Improvements in the Frying Quality of Vegetable Oils by Blending with Palm Olein

Teah Yau Kun

ABSTRACT

Palm olein, with its inherent excellent frying properties, improves the frying quality of other vegetable oils when blended with them. Thus the induction period of a variety of oils is raised by blending, indicating improved resistance to oxidation. The improvement is also seen in measurements reflecting primary and secondary oxidation, and the formation of free fatty acids, other volatiles and polymers. Data of this kind are presented for groundnut oil and its blend with palm olein.

The cloud points of most vegetable oils are raised slightly (into the range – 10°C to + 5°C) by blending with palm olein.

INTRODUCTION

Fats and oils are widely used for deep frying and are among the most important materials used in the catering and food manufacturing industries. In normal deep fat frying, the content of linoleic and linolenic acid is kept low to improve the oxidative stability of the oils. Thus it is customary to partially hydrogenate vegetable oils to reduce their linolenic acid content to an acceptable level. An alternative means is to blend vegetable oils with palm olein, which has a similar effect to partial hydrogenation in reducing the linoleic and linolenic acid content, but without introducing *trans* isomers of fatty acids. Palm oil and its products have excellent oxidative and frying stability owing to their inherent composition and to the presence of tocopherols, which are natural antioxidants. By blending vegetable oils with palm olein, the positive effects of palm olein are conferred on the blend during frying. Peanut oil is the most favoured oil for frying, followed by cottonseed oil. Addition of 30% palm olein to these oils has been found to improve their frying quality in terms of primary and secondary oxidation and formation of polymers, polar components and oxidized fatty acids.

Data are presented below on the behaviour of groundnut oil and a blend of groundnut oil and palm olein during frying.

METHODS

The performance of oils was assessed by frying potato-chips under the following conditions:—

Quantity of oil	:	5 kg
Frying vessel	:	Valentine batch fryer (2.5 – 4.01; 2kW; 220V)
Amount of chips fried	:	100 g each time
Temperature	:	180°C ± 5°C
Frying frequency	:	10 batches every 8 hours
Total frying time	:	40 hours

Analyses were carried out according to internationally accepted techniques.

RESULTS AND DISCUSSION

Induction Period. The induction period is an expression of the stability of oils and fats towards oxidation. At low temperatures, during storage, autoxidation is characterized by an induction period in which the addition of oxygen is very slow. The length of the induction period varies with the kind and the amount of unsaturation, the temperature, the extent of contamination with prooxidant substances and the amount of antioxidants present.

Among all the common vegetable oils, palm olein has the longest induction period, of 44 hours at 100°C. Addition of palm olein lengthens the induction period of other vegetable oils (*Table 1*).

Free Fatty Acids. Free fatty acid content is usually considered to be one of the main parameters for evaluating the quality of an oil, especially the state of a frying oil. The determination of free fatty acid (FFA) measures the content of acid which results partly from hydrolysis and partly from further oxidation of the secondary products formed during frying.

Figure 1 shows that in a blend of palm olein and groundnut oil (30:70) the rate of formation of FFA during frying is lower than in groundnut oil on its own. The general trend during frying was an increase in free fatty acid.

Smoke Point. The amount of the smoke emanating from a fryer is proportional to the concentration of low molecular weight decomposition products in the fat and the temperature. The free fatty acids and other volatiles leaving the fat as gases will appear as smoke when their concentration is great enough to permit aggregation to colloidal-sized particles. During deep frying, as the decomposition products, in particular free fatty acids and partial glycerides, accumulate, the temperature of the smoke point will decrease. In frying, smoke point is used to predict the stability of the fat and as a general indicator of its condition.

TABLE 1. INDUCTION PERIOD (I.P) AND CLOUD POINTS OF OILS AND BLENDS

Oils and Blends	Induction Period (hours)	Cloud Point (°C)
RBD Palm olein	44.0	9.6
Cottonseed	11.1	-3.0
Cottonseed/Palm olein	...	5.0
Groundnut	15.0	1.9
Groundnut/Palm olein	21.0	2.0
Maize	9.0	-9.5
Maize/Palm olein	12.0	-1.9
Olive	11.8	-10.0
Olive/Palm olein	..	-10.0
Rapeseed	11.5	-5.0
Rapeseed/Palm olein	16.0	0.0
Sesame	8.0	-
Sesame/Palm olein	7.0	0.3
Soybean	16.0	-9.0
Soybean/Palm olein	19.0	-2.2
Sunflowerseed	6	-9.5
Sunflowerseed/Palm olein	7	-2.3

Note (i) Palm olein was added at 30% in each blend.
(ii) All systems have 0 hr. Induction Period at the end of frying.

