TABLE II

Polymer Formation and Viscosity Changes of Cooking Oils after Oxidation [a]

Oil [b]	Viscosity at 25C				% Polymer after oxidation
	Before oxidation		After oxidation		
	Gardner	Stokes	Gardner	(Stokes)	
High oleic safflower (crude)	B	0.65	H	2.00	29.1
High oleic safflower (deodorized and bleached)	B	0.65	K	2.75	28.4
Commercial safflower	B	0.65	R	4.70	48.1
Commercial safflower (deodorized, not stabilized)	A	0.50	P	4.00	51.0
Commercial soybean	B	0.65	P	4.00	37.0
Commercial cotton seed	B	0.65	M	3.20	37.8
Commercial hydrogenated frying oil	C	0.85 [c]	K	2.75	34.1

[a] Conditions: 185C, air at 200 ml/min for 18 hr.
[b] All commercial oils obtained locally.
[c] Oil was supercooled at 25C.

ported some preliminary studies on this type of seed as well (2). Because linoleic acid, with its methylene group between two double bonds, is the component of ordinary safflower oil most reactive with oxygen, it was anticipated that the UC-1 variety would be considerably more stable towards oxygen than current commercial varieties. We have demonstrated this at high temperature by comparing the oxidative stability of UC-1 oil with that of several commercially available, edible oils.

The oils were tested in a very simple apparatus. A 250-ml three-neck flask equipped with thermometer, capillary bubble tube and outlet tube leading to a dry-ice trap was immersed in a controlled-temperature oil bath kept at 185C ± 1C. An 80-g sample of the oil to be examined was introduced and when the oil temperature reached 180C, compressed air (breathing quality, Ohio Chemical Co.) was bubbled into the oil at 200 ml/min ± 10 ml/min. The air flow and heating were maintained for 18 hr, after which time the oil was cooled and stored under nitrogen until it was analyzed. The various oils examined, their viscosities before and after heating, and the amounts of polymer found are shown in Table II.

Particularly noteworthy is that UC-1, containing only slightly more than 7% saturated acids, compares favorably to the hydrogenated commercial frying oil which contains over 25% saturated acids. Moreover, the very bland, high-oleic oil is liquid at refrigerator temperatures, while the commercial frying oil is solid at room temperature. All the oils darkened during oxidation, but the UC-1 and other safflower oils remained lightest in color after reaction.

At the beginning of oxidation, all of the oils tested had low peroxide value (ca. 1) and these values did not rise significantly throughout the oxidation. Thus, our results agree with those of Hess and O'Hare (3) who showed that peroxide breakdown in linseed oil is so rapid at high temperatures that maximum values are low. Oxygen is necessary for reaction to occur, however. No significant increase in viscosity and no polymer formation was noted in regular safflower oil in which nitrogen was bubbled through at 185C, whether or not water was added [as moist cotton balls (4)] during the heating.

To determine amount of polymer formed in the oils, the triglycerides were converted to fatty acid methyl esters by sodium methoxide–catalyzed transesterification. The product esters were distilled at 0.01 mm of mercury from a flask heated in an oil bath at 185C. Material remaining in the flask was weighed and reported as polymer (Table II). The UC-1 oil formed less polymer than any of the commercial oils, including the hydrogenated frying oil.

This is a severe test which does not correspond to any ordinary conditions of cooking. Our purpose, however, was to devise a means of screening oils for oxidative stability, as well as a means for forming considerable amounts of polymeric and volatile materials for analysis. The method clearly illustrates the differences in various oils under such conditions, and detailed analyses of the volatile and polymeric products will be reported. Related stability studies at lower temperatures are in progress as well.

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• *Erratum*

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In Table I, p 377, the data in lines 12 and 13 are in reverse order. The table should read:

Epoxidized linseed oil (Control A)	9.00 [b]	0.11	5.0 [b]	0–1
Epoxidized soybean oil (Control B)	6.60 [b]	0.22	2.7 [b]	1