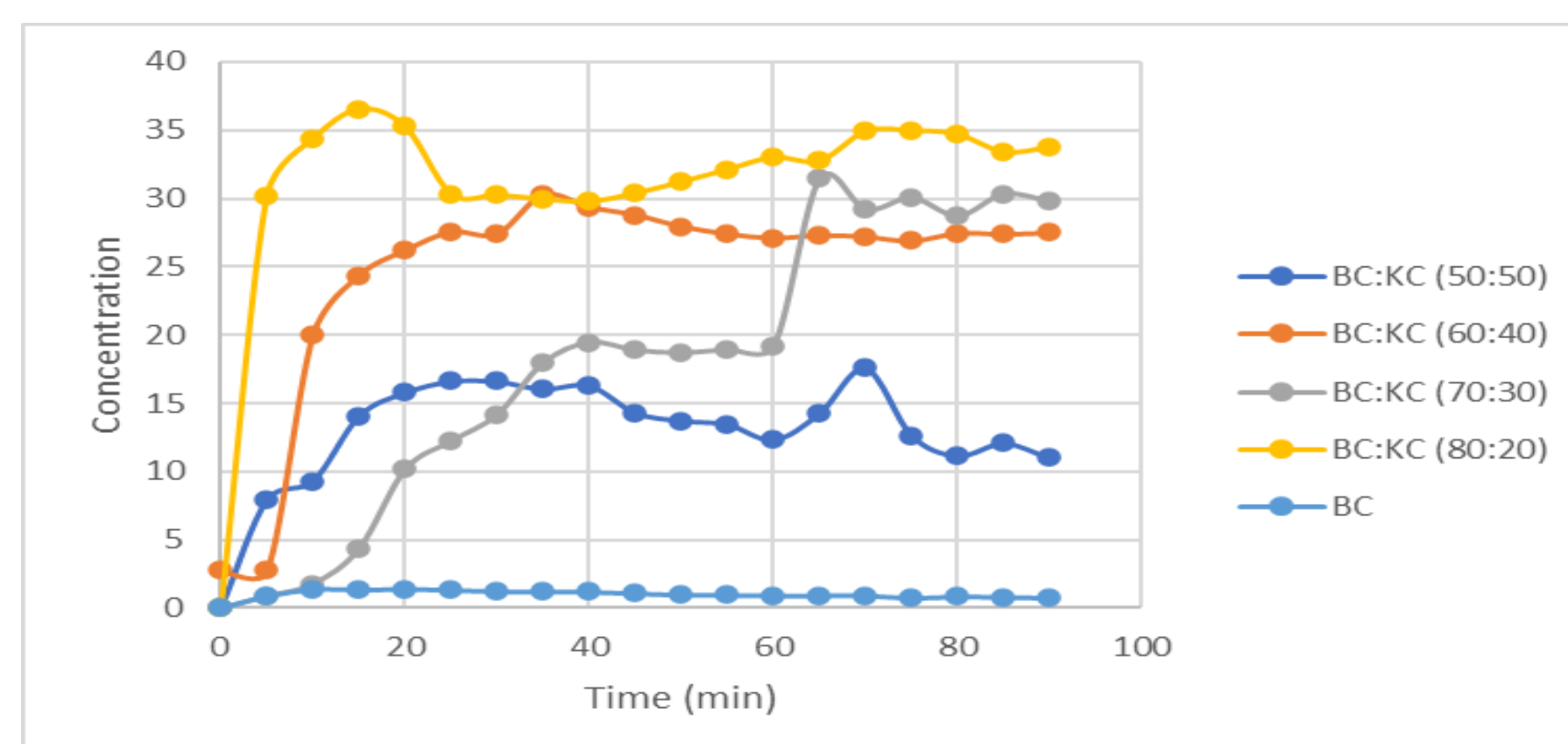


Schematic representation of ex situ preparation of BC/ (κ) carrageenan

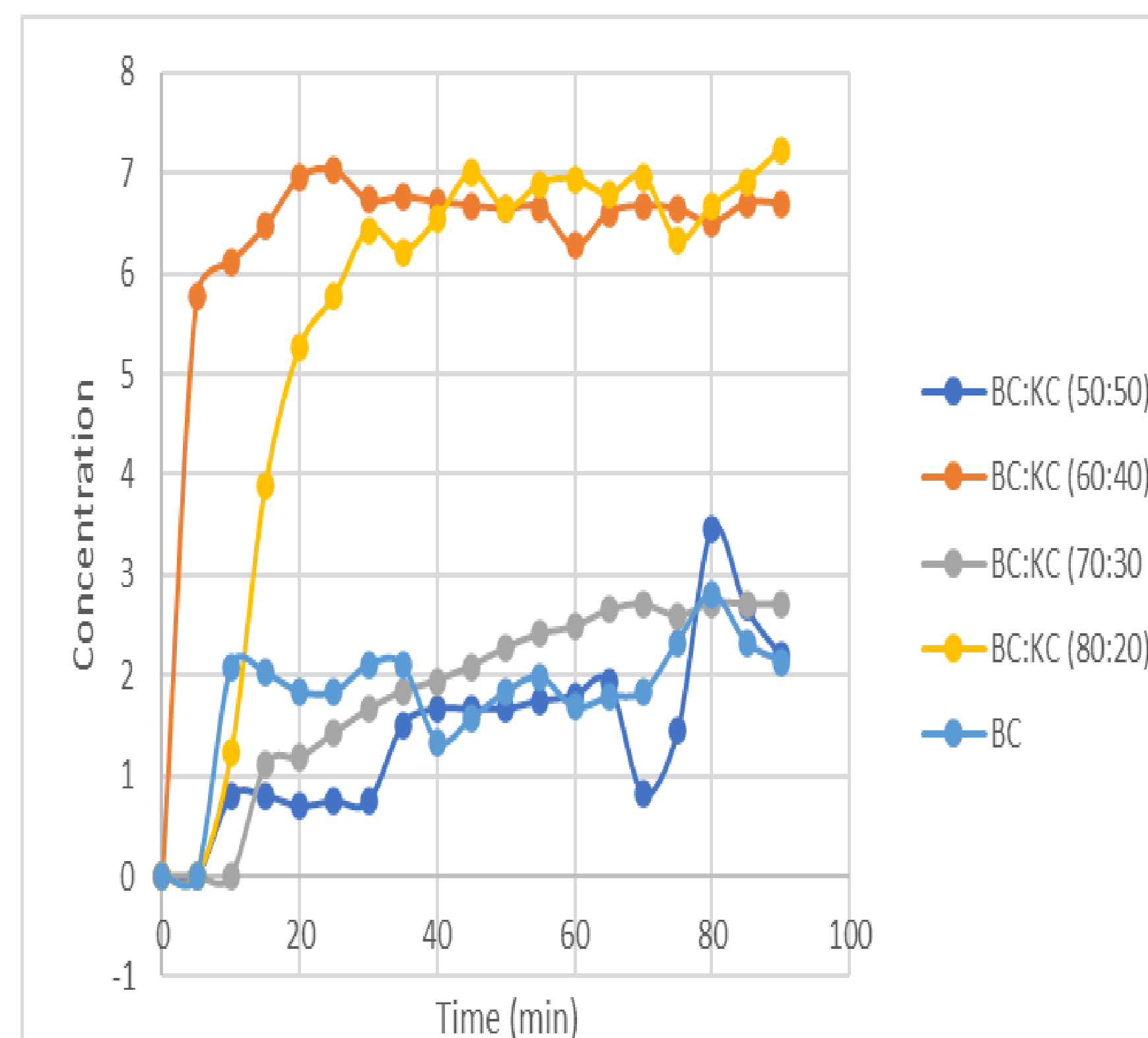
Results / Discussion



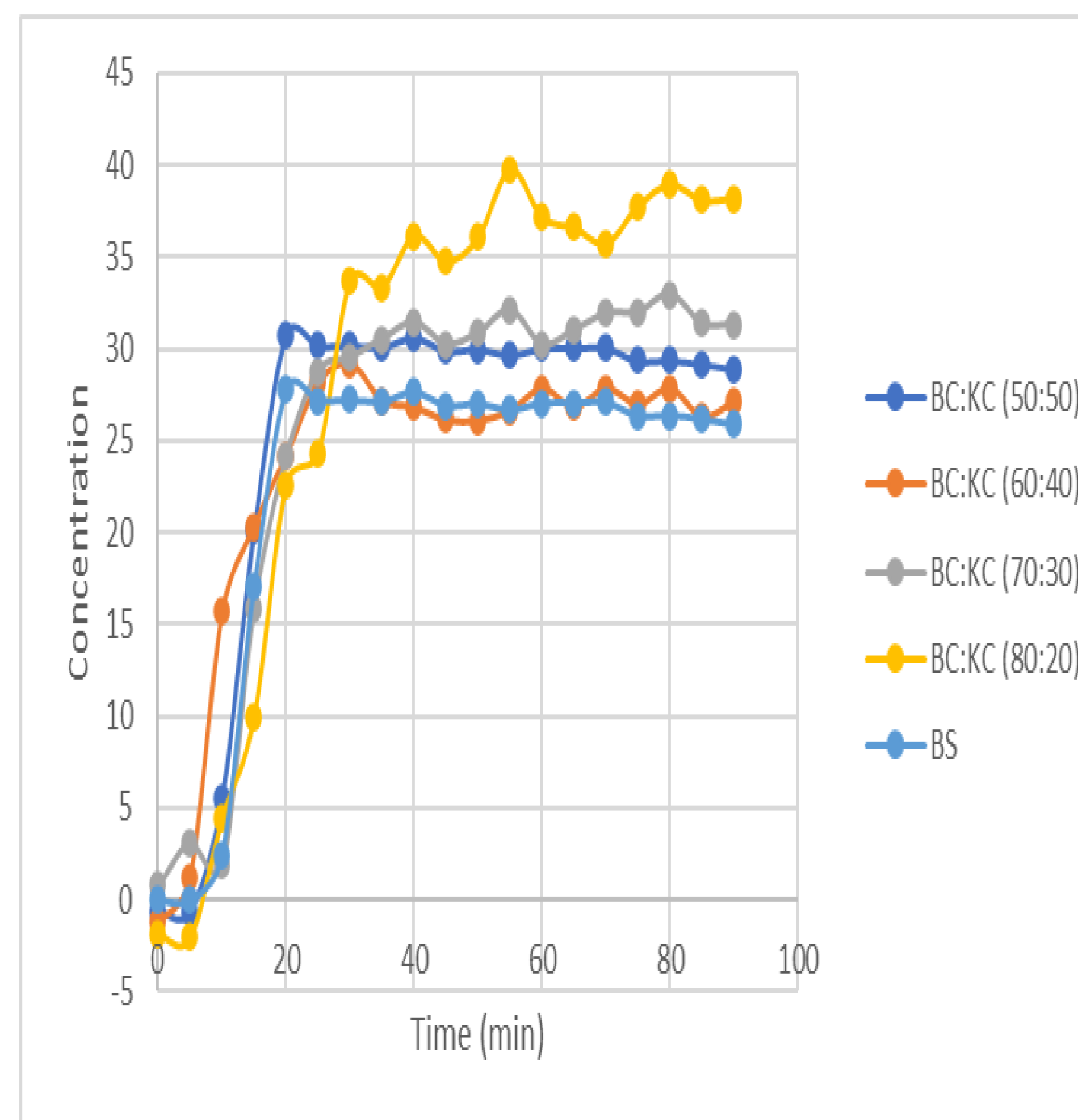
Standard curve of Quetiapine



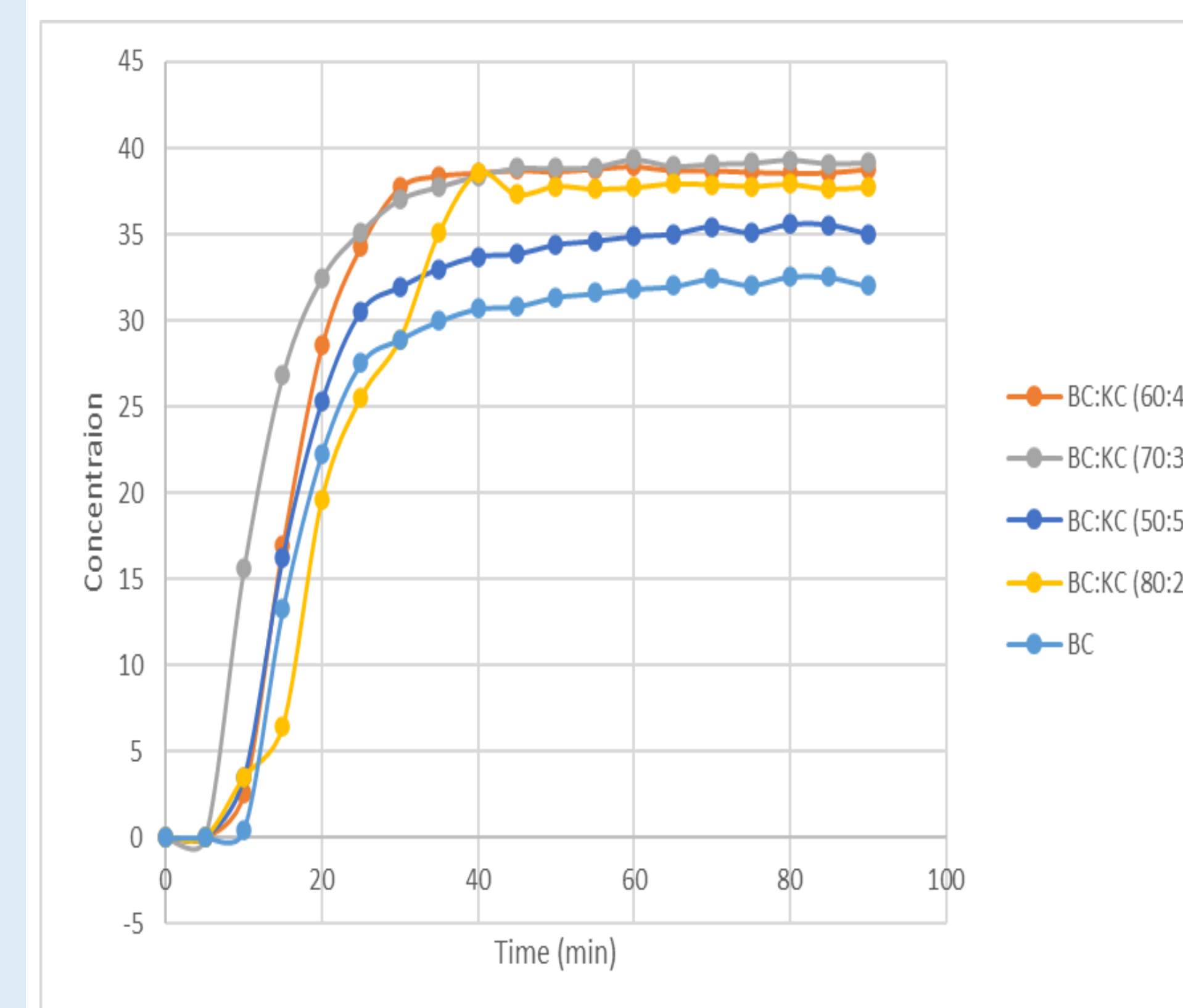
Drug release at pH 1



Drug release at pH 4.5



Drug release at pH 6.8



Drug release at pH 7

The drug release mechanism in pH 1, pH 6.8, and pH 7 follows the Higuchi model, whereby the drug release is facilitated by diffusion mechanism. In pH 4, the