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OPTIMIZATION OF ULTRASOUND-ASSISTED EXTRACTION OF SOLANESOL FROM TOBACCO WASTE

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INTRODUCTION

Solanesol is long-chain polyisoprenoid alcohol with nine isoprene units present in solanaceous crops, primarily in tobacco, and in potatoes, tomatoes, eggplants and peppers. It represents an important pharmaceutical intermediate for the synthesis of ubiquinone drugs such as coenzyme Q10 and vitamin K2. Besides that, solanesol possesses antibacterial, antifungal, antiviral, anticancer, anti-inflammatory and anti-ulcer activities. Considering the composition of solanesol which includes nine isoprene units, the synthesis of this compound is difficult; so it is therefore mainly extracted from tobacco plants. According to many authors, the content of solanesol in tobacco leaves is 0.3-3.0%.

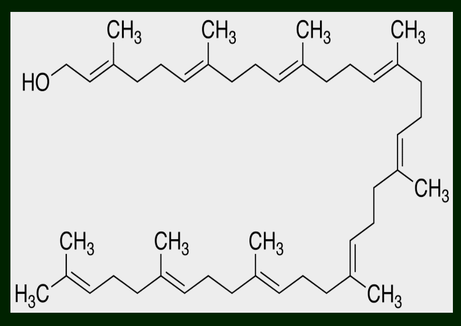

Fig.1 Solanesol structure

PLANT MATERIAL

Tobacco leaves and 3 types of tobacco waste (machine crumbs. dust and rib) were obtained from tobacco factory „Fabrika Duhana Sarajevo" Bosnia and Herzegovina in 2018. Before the extraction, the plant material was grounded using laboratory mill.

a) b) c) d)

Fig.2 a) tobacco leaves b) dust c) rib d) machine crumbs

UTRASOUND-ASSISTED EXTRACTION

Ultrasound-assisted extraction (UAE) from different fractions of tobacco waste and leaves was performed. The influence of extraction temperatures (33.78, 40, 55, 70, 76.2 °C) and time (8.78, 15, 30, 45, 51.21 min) on solanesol content in obtained extracts was determined. Extraction was improved by adding NaOH into the extraction solvent in concentration of 0.05M. Extraction was performed in ultrasound-bath Elma, Elmasonic P 70 H, with frequency 37 kHz and power 50W. Afterwards, obtained extracts were filtered through filter paper and stored at 4°C until HPLC analysis.

DETERMINATION OF SOLANESOL BY HPLC

Before HPLC analysis, all sample extracts were filtered trough 0.2 µm PTFE filter. The content of solanesol was determined using reversed-phase High Performance Liquid Chromatography (Agilent technologies 1260 Infinity II) following condition:mobile phase: isopropanol-methanol (40:60 v/v), injection volume 20µl, flow rate 0.5 ml/min and pressure 39.6 bar. Used column was zorbax Eclipse Plus C18 (particle size 250 mm x 4.6mm, 5 µm) on room temperature. Analysis was monitored at 214 nm on DAD detector.

