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THE EFFECT OF CYCLODEXTRIN ON THE STABILITY OF *Rosa canina* L. NATURAL DEEP EUTECTIC SOLVENT EXTRACT

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ABSTRACT

Rosehip is a valuable source of polyphenols with significant antioxidant potential. This study examined the influence of β-cyclodextrin (β-CD) on the stability of total polyphenol content (TPC) in rosehip extracts prepared using a natural deep eutectic solvent. During storage, TPC decreased in all samples, with greater stability observed at 4°C than at 25°C. The addition of β-CD improved polyphenol retention during storage, particularly at 4 wt%, indicating enhanced protection of phenolic compounds through the inclusion complex formation. These findings indicate that the combined use of β-CD and refrigerated storage effectively enhances the stability of rosehip polyphenols.

INTRODUCTION

Rosehip is traditionally used as an anti-inflammatory medicinal plant with pain-relieving properties [1]. Recent studies have investigated its potential in the treatment of various disorders, including inflammatory diseases, arthritis, diabetes, obesity, and cancer, mainly due to its antioxidant phytochemicals such as ascorbic acid, phenolics, and fatty acids [1,2]. Cyclodextrins are promising compounds for improving the solubility and stability of plant bioactives through inclusion complex formation [3]. Cyclodextrin-based extraction is considered an emerging green technology for efficient extraction and improved utilization of polyphenols from plant materials [4-6].

EXPERIMENTAL

Dried and ground rose hips were obtained from the Institute for Medicinal Plants Research ”Dr Josif Pančić”, Serbia. The rosehip extracts were prepared employing an ultrasound probe Sonopuls (Bandelin, Germany) and natural deep eutectic solvent (betaine and citric acid with 50% water) in the absence or presence of β-cyclodextrin (β-CD, 2 and 4 wt%), the solid-to-solvent ratio of 1:100 g/mL, extraction time of 12 min, and amplitude of 43%. The total polyphenol content (TPC) was determined in all samples using the modified Folin-Ciocalteu assay [7] on the 1st and 30th days after storage at 4°C and 25°C.

RESULTS AND DISCUSSION

Table 1 presents the total polyphenol content (TPC) of rosehip extracts prepared using a natural deep eutectic solvent, with and without β-CD, monitored over 30 days of storage at 4°C and 25°C.

Table 1. Total polyphenol content (TPC) in rosehip extract with a natural deep eutectic solvent in the absence and presence of β-cyclodextrin (β-CD).

Sample	Storage conditions	TPC (mg GAE*/mL)	
		1st day	30th day
Extract without β-CD	4°C	1.09±0.07	1.04±0.08
	25°C		0.98±0.05
Extract with 2 wt% β-CD	4°C	1.07±0.10	1.01±0.01
	25°C		0.97±0.05
Extract with 4 wt% β-CD	4°C	0.84±0.09	0.92±0.11
	25°C		0.88±0.15

*GAE, gallic acid equivalent.

The TPC of rosehip extracts prepared using a natural deep eutectic solvent showed only minor variations during storage and in the presence of β-CD. In the absence of β-CD, TPC slightly decreased from 1.09±0.07 mg GAE/mL on the 1st day to 1.04±0.08 mg GAE/mL after 30 days at 4°C, while a more pronounced reduction was observed at 25°C (0.98±0.05 mg GAE/mL). A similar trend was observed for extracts containing 2 wt% β-CD, where TPC remained relatively stable during storage at 4°C (1.07±0.10 to 1.01±0.01 mg GAE/mL), while a decrease was recorded at 25°C (0.97±0.05 mg GAE/mL). In contrast, the addition of 4 wt% β-CD resulted in lower initial TPC values but generally maintained or slightly improved stability over the storage period, particularly at 4°C (0.84±0.09 to 0.92±0.11 mg GAE/mL). This suggests that higher cyclodextrin concentration may enhance the formation of inclusion complexes with phenolic compounds, thereby improving their resistance to degradation and/or oxidation during storage. Namely, storage temperature had a stronger effect on phenolic stability than β-CD concentration, indicating partial degradation or structural

transformations of phenolic compounds under room temperature conditions. Similar findings have been reported for rosehip-derived polyphenols, where storage temperature significantly affected the stability and retention of bioactive compounds [8,9].

