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Salvia sclarea essential oil: Antioxidant capasity, kinetic and thermodynamic investigation

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ABSTRACT

Different investigations at Clary sage (Salvia sclarea L.) essential oil were presented. Antioxidant properties of the oil were evaluated by four different methods – DPPH, ABTS, FRAP, and CUPRAC. The oxidative stability of clary sage essential oil was provided at two temperatures 6 and 25°C. Using the Arrhenius equation the rate constant of the oxidative process was determined. Activating parameters as activation energy (Ea), enthalpy of activation (ΔH*), the entropy of activation (ΔS*), and Gibbs free energy of activation (ΔG*) were calculated.

METHODOLOGY OF THE INVESTIGATION

Salvia sclarea L. (family Lamiaceae) was used to obtain a clary sage essential oil. The oil is isolated by steam distillation of flowering tops and foliage.
In the investigation of this work clary sage essential oil distribution of components of functional groups in relation to the total oxygen-containing components is shown in Fig. 1. The esters dominated in the oil (65.08%) with the main compound linalyl acetate (40.31% and geranyl acetate (4.63%), followed by alcohols (21.63%) with the main component linalool (22.72%) and α-terpineol (7.74%), oxides (0.64%), and aldehydes (0.56%).

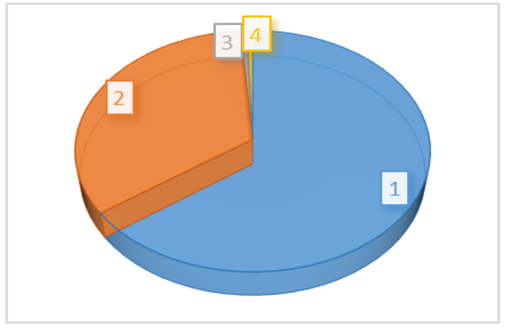

Fig. 1. Group of oxygenated components in clary sage weed essential oil, %.

Table 1. Antioxidant activity

Clary sage essential oil	Total phenolic content, mg GAE*/mL	Antioxidant activity, mM TE**/mL			
		DPPH	*ABTS*	*FRAP*	*CUPRAC*
	0.014 ± 0.001	0.339 ± 0.008	6.006 ± 0.004	0.114 ± 0.020	2.079 ± 0.057

* Gallic acid equivalent; ** Trolox® equivalent

More investigations of this oil were provided by the DPPH method. We consider that there is a correlation between the antioxidant activity of clary sage essential oil and its chemical composition.

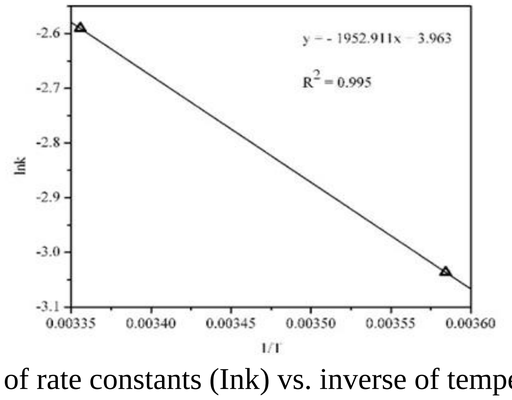

Fig. 2. Natural ln of rate constants (Ink) vs. inverse of temperature (1/T) for clary sage essential oil

Fig. 2 presents the coefficients of regressions between the natural ln of rate constants versus the reciprocal of temperature for clary sage essential oil. After linear dependence between them the high regression coefficient R^2 was obtained.

CONCLUSIONS

In this work, the clary sage (*S. sclarea*) essential oil was investigated. The stability of this oil was determined after the evaluation of the antioxidant properties and influenced by the temperature variables. The antioxidant properties were evaluated by using different methods.. After the experiment classical temperature dependence was observed. The rate constant increased with increased temperature. On the storage of clary sage essential oil for 48 days, the higher temperature and the longer the storage time will lead to decrease of oxidative stability in the system.