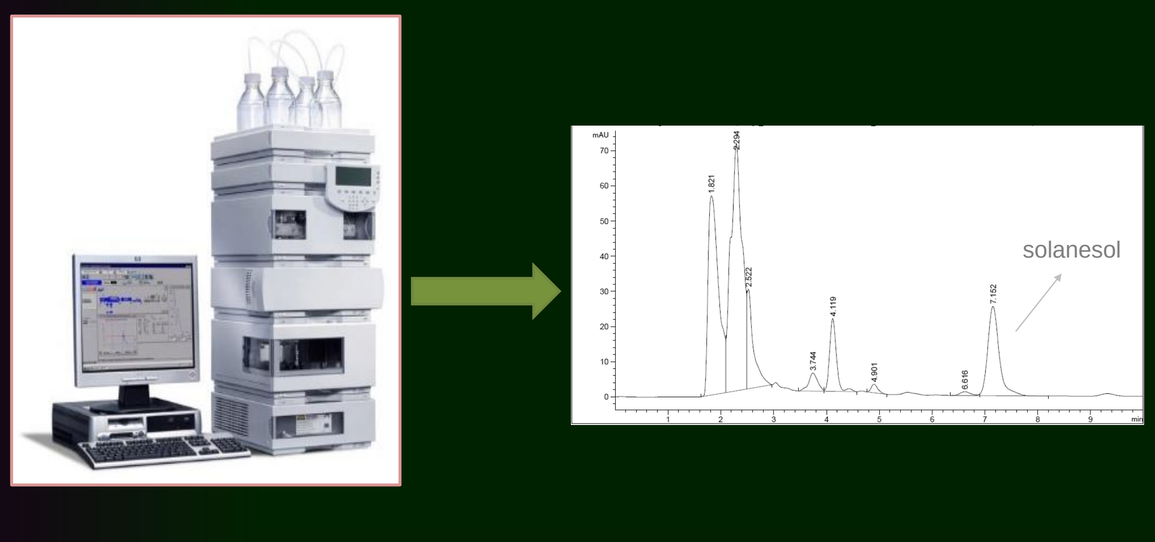

Fig.3 HPLC determination and obtained Chromatogram (dust, run 10)

OPTIMIZATION

Optimization of ultrasound assisted extraction was performed using response surface methodology (RSM) based on extraction parameters (temperature and time) as independent variables and their influence on solanesol content as a response.

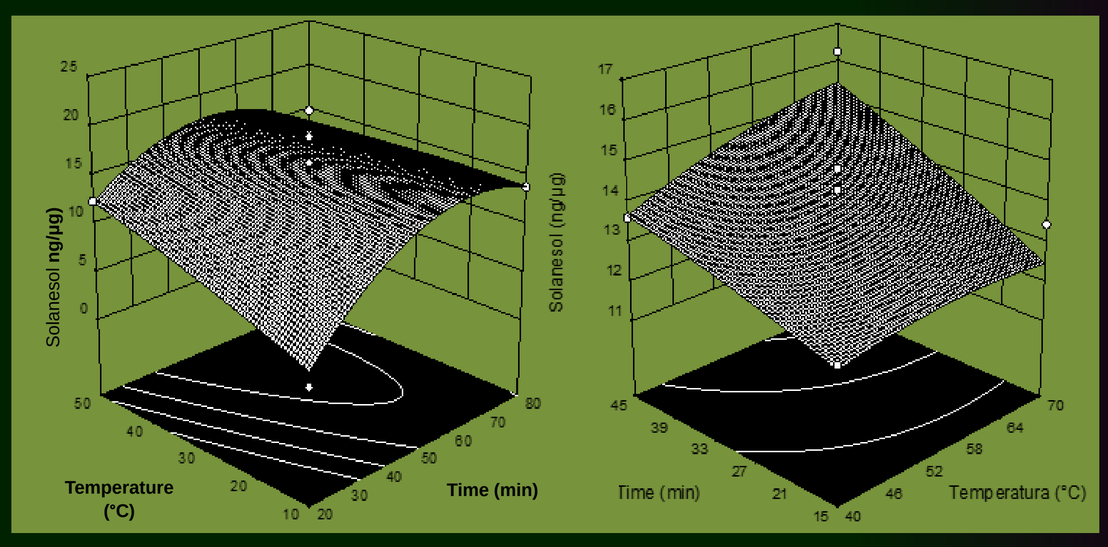

Fig.4 Three –dimensional plots for the solanesol as a function of different UAE parameters

RESULTS

Table 1. Solanesol content in obtained extracts at different UAE parameters

RUN	UAE CONDITIONS		SOLANESOL (ng/µg)			
	Temperature (°C)	Time (min)	Leaves	Machine crumbs	Dust	Rib
1	**70**	**45**	55.16	16.25	14.8	6.12
2	**55**	**51.21**	59.89	14.82	13.77	5.42
3	**55**	**30**	48.51	14.84	12.84	5.39
4	**55**	**30**	40.62	14.32	12.59	5.38
5	**55**	**30**	45.61	13.50	12.58	5.20
6	**76.22**	**30**	59.87	12.94	18.28	5.67
7	**55**	**8.79**	41.64	11.44	10.64	5.75
8	**33.79**	**30**	29.49	12.73	10.94	5.17
9	**70**	**15**	45.74	13.45	8.17	5.54
10	**40**	**15**	39.87	12.32	9.65	5.03
11	**40**	**45**	47.37	13.63	13.27	5.43
12	**55**	**30**	53.95	13.35	12.20	6.27
13	**55**	**30**	44.62	12.98	9.28	5.55

CONCLUSION

Solanesol was successfully extracted from tobacco leaves and waste using ultrasound-assisted extraction. The results showed that concentrations of solanesol in different types of wastes extract were between (5.03 - 18.28 µg/mL). In comparison with leaves, tobacco waste extracts contained lower concentrations of solanesol. Ultrasound extraction conditions had statistically significant influence on the content of solanesol.

ACKNOWLEDGEMENT

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