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The effect of the emulsifier on the extraction process of flavonoids and carotenoids from *Hypericum maculatum* with a system of different polarity extractants

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The effect of the emulsifier on the extraction process of flavonoids and carotenoids from *Hypericum maculatum* with a system of different polarity extractants

Abstract: The composition of *Hypericum maculatum* herb contains a wide range of biologically active compounds: flavonoids (hyperoside, rutin, quercetin), tannins, carotenoids, essential oil, ascorbic acid and others.
Two-phase extraction by a system of solvents of different polarity allows for two extracts containing both polar and lipophilic bioactive compounds from one raw material in one technological cycle.
The authors investigated the effect of the non-polar extractant (hexane and almond oil) type and the emulsifier (Tween 80) on the effectiveness of bioactive substances two-phase extraction from the *Hypericum maculatum* herb. Tween 80 is a non-ionic surfactant from the group of polysorbates. The optimal content of Tween 80 in the extractant system was 1 ml per 1 g of raw material. The ratio of raw material: polar phase: non-polar phase was 1: 10: 10. The quantitative content of flavonoids was determined in the studied polar phases by spectrophotometry, and carotenoids in non-polar phases.
It was found that flavonoids were more efficiently extracted with a system of extractants of 70% ethanol: almond oil. The addition of Tween 80 significantly increased the release of flavonoids and carotenoids during the extraction process.

Keywords: *Hypericum maculatum* herb; flavonoids; carotenoids; Tween 80; two-phase extraction

Introduction

Hypericum maculatum herb is a promising raw material for creating extracts with antioxidant, venotonic, regenerating effects. It contains natural bioactive substances: flavonoids, carotenoids, essential oil, water-soluble vitamins. The two-phase system of different polarity extractants is necessary to optimize the extraction method, which provides simultaneous production of polar and lipophilic substances extracts.

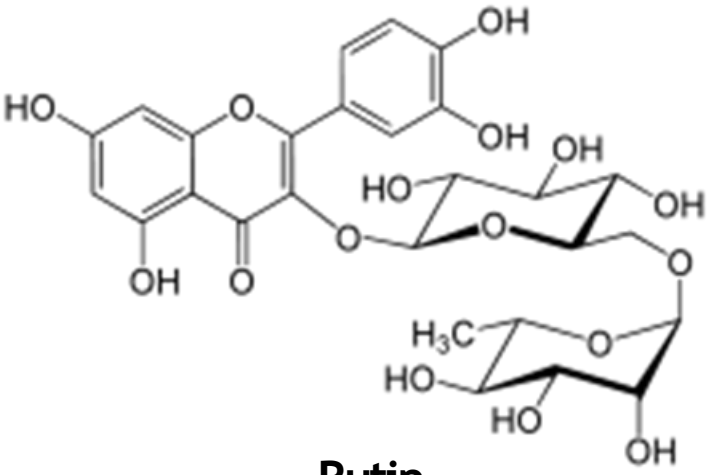
Addition of emulsifier Tween 80 used to increase the efficiency of two-phase extraction.

Hypericum maculatum herb contains a complex of biologically active substances of different polarity:

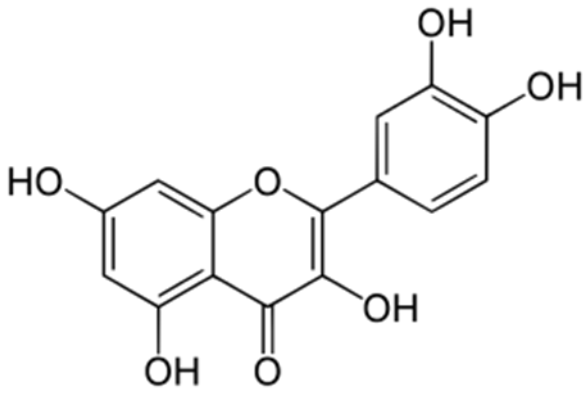
- ✓ flavonoids: rutin, quercetin up to 5 - 7%;
- ✓ carotenoids (about 50 mg %);
- ✓ essential oil (up to 3%);
- ✓ hypericin (up to 0.4%);
- ✓ water-soluble vitamins