Figure 2 shows changes during frying in the smoke points of groundnut oil and a blend of palm olein and groundnut oil (30:70). The rate of decrease in smoke point in the blend appeared to be lower than in the unmixed groundnut oil.

Polymer Formation. One of the most important changes which occurs in a fat during frying is the formation of polymeric materials. These are mainly responsible for the increase in viscosity which takes place, and they contribute to the foaming tendency of a heated oil.

In all frying systems there tends to be an increase in polymer content. Vegetable oils in general develop a higher polymer content during frying because of their high poly-unsaturation. Thus most such oils have to be hydrogenated before they are used as deep frying fat. *Figure 3* illustrates the formation of polymers in groundnut oil during frying and also shows that the process is slower in a blend of palm olein and groundnut oil (30:70).

CONCLUSION

The addition of 30% of palm olein to various vegetable oils resulted in improved oxidative stability. This is an important change since it implies that the oils would have a longer shelf stability both during storage and before consumption.

Blending also brings about definite improvements in the frying qualities of vegetable oils as exemplified by the results with groundnut oil. Blending is by far the most economical process for fat modification; in the case of fat for deep frying, it has a similar effect to partial hydrogenation, i.e reduction of linoleic and linolenic acid content, but without the introduction of the *trans* fatty acids associated with hydrogenation.

