SURFACE PROPERTIES OF POLYMER FILMS BASED ON GELLAN GUM AND CARRAGEENAN

Katarzyna Noryca, Justyna Kozlowska*

Nicolaus Copernicus University in Torun, Faculty of Chemistry

Gagarina 7, 87-100 Torun, Poland

justynak@umk.pl

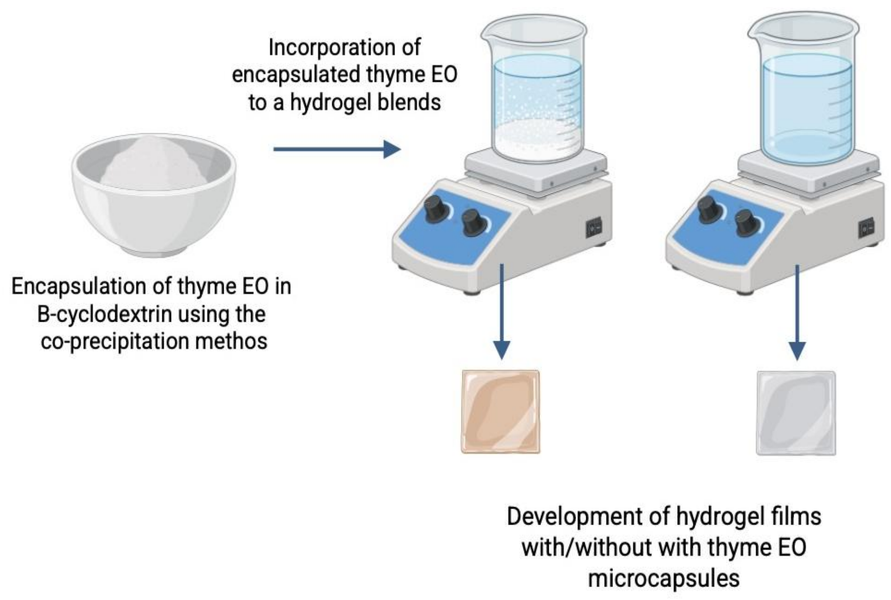
INTRODUCTION

In this study, we developed biopolymeric films composed of gellan gum (GG), carrageenan (KAR) in different ratio (100, 90/10, 50/50 10/90, 100), enriched with encapsulated thyme oil in a β-cyclodextrin. The main objective of the project was to develop and evaluate an innovative formulation to become a substitute for traditional orthodontic wax.

Thyme essential oil is a source rich in bioactive compounds, including thymol and carvacrol. They have been found to display different biological activities – anti-inflammatory, analgesic antiviral and antibacterial properties.

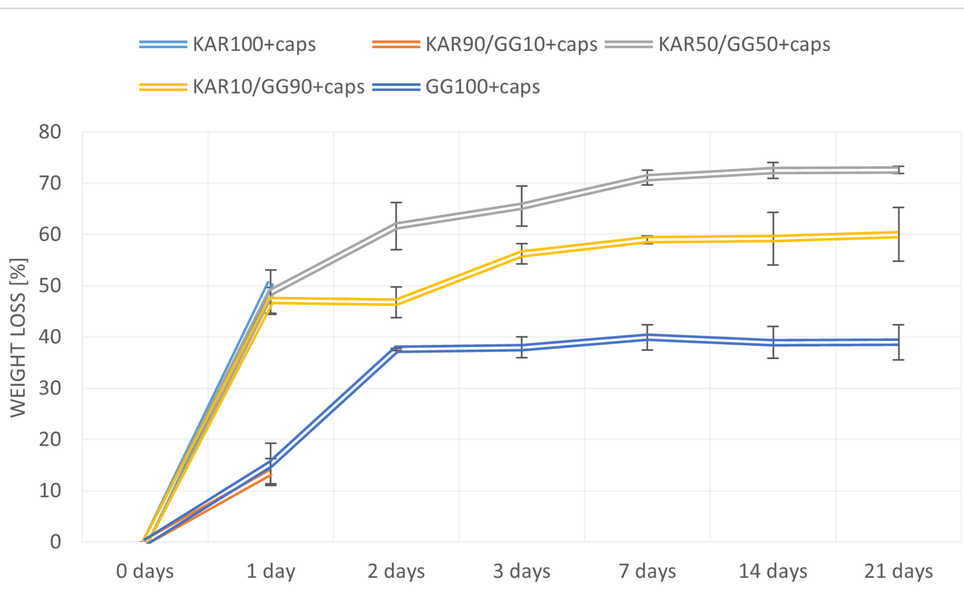
Cyclodextrins (CDs), as natural oligosaccharides, have been well known for their biodegradability, biocompatibility and non-toxicity. Their features allow CDs to form capsules, entrapping lipophilic compounds in their cavities and forming inclusion complexes [1].

Gellan gum (GG) and carrageenan (KAR) are natural polysaccharide polymers commonly used for their functional properties – moisture retention, versatile rheological properties, customizable behaviour, biocompatibility and biodegradability [2,3].

