ANTI-CRYSTALLIZERS IN PALM OLEIN

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Palm olein is the preferred oil for cooking and frying because it has good oxidative stability. However, it tends to crystallize and becomes cloudy in cold weather in temperate countries. In these countries, even palm super olein clouds at very low temperature. In Malaysia and other tropical countries, there is no problem with clouding as ambient temperature is high. However, there may be a problem with clouding when palm olein is displayed on the supermarket shelf as supermarket is normally air-conditioned. Air-conditioned room temperature is normally between 20°C to 23°C. Consumers perceive a cloudy oil as deteriorated oil. They do not like to buy oil that is cloudy, they prefer oil that is clear.

Although crystallization in oils and fats has been found to be slowed down by diglycerides (Hernqvist and Anjou, 1983), the reverse is true in the case of palm olein (Siew and Ng, 1996a). Crystals formed in palm olein during prolonged storage were found to be high in diglycerides (Swe *et al.*, 1994). Palm diglycerides, especially the dipalmitin, increased crystallization rate in palm olein (Siew and Ng, 1996a). Other factors which may influence crystallization in palm oleins are degree of unsaturation (IV) and ratio of POP to POO triglycerides. High POP/POO ratio tends to increase rate of crystallization (Siew and Ng, 1996b).

EFFECT OF ANTI-CRYSTALLIZER

Certain anti-crystallizers help delay crystallization in refined, bleached and deodorized palm olein at low temperatures, thus preventing the oil from clouding.

This technology uses anti-crystallizers which are used in foods, only in this case they are used as crystal inhibitors to depress crystal formation in palm olein. Anti-crystallizers were added to palm olein having different iodine values (IV). *Tables 1* to *3* show the duration the palm olein samples remained clear when stored at 5°C, 10°C, 15°C and 20°C. Some anti-crytallizers have been found to inhibit crystallization while some others behaved as crystal promoters at certain temperatures.

There was a significant improvement in clarity of palm olein (IV 56) stored at 20°C when anti-crystallizers were added. Among the anti-crystallizers, the one coded as J showed the best effect *(Table 1)*. The sample remained clear for 210 days compared to only one day shown by the control sample (palm olein without any anti-crystallizer).

Palm olein of IV 60 showed better resistance to crystallization than palm olein of IV 56. With anti-crystallizers coded as SK and ST, palm olein of IV 60 remained clear for 49 days compared to only eight and four days, respectively, when they were added to palm olein of IV 56. Among the three anti-crystallizers selected, the one coded as T9 showed the best anti-crystallization effect.

TABLE 1. RESISTANCE TO CRYSTALLIZATION[a] OF PALM OLEIN OF IODINE VALUE (IV) 56 WITH ANTI-CRYSTALLIZERS AT STORAGE TEMPERATURES OF 5°C, 10°C, 15°C AND 20°C

Anti-crystallizer code	Temperature (°C)			
	5	10	15	20
Control	2 hr	>3 hr	3 hr	24 hr
SK	1.5 hr	1.5 hr	>24 hr	8 d
ST	0.5 hr	1 hr	1.5 hr	4 d
T9	>3 hr	>3 hr	4 hr	29 d
F	<1 hr	<1 hr	<24 hr	48 d
J	2 hr	5 hr	5 d	210 d

Note: [a] Duration of remain clear (hr denotes hours and d denotes days).

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TABLE 2. RESISTANCE TO CRYSTALLIZATION[a] OF PALM OLEIN OF IODINE VALUE (IV) 60 WITH ANTI-CRYSTALLIZERS AT STORAGE TEMPERATURES OF 5°C, 10°C, 15°C AND 20°C

Anti-crystallizer code	Temperature (°C)			
	5	10	15	20
Control	3 hr	>5 hr	1 d	7 d
S K	1.5 hr	1.0 hr	7 d	49 d
S T	0.5 hr	0.5 hr	1 hr	49 d
T9	1.5 hr	>5 hr	24 d	60 d

Note: [a]Duration oil remain clear (hr denotes hours and d denotes days).

TABLE 3. RESISTANCE TO CRYSTALLIZATION[a] OF PALM OLEIN OF IODINE VALUE (IV) 65 WITH ANTI-CRYSTALLIZERS AT STORAGE TEMPERATURES OF 5°C, 10°C, 15°C AND 20°C

Anti-crystallizer code	Temperature (°C)			
	5	10	15	20
Control	>4.5 hr	>5 hr	3 d	59 d
S K	4.5 hr	4.5 hr	11 d>	180 d
S T	0.5 hr	0.5 hr	2 hr>	180 d
T9	>4.5 hr	1 d	60 d>	180 d
D	<4 hr	<2 hr	>23 d	280 d
J	<24 hr	<10 d	<20 d	360 d

Note: [a]Duration oil remain clear (hr denotes hours and d denotes days).

Anti-crystallizer coded as J, once again showed the best crystal inhibition effect. It was effective at all the four temperatures studied, particularly at 10°C and 20°C, when added to palm olein of IV 65. The sample remained clear for one year at 20°C as compared to two months in palm olein IV 65 without any crystal inhibitor. At 15°C, anti-crystallizer T9 was more effective than the others.

How does the anti-crystallizer work? It has been suggested that anti-crystallizers could have a restrictive influence on seed development, thus delaying crystallization. It is possible that the additive attaches itself to the crystallite (the nucleus formed when crystallization is initiated). It then acts as a poison, preventing growth of crystal.

The effectiveness of the anti-crystallizer is influenced by several factors including dosage, degree of unsaturation of palm olein and temperature at which the olein is stored.

BENEFIT

Adding anti-crystallizer to regular palm olein of IV 56 to 58 is an alternative to the current scenario of retailing super olein (IV 60 and above) on the supermarket shelf. The product has good resistance to crystallization and remains clear four to two hundred times longer than regular palm olein without any anti-crystallizer.

ECONOMIC FEASIBILITY

Adding anti-crystallizers in palm olein is economically feasible for any palm oil refinery or which already have the facilities for refining palm oil or palm olein. It is also feasible for exporters of palm olein. Companies doing packaging of palm olein for retail market will also find this attractive.

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