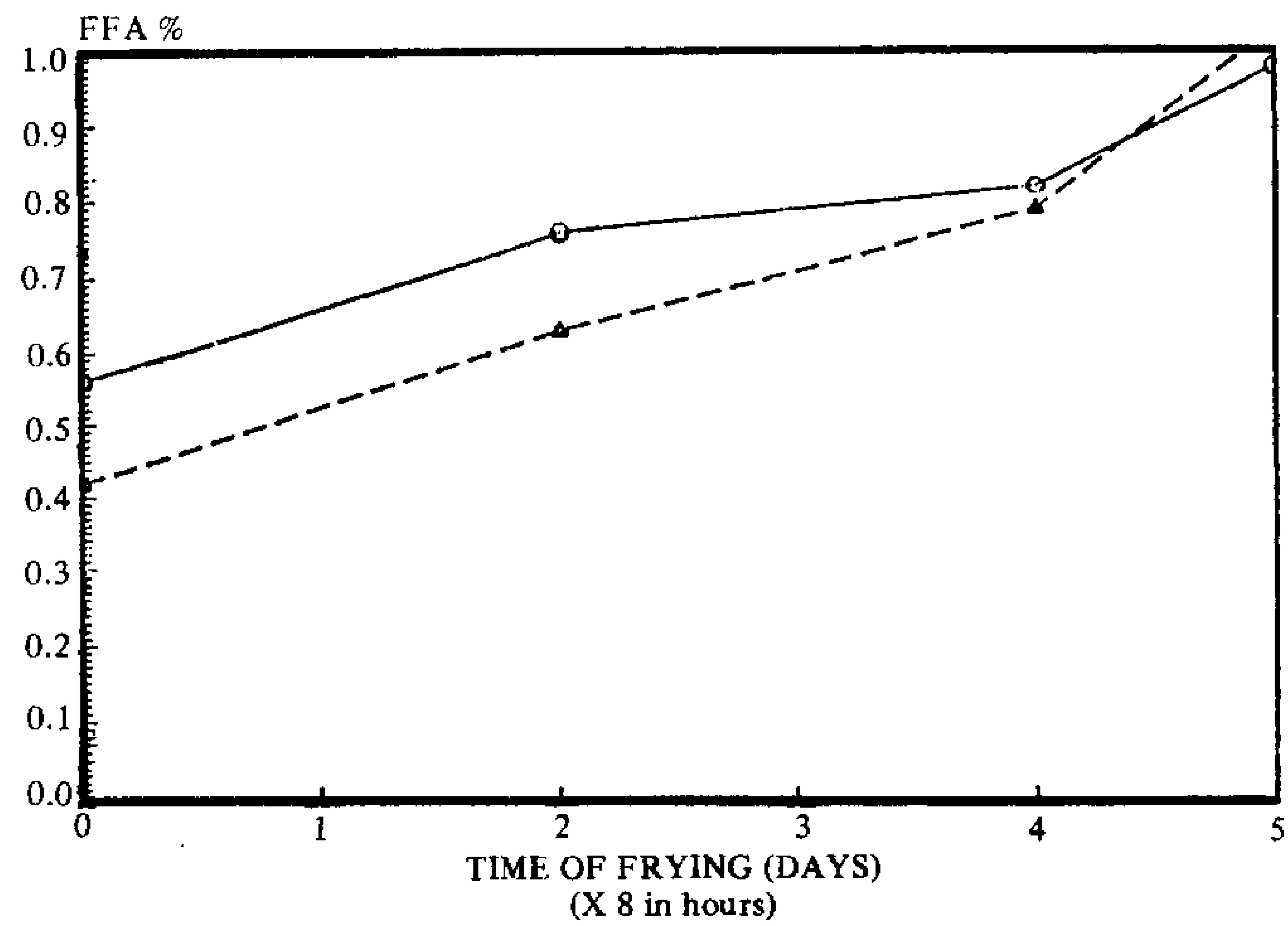

Figure 1. Formation of FFA in groundnut oil (———0———) and in a blend (30:70) of palm olein and groundnut oil (– – Δ – –) during frying.

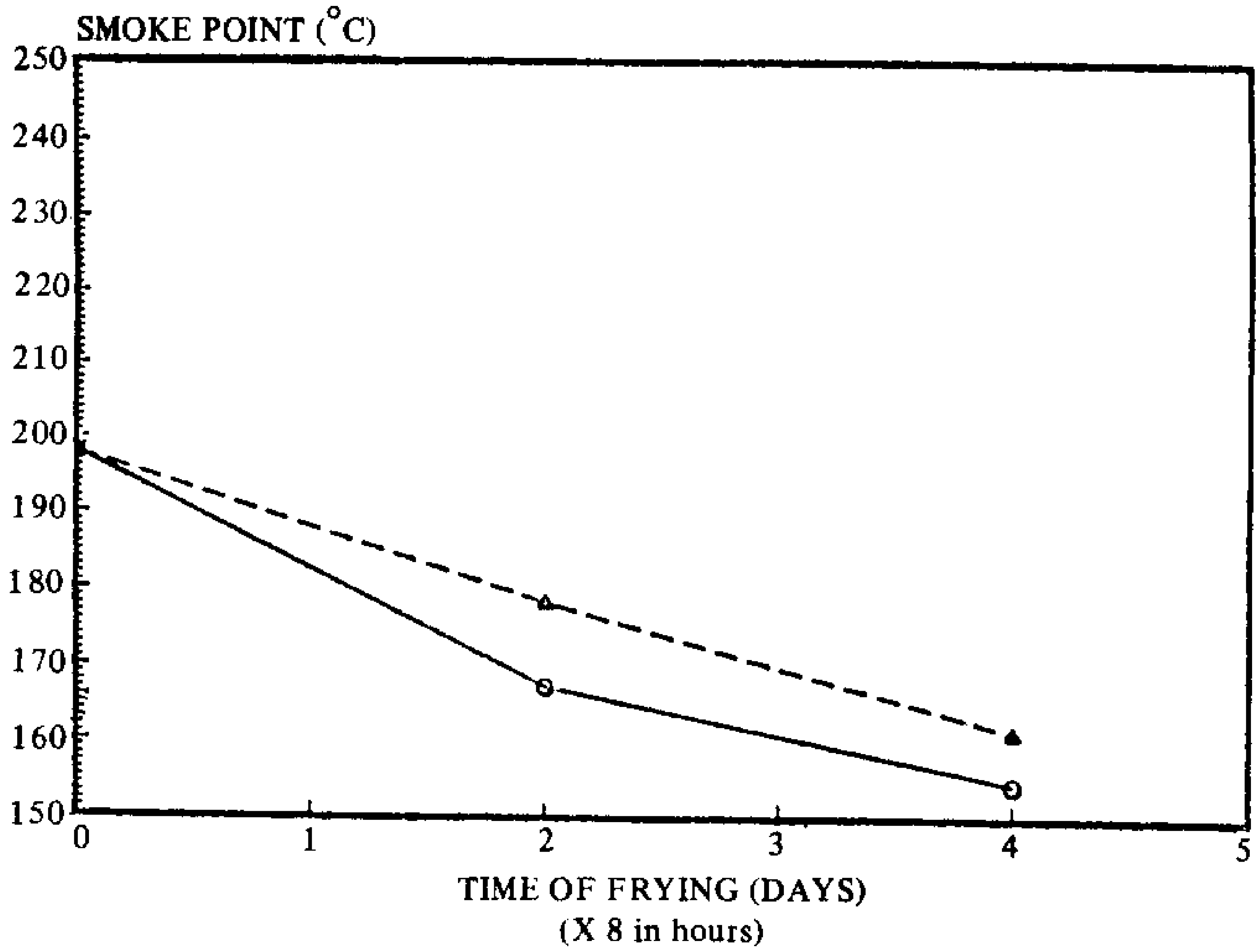

Figure 2. Changes in smoke points of groundnuts oil (——0——) and in a blend (30:70) of palm olein and groundnut oil (– – Δ – –) during frying.