drug release follows Korsemeyer-Peppas, whereby several release mechanisms are involved in drug delivery.

These are condition-controlled drug delivery systems. By altering the conditions, the different hydrogel membranes release different concentrations of quetiapine within mimicked conditions of the gastrointestinal tract. It can be used as medical capsules encapsulating pharmaceutical agents to help control release of quetiapine in victims of Alzheimer disease or Amentia which may have difficulty swallowing pills or remembering their time of medication.

Conclusion

In this study, homogenized BC and (κ) carrageenan formed hydrogels with efficient drug delivery. The biomaterial served as a sufficient system for quetiapine due to its high hydrophilic nature. Therefore, the hydrogel strand could be a potential candidate for medical capsules encapsulating pharmaceutical agents, targeting patients suffering from Alzheimer or amentia.

References

1. Gereniu, C. R. N., Saravana, P. S., & Chun, B.-S. (2018). Recovery of carrageenan from Solomon Islands red seaweed using ionic liquid-assisted subcritical water extraction. *Separation and Purification Technology*, 196, 309–317.
2. Salari, M., Sowti Khiabani, M., Rezaei Mokarram, R., Ghanbarzadeh, B., & Samadi Kafil, H. (2019). Preparation and characterization of cellulose nanocrystals from bacterial cellulose produced in sugar beet molasses and cheese whey media. *International Journal of Biological Macromolecules*, 122, 280–288.

Acknowledgement

The School of Agriculture, Geography, Environment, Oceans and Natural Sciences, and the Polymer Research Group is acknowledged.