Author: Jan Kops - www.BioLib.de, public domain, https://commons.wikimedia.org/w/index.php?curid=18926034

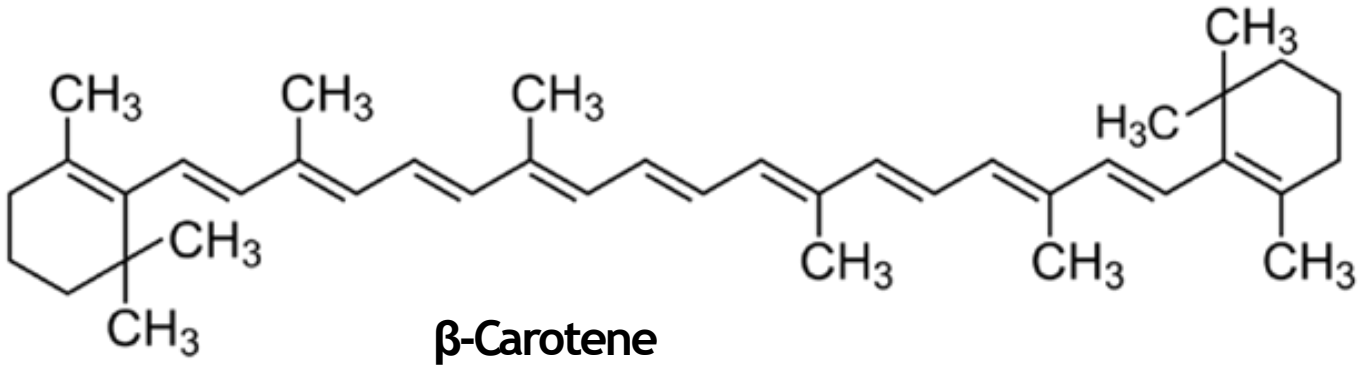
Biologically active substances of *Hypericum maculatum*



Rutin

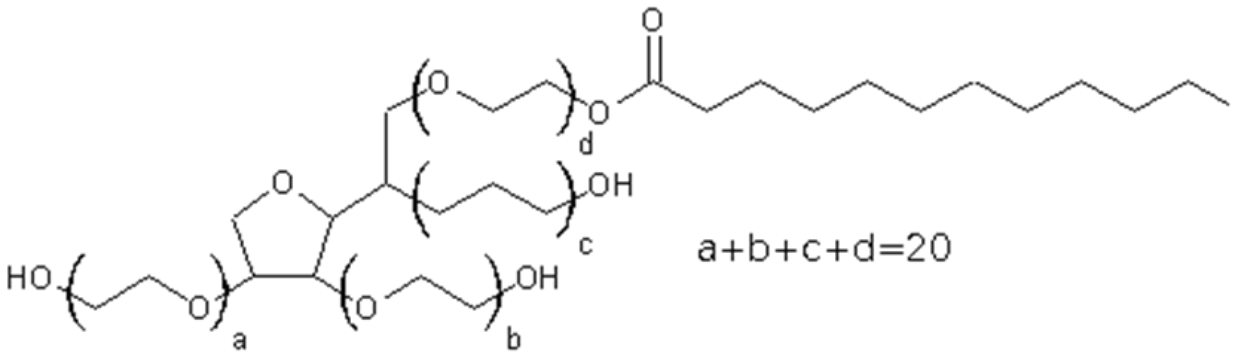


Quercetin



β-Carotene

TWEEN 80



Tween 80 ($C_{64}H_{26}O_{124}$) is a polyoxyethylene sorbitan monooleate. Non-ionic surfactant from the polysorbate group.

It is used in the cosmetic, food and pharmaceutical industries as an emulsifier, solubilizer, and stabilizer of essential oils.

