SELECTION FOR LIPASE ACTIVITY IN THE OIL PALM

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Lipase is the first enzyme involved in the degradation of stored lipids. The increase in free fatty acid (FFA) levels in palm oil is attributed to the action of lipase. However, evidence as to the nature of the lipase has been contradictory. Oo (1981) and Tombs and Stubbs (1982) reported the absence of endogenous lipase in the oil palm mesocarp and attributed FFA increases in the oil palm mesocarp to microbial activity. Hartley (1988), however, suggested the presence of a very active endogenous lipase in the oil palm. This fact was firmly established by Sambanthamurthi *et al.* (1991;1995) who also established that the lipase is activated at low temperature (*Figure 1*).

NOVEL PROCESSES

- **Novel cold-induced lipase assay.** Lipase activity is conventionally assayed by an *in vitro* radioactive procedure. A novel assay was developed where fruits were exposed to 5°C and the oil subsequently titrated for FFA. A strong positive correlation was obtained between results from the two techniques. The low temperature activation assay was subsequently used for screening a germplasm collection for lipase activity as this method is more convenient and avoids the use of radioactive material.

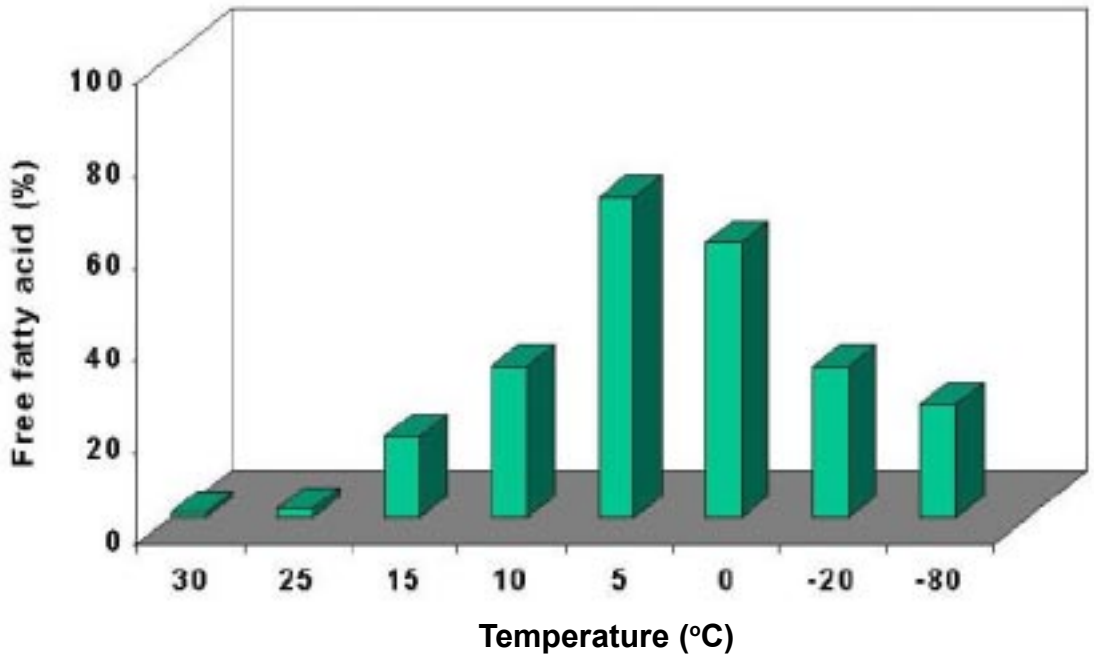

Figure 1. Change in free fatty acid level with temperature in oil palm mesocarp (commercial variety).

- **Fat splitting.**
  FFA for oleochemical purposes is conventionally produced by fat splitting at high temperatures. Low temperature activation of lipase, that is exposure of oil palm bunches to low temperature may be a convenient alternative process for fat splitting in the oil palm.

