

Application Bulletin



Of interest for:
Food, pharmaceuticals, cosmetics

No. 232/1 e

Determination of antioxidant activity by the Rancimat method

<p>Summary</p>	<ul style="list-style-type: none"> ▶ For years, the Rancimat has well proved its worth for the determination of the oxidative stability of oils and fats. The same apparatus allows the selection of synthetic and natural antioxidants. Operation of the Rancimat is extremely simple. It works automatically and neither expensive nor toxic chemicals nor time-consuming titrations are needed. Up to six samples can be analyzed together at the same time. ▶ The "antioxidative activity index" (AI) was introduced as a criterion for the effectiveness of antioxidants. This Bulletin describes the determination in detail, including the sample preparation, the actual analysis and the calculation. A table lists the AIs of 16 different antioxidants.
<p>Apparatus</p>	<ul style="list-style-type: none"> ▶ 2.679.001X Rancimat ▶ Micropipettes, volumetric flasks, balance
<p>Reagents</p>	<ul style="list-style-type: none"> ▶ Pure lard, without any additives ▶ Dist. or deion. water ▶ Antioxidants or their solutions/dilutions
<p>Methods</p>	<ul style="list-style-type: none"> ▶ The temperature calibration of the Rancimat is performed at the same temperature and with the same air flow rate as used with the samples, but with 2.5 g paraffin oil or glycerol. ▶ Without contaminating the side walls, 2.5 g of the lard/antioxidant mixture are weighed into the reaction vessels. The fraction of antioxidants in the sample should be 0.02% (2 mg/10 g). Ensure the mixture is well mixed. For a control, pure lard is added to a reaction vessel. ▶ 50...75 mL dist. water are added to the absorption vessels and the measuring cells inserted and connected ensuring freedom from air bubbles. The samples with the reaction vessels are inserted in the heating block and after 5...10 min, the air supply and the absorption vessels attached. The analysis is now started with "GO". ▶ The temperature selected depends on the oxidative stability of the sample and the activity of the antioxidants. Normally, the experiments are performed at 100°C or 110°C. (A temperature rise of 10°C lowers the induction time by a factor of 2.)
<p>Calculation</p>	$\text{Antioxidative activity index (AI)} = \frac{\text{Induction time with additive}}{\text{Induction time without additive}}$ <p>The larger the AI, the greater the antioxidative activity.</p>
<p>Remarks</p>	<ul style="list-style-type: none"> ▶ The reproducibility of the induction times depends greatly on the cleanliness of the reaction vessels. ▶ We thank Prof. Chi-Tang Ho from Rutgers University in New Brunswick NJ for preparing this Bulletin.

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Determination record and curve examples of different antioxidants

Position 1: EGCG Position 4: BHA
 Position 2: Carnosol Position 5: BHT
 Position 3: α -Tocopherol Position 6: Control

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METROHM 679 RANCIMAT METHOD 0

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RESULTS

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ch	smpl.ident	eval.1	eval.2	eval.3
1	1.1	28.8 h		
2	1.2	20.7 h		
3	1.3	13.3 h		
4	2.1	9.65 h		
5	2.2	6.15 h		
6	2.3	2.15 h		

eval.1: induction time

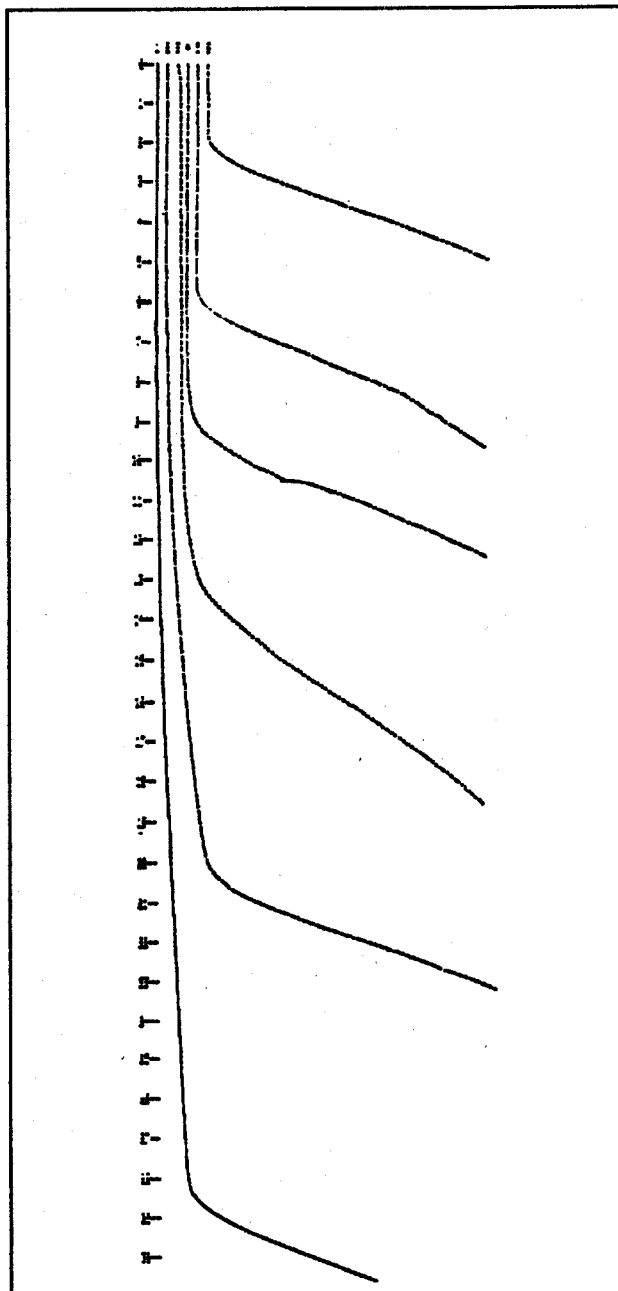
DATE 92-11-10

TIME 20:43

PARAMETERS

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temperature	110	Cel
temperature correction	0.0	Cel
conductivity range	200	uS/cm
evaluation modes	1/-/-	
delay time	0	h
paper feed	1	cm/h
cell constants: channel 1	0.77	/cm
channel 2	0.79	/cm
channel 3	0.79	/cm
channel 4	0.84	/cm
channel 5	0.85	/cm
channel 6	0.79	/cm
measuring time	INF	h
end mode: EP stop	ON	
heater stop	ON	
air stop	ON	



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Table of AIs of 16 different antioxidants

Antioxidative	Induction times (h)	Antioxidative activity Index
BHA	9.65	4.49
BHT	6.15	2.86
α -Tocopherol	13.30	6.19
EGCG	28.80	13.40
EGC	26.50	12.32
ECG	15.80	7.35
EC	5.30	2.46
Gallic acid	31.60	14.70
Carnosol	20.70	9.63
Carnosic acid	30.60	14.23
Ursolic acid	2.47	1.15
Tanshen I	8.93	4.15
Dihydrotanshinone	10.04	4.67
Tanshinone IIA	2.43	1.13
Tanshinone IIB	5.45	2.53
Danshenxinkun B	4.38	2.04
Control	2.15	

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