Results and discussion

Investigation of the emulsifier effect on the efficiency of two-phase extraction

Experimental two-phase extractant systems

- **Two-phase extractant system № 1 - 70% ethanol / hexane**
- **Two-phase extractant system № 2 - 70% ethanol / almond oil**
- **Two-phase extractant system № 3 - 70% ethanol / almond oil / Tween 80**

Results and discussion

Scheme for the preparation and study of extracts

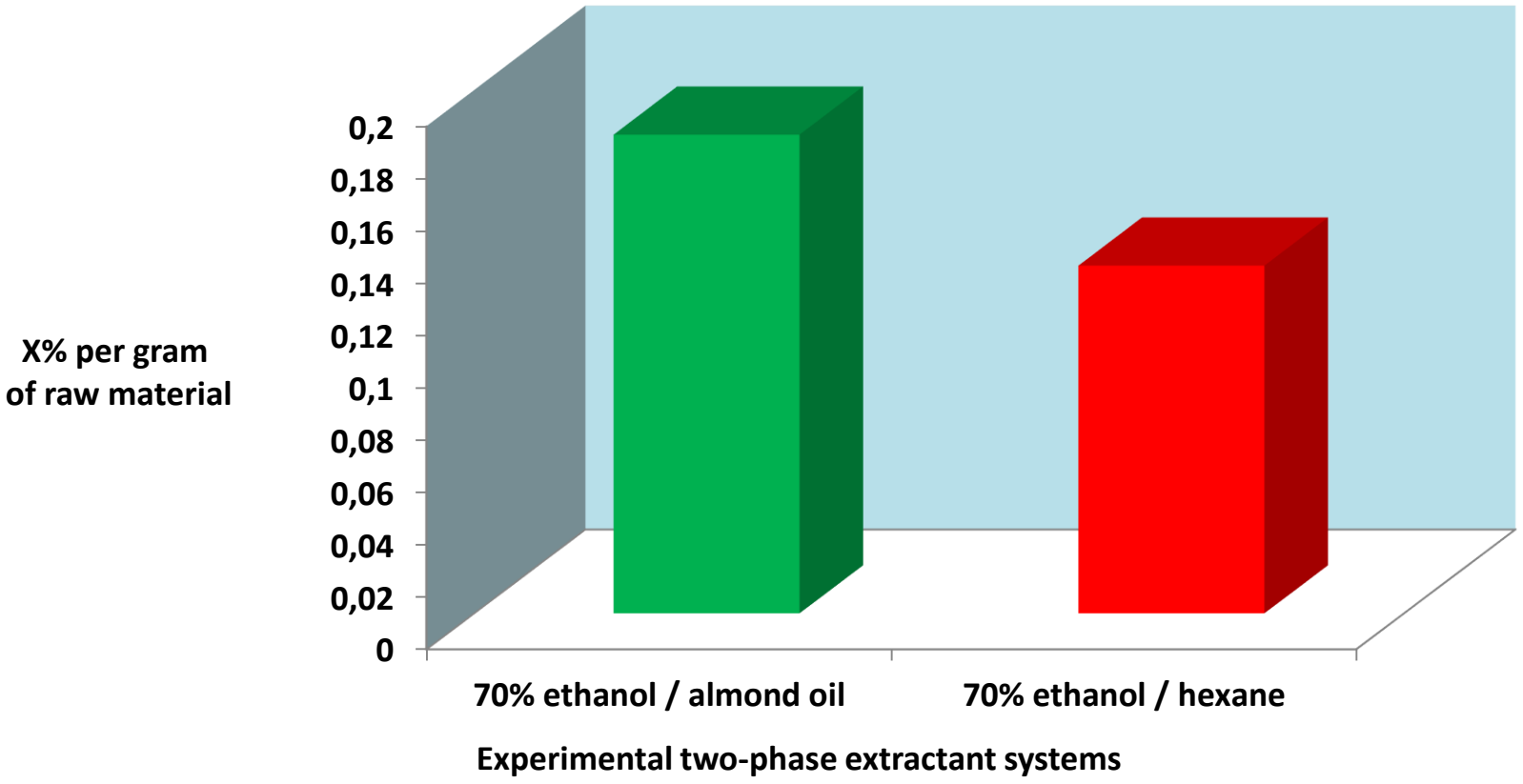
The raw material portion was soaked in 70% ethanol for 1 hour at t = 20 ° C in a ratio of 1:10

