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HEATING EFFECTS ON SOME QUALITY CARACTERISTICS OF DATE SEED OIL

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Abstract: Effects of heating on some quality characteristics of date seed oil from two cultivars (Deglet Nour and Allig) have been investigated using an accelerated test in Rancimat system (T = 100 °C, Air flow = 15 L / h). Fatty acid, viscosity, absorptivity at 232 nm and 270 nm, colour and total melting enthalpy of Deglet Nour seed oil were less changed comparing to that of Allig seed oil, because the former contained a higher amount of total phenolic compounds (525.87 µg / g against 215.32 µg / g) and a lower content in unsaturated fatty acids. Viscosity and absorptivity at 232 nm and at 270 nm increased rapidly after reaching the oxidation induction time. Differential scanning calorimetry (DSC) melting profiles of date seed oils were also changed under heating in Rancimat. Melting enthalpies seemed to be constant during initial stages of Rancimat treatment and then reduced after the induction time reached. The obtained data shows that date seed oils were resistant to thermal treatment during a long period (~ 30-40 h). This may indicate that they could bear thermal treatments that could be applied in refining procedure or in culinary treatment such as frying and cooking conditions. We could also expect that they may have a good shelf life and could be safely conserved.

Keywords: date seed oil; heating; oxidation; quality characteristics

Introduction: Rancimat method was the most frequently cited for the determination of the resistance of fat and oil to oxidation. The stability of fatty substances was determined in accelerated and standard controlled conditions with a dry air flow and high temperature. The system allowed automatic evaluation of the oxidation induction time but could be also used to follow physico-chemical characteristics changes during thermal treatment of fats and oils, in well controlled conditions.

The use of date seed oil for industrial applications or for culinary preparations could necessitate its exposure to high temperature such as refining operation, frying, cooking conditions, etc. These thermal treatments could lead to changes in quality characteristics of oils. The aim of this present work was to study physico-chemical changes of date seed oils during heating. Following up heat-induced physico-chemical characteristics changes of date seed oils, we could also indicate until what stage they could bear this treatment.

Table 1: Oxidation induction time (h) and total phenols (µg GAE / g) of seed oil from the two studied date cultivars.

	Cultivars	
	Deglet Nour	Allig
Induction time	44.60 ± 0.55	37.86 ± 0.26
Total phenols	525.87 ± 13.92	215.32 ± 9.27

All values given are mean of six determinations.

Table 2: Fatty acid composition (%) of date seeds oils.

Fatty acid	Deglet Nour		Allig	
	NT	T	NT	T
SAFA	41.25 ± 0.06	40.82 ± 1.06	26.98 ± 0.66	68.27 ± 1.16
MUFA	41.46 ± 1.10	35.20 ± 1.96	39.23 ± 1.15	29.16 ± 1.72
PUFA	14.10 ± 1.02	3.55 ± 0.52	21.77 ± 0.68	2.19 ± 1.03

All values given are mean of three determinations. NT: non treated oil, T: oil treated in Rancimat at 100 °C for 48 h with an air flow of 15 l / h. SAFA: Saturated fatty acids, MUFA: monounsaturated fatty acids, PUFA: polyunsaturated fatty acids.

Table 3: CieLab Coordinates (L^*, a^*, b^*) of date seeds oils.

Colour parameters	Deglet Nour		Allig	
	NT	T	NT	T
L^*	68.52 ± 0.20	69.76 ± 0.21	69.28 ± 0.30	71.41 ± 0.25
a^*	-1.87 ± 0.12	-1.55 ± 0.02	2.43 ± 0.18	2.18 ± 0.04
b^*	9.09 ± 0.07	9.26 ± 0.09	10.25 ± 0.24	9.74 ± 0.10
ΔE*	51.27 ± 0.57		55.25 ± 0.31	

All values given are mean of twelve determinations. NT: non treated oil, T: oil treated in Rancimat at 100 °C for 48 h with an air flow of 15 l / h.

