

COMPARISON OF GASTROINTESTINAL STABILITY OF ISOTHIOCYANATES FROM *TROPAEOLUM MAJUS* L.

USING *IN VITRO* AND *EX VIVO* DIGESTION METHODS

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INTRODUCTION

The plant *Tropaeolum majus* L. is a member of the Tropaeolaceae family which belongs to the order Brassicales. The plant is edible and in biological terms is considered valuable due to the presence of compounds called glucosinolates whose degradation products (isothiocyanates) have a wide range of biological activities (anticancer, antimicrobial, antifungal, anti-inflammatory...).

The aim of this research was the extraction of volatile compounds (isothiocyanates) from *Tropaeolum majus* L. seeds using microwave assisted extraction (MAE) and the evaluation of their gastrointestinal stability and bioaccessibility using *ex vivo* and *in vitro* digestion methods.

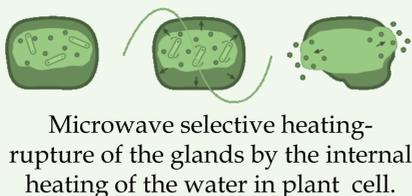
MATERIALS AND METHODS

Tropaeolum majus L. seeds were pulverised before isolation of volatile compounds. Microwave assisted extraction (MAE) was done using ETHOS X apparatus. The analysis of isothiocyanates content in essential oil was made by GC/MS technique. Two simulated digestion methods were used for this study - the *ex vivo* method with human digestive enzymes (gastric and duodenal) and the *in vitro* digestion method based on the use of commercial enzymes. The degree of stability and bioaccessibility of isothiocyanates from the essential oil of the *Tropaeolum majus* L. seeds was determined using the GC-MS/MS technique.



Figure 1. MAE

- Solvent: distilled water
- Power: 500 W
- Temperature: 98 °C
- Time: 30 minutes



Microwave selective heating-rupture of the glands by the internal heating of the water in plant cell.



Figure 2. GC-MS analysis

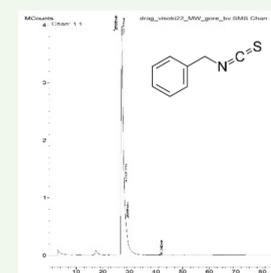


Table 1. Chemical composition of volatile compounds in *Tropaeolum majus* L. seeds

Volatile compounds in <i>Tropaeolum majus</i> L.	Retention time, min	Content, %
benzyl-nitrile	17,50	0,80
benzyl-isothiocyanate (BITC)	27,11	97,81

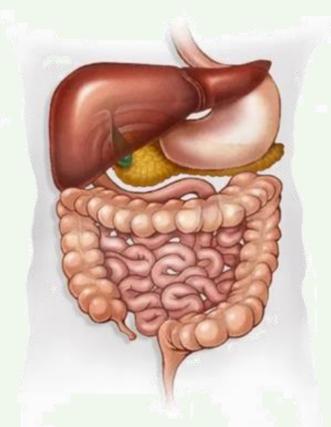


Figure 3. Human vs. commercial digestive enzymes (gastric and duodenal)

GASTRIC PHASE

- Simulation of pH value in stomach of an adult
- pH 2,5 - 3
- Duration of gastric phase: 60 min
- Temperature: 37 °C

INTESTINAL PHASE

- Simulation of pH value in the intestines of an adult
- pH 6,5 - 7
- Duration of intestinal phase: 120 min
- Temperature: 37 °C

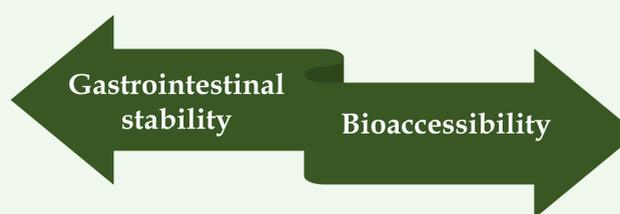
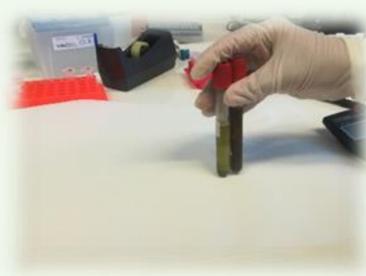


Figure 4. GC-MS/MS analysis

Table 2. Concentration of BITC before and after *ex vivo* and *in vitro* digestion methods

Concentration of BITC in essential oil of <i>Tropaeolum majus</i> L. seeds before and after digestion	Concentration (mg/ml)
BITC concentration before digestion	2,9542
BITC concentration after gastric phase (<i>ex vivo</i>)	0,3003
BITC concentration after intestinal phase (<i>ex vivo</i>)	0,6823
BITC concentration after gastric phase (<i>in vitro</i>)	0,6652
BITC concentration after intestinal phase (<i>in vitro</i>)	0,6387

DISCUSSION AND CONCLUSION

The use of microwave assisted extraction (MAE) significantly decreases extraction time and it is appropriate manner to obtain volatile compounds of *Tropaeolum majus* L. seeds. GC/MS analysis showed that essential oil from *Tropaeolum majus* L. seeds contains benzyl-isothiocyanate as a dominant compound (97,81%). GC-MS/MS analysis showed that BITC is more stable after the intestinal phase using human (*ex vivo*) and commercial digestive enzymes (*in vitro*) thanks to the favorable pH. Using human gastric juices from the stomach leads to greater breakdown of the BITC.