At the end of the swelling of the raw material were added appropriate non-polar phases and carried out two-phase extraction for 1 hour

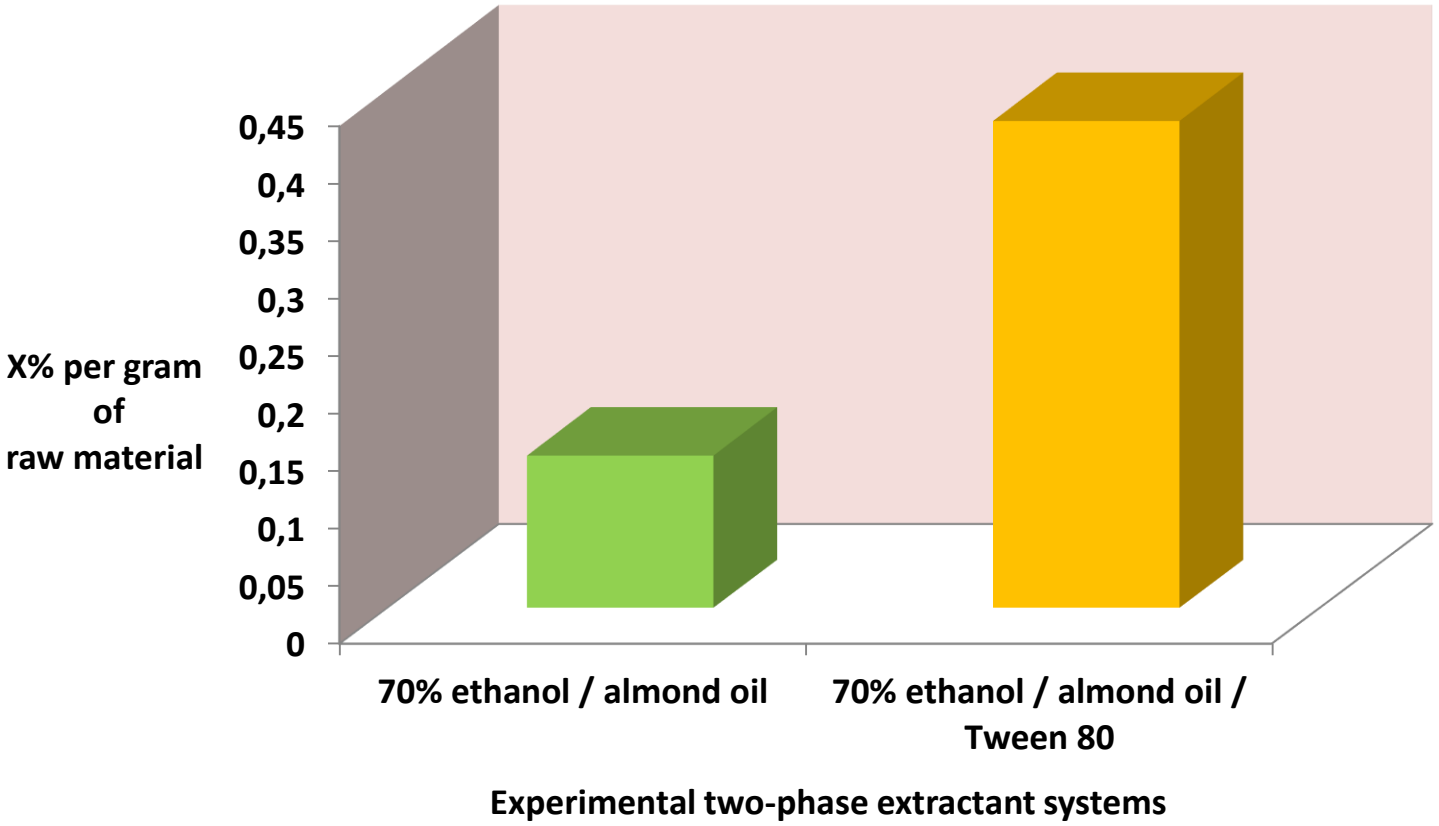
The obtained aqueous-alcohol and non-polar phases were separated in a separating funnel.