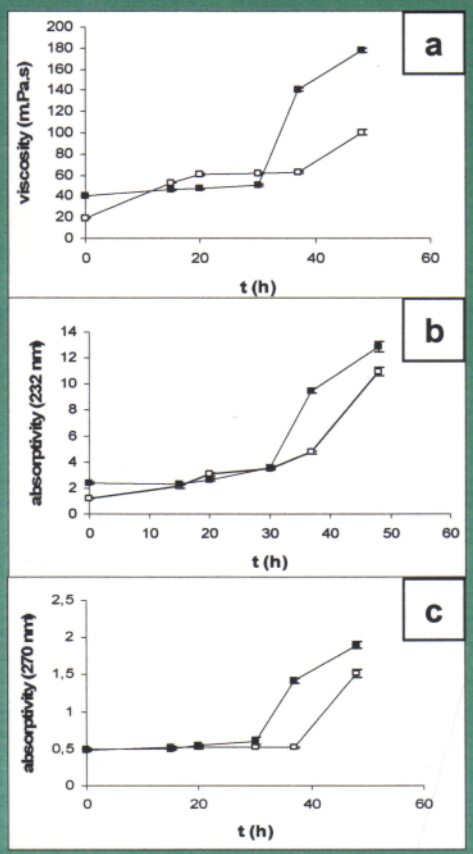

Figure 1: Changes in viscosity (a) and in absorbtivity at 232 nm (b) and at 270 nm (c) during Rancimat treatment of date seed oils. (○): Deglet Nour, (●): Allig.

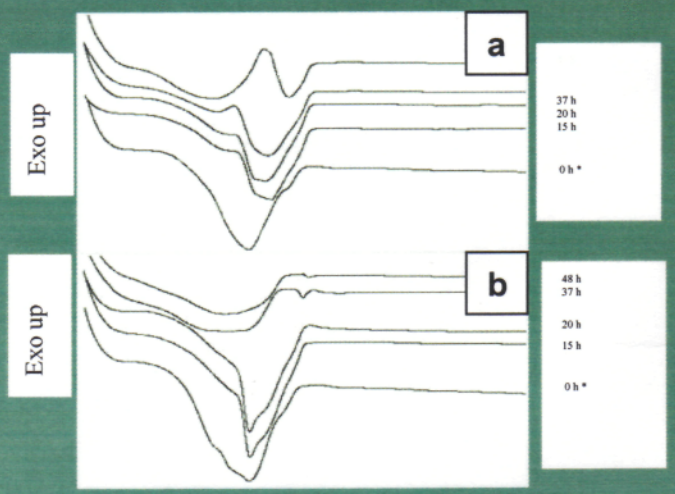

Figure 2: Melting thermograms of date seed oil samples with different Rancimat treatment time (0 h - 48 h). (a): Deglet Nour, (b) : Allig.

Table 4: Melting enthalpies (J / g) of date seed oil samples with different Rancimat treatment time.

	Melting enthalpies (J / g)	
Time (h)	Deglet Nour	Allig
0*	67.50 ± 0.72	71.57 ± 0.06
15	66.92 ± 0.73	69.90 ± 1.17
20	62.76 ± 1.76	59.81 ± 2.23
37	52.72 ± 2.06	51.05 ± 1.55
48	52.50 ± 0.23	50.70 ± 1.76

All values given are mean of three determinations.

Conclusions: The two studied date seed oils presented high oxidation stability and a considerable total phenol contents. Results show that both studied date seed oils could resist thermal treatments that may be applied during frying, cooking conditions or during refining processes. Date seed oils were resistant to thermal treatment during a long period (~ 30-40 h) regarding the high stability of some of their quality parameters. So, we could predict that they may have a good shelf-life and then could be stored safely during a long period. This hypothesis will be supported by the study of the behaviour of date seeds oils during storage at ambient temperature.