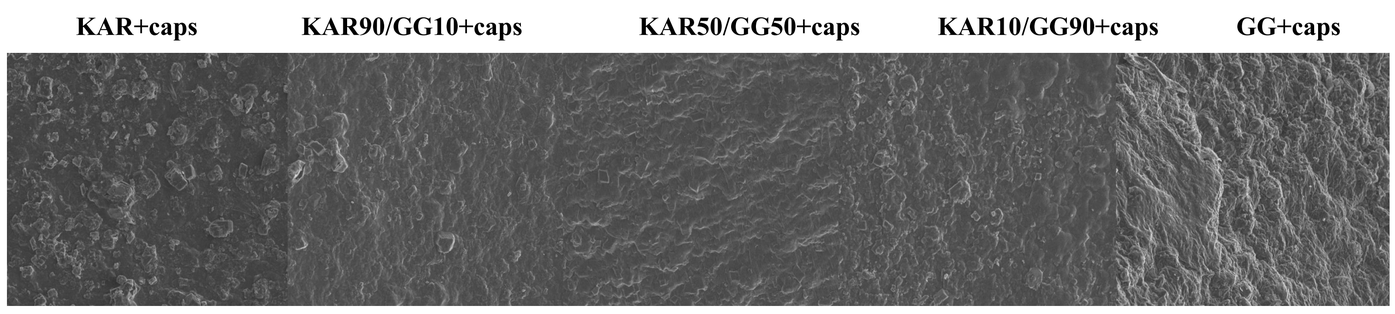


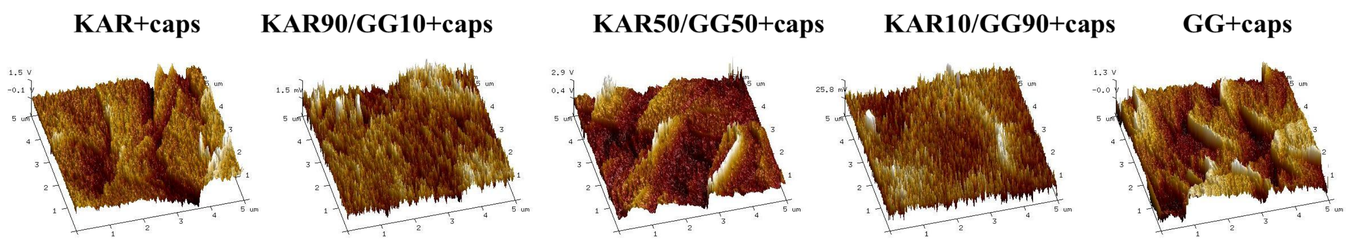
RESULTS

WEIGHT LOSS

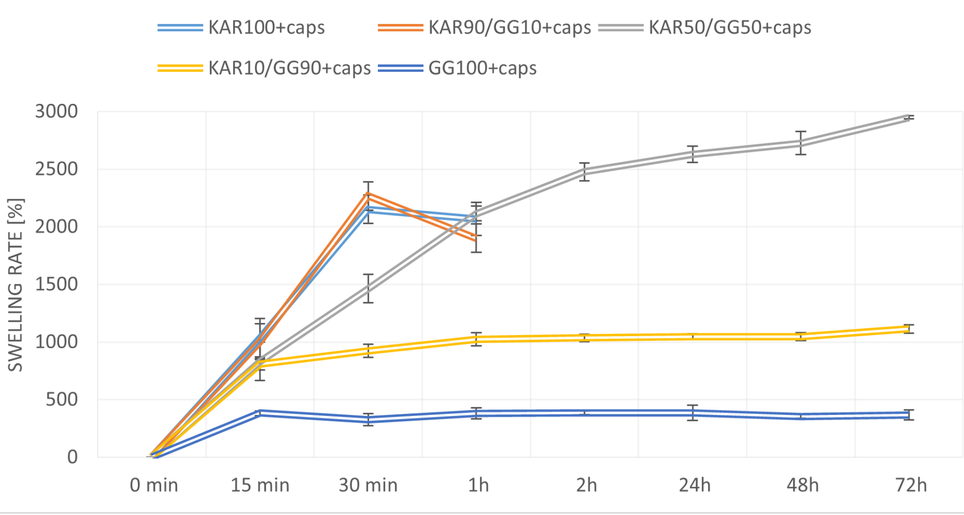


SEM images





SWELLING RATE



AFM Results		
	Ra (nm)	**Rq (nm)**
KAR+caps	7,57±1,09	9,22±1,38
KAR90/GG10+caps	4,08±0,80	4,98±0,95
KAR50/GG50+caps	46,30±15,6	39,00±20,70
KAR10/GG90+caps	5,28±1,22	6,58±1,41
GG+caps	14,75±5,96	18,50±7,80

CONCLUSIONS

- The incorporation of gellan gum enhances the durability of hydrogel films, whereas samples with higher carrageenan content undergo rapid degradation;
- The SEM images reveal significant differences in the surface microstructure – smooth, uniform ares and regions with visible aggregates.
- The topography varied significantly across samples, showing regions with both smooth and pronounced elevations – these heterogeneities likely result from uneven distribution or partial aggregation of the encapsulated complexes within the polymer matrix;
- This structural heterogeneity may influence funtional properties – adhesion to surfaces, mechanical stability of the films.

REFERENCES

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3. Kfoury M, Auezova L, Greige-Gerges H. et al. Encapsulation in cyclodextrins to widen the applications of essential oils. Environmental Chemistry Letters. 2019;17(6),129–143.