The quantitative content of carotenoids in non-polar phases was determined, and in the aqueous-alcohol phase the flavonoids content was determined

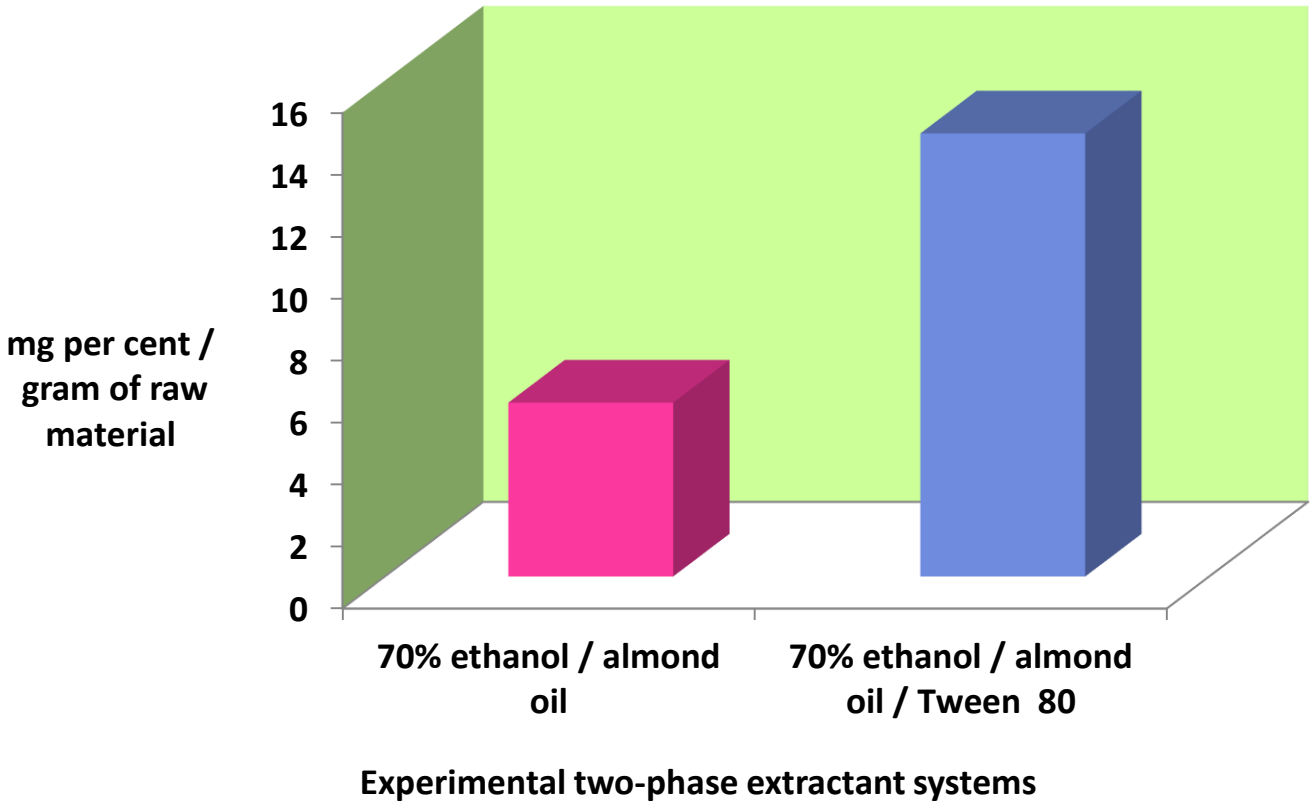
Extraction of flavonoids under the conditions of a two-phase extractant systems



Extraction of flavonoids in the presence of Tween 80



Effect of Tween 80 on carotenoid extraction efficiency



Conclusions

- ✓ The addition of the emulsifier to a two-phase extractant system increases the solubility of lipophilic bioactive substances in *Hypericum maculatum* herb particles and enhances their subsequent diffusion into the extractant.

- ✓ Tween 80 in the system of extractors with 70% ethanol : almond oil significantly increases the extraction level of rutin and carotenoids.

Acknowledgments

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