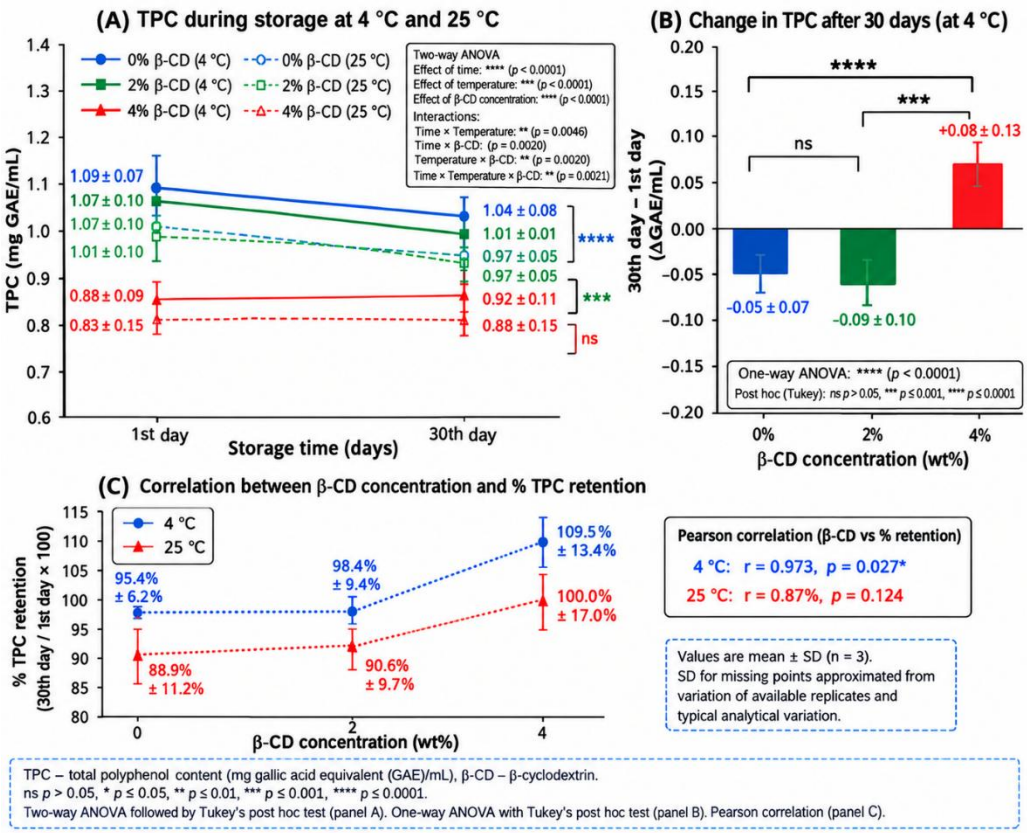


Figure 1. Changes in total polyphenol content (TPC) and correlation analysis as affected by storage temperature and β-cyclodextrin (β-CD) concentration.

Figure 1 shows that storage temperature and β-CD concentration influence TPC during storage. Although TPC decreased within all samples, formulations stored at 4°C showed greater stability than those at 25°C. The addition of β-CD further improved polyphenol retention, with 4 wt% β-CD providing the highest stability, while samples without β-CD showed the greatest losses. Correlation analysis confirmed a significant positive relationship between β-CD concentration and TPC retention at 4°C. Namely, β-CD encapsulation combined with refrigerated storage effectively improved polyphenol stability.

CONCLUSION

This study investigated the effect of β-CD and storage conditions on the stability of polyphenols in rosehip extracts obtained using ultrasound-assisted extraction with a natural deep eutectic solvent. The addition of β-CD improved the stability of polyphenols during storage, while refrigerated conditions (4°C) significantly enhanced total polyphenol content (TPC) retention compared to room temperature. The most pronounced stabilizing effect was observed at 4 wt% β-CD, suggesting efficient inclusion complex formation with phenolic compounds. These findings indicate that combining β-CD encapsulation with low-temperature storage is a promising strategy for preserving bioactive compounds in plant extracts.

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