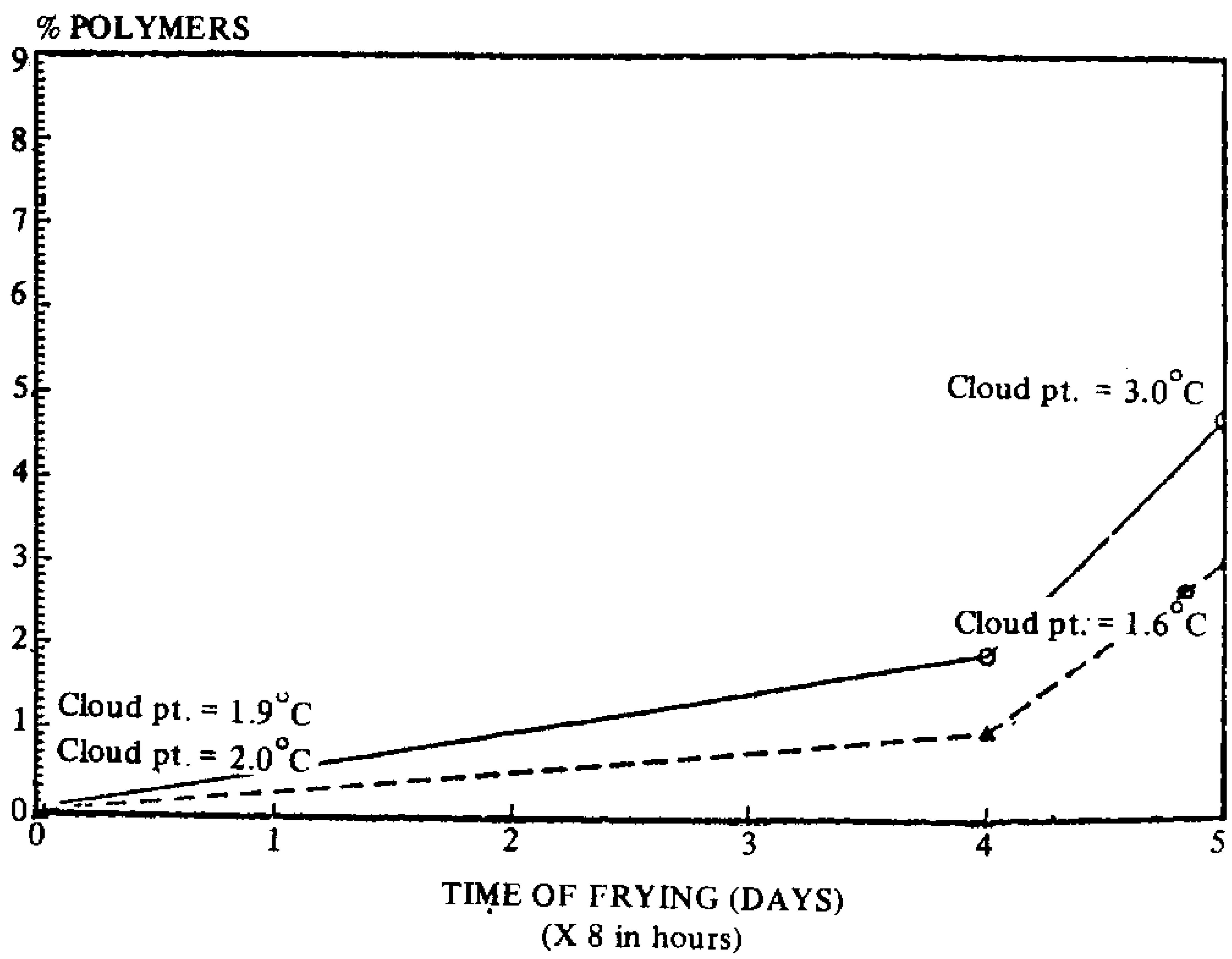

Figure 3. Polymer formation in groundnut oil (——o——) and in a blend (30:70) of palm olein and groundnut oil (– – Δ – –) during frying).