- **Selection for lipase varieties.**
  The genetic control of lipase activity is still unknown. Mass selection was thus carried out. The Malaysian Palm Oil Board (MPOB) has the world's largest oil palm germplasm collection. Fruits from various palms from this collection were screened for lipase activity. A sample of the results is shown in *Table 1*. The fruits analysed belonged to two species, *Elaeis guineensis* and *E. oleifera*. *E. guineensis* fruits generally had higher lipase activities compared with those of *E. oleifera*. *E. oleifera* fruits also had much lower oil content.

The *E. guineensis* fruits had higher lipase activity, and there was also a wide variation in activity between fruits of *E. guineensis*. The fruits from the Cameroonian collection generally had lower lipase activities and hence lower FFA content compared with the fruits from Tanzania and Angola. Highest FFA content was observed in fruits from the Angolan collection. Some of the

TABLE 1. FFA LEVELS IN DIFFERENT OIL PALM SAMPLES

Palm	Genus	Origin	FFA
0.219/1676	*E. guineensis*	Cameroon	26.6 ± 1.0
0.219/179	*E. guineensis*	Cameroon	3.2 ± 0.5
0.219/1757	*E. guineensis*	Cameroon	12.9 ± 1.2
0.219/1680	*E. guineensis*	Cameroon	26.9 ± 0.7
0.219/833	*E. guineensis*	Cameroon	8.2 ± 0.8
0.219/1867	*E. guineensis*	Cameroon	12.6 ± 1.0
0.218/1064	*E. guineensis*	Cameroon	29.0 ± 0.7
0.218/1076	*E. guineensis*	Cameroon	3.4 ± 0.3
0.256/2202	*E. guineensis*	Tanzania	8.5 ± 0.6
0.256/2166	*E. guineensis*	Tanzania	31.8 ± 0.5
0.256/2113	*E. guineensis*	Tanzania	22.3 ± 0.3
0.256/2093	*E. guineensis*	Tanzania	36.1 ± 0.7
0.256/2115	*E. guineensis*	Tanzania	32.6 ± 0.8
0.256/2094	*E. guineensis*	Tanzania	13.9 ± 0.3
0.256/2116	*E. guineensis*	Tanzania	40.4 ± 0.4
0.256/2246	*E. guineensis*	Tanzania	10.3 ± 0.6
0.313/24	*E. guineensis*	Angola	66.8 ± 0.3
0.313/102	*E. guineensis*	Angola	10.11 ± 0.5
0.313/25	*E. guineensis*	Angola	14.5 ± 0.6
0.313/22	*E. guineensis*	Angola	54.4 ± 0.5
0.313/99	*E. guineensis*	Angola	9.7 ± 0.3
0.312/1060	*E. guineensis*	Angola	43.4 ± 0.5
0.312/994	*E. guineensis*	Angola	43.0 ± 0.8
0.177/46	*E. oleifera*	Surinam	3.2 ± 0.2
0.177/66	*E. oleifera*	Surinam	5.3 ± 0.1
0.177/28	*E. oleifera*	Surinam	3.5 ± 0.3
0.188/59	*E. oleifera*	Brazil	3.1 ± 0.5
0.188/45	*E. oleifera*	Brazil	6.2 ± 0.1
0.188/38	*E. oleifera*	Brazil	5.5 ± 0.5
0.211/442	*E. oleifera*	Honduras	2.9 ± 0.1
0.211/533	*E. oleifera*	Honduras	5.8 ± 1.0

palms from the Cameroonian and Tanzanian collections had very low FFA levels, *e.g.* palms 0.219/179, and 0.218/1076 which had FFA levels around 3.5% even following cold-activation. Commercial oil palm varieties typically showed FFA levels ranging from 22%-73% following exposure to low temperature. These results confirmed that lipase activity is genotype-dependent. It would be very useful to select for these lower lipase varieties. There may also be commercial value in selecting for high lipase activity for specific purposes, *e.g.* for the production of FFA for oleochemical uses.

IMPACT OF INVENTION

The level of FFA is a very important determinant of oil quality. Oxidation of FFA results in rancidity and impairment of oil quality. FFA can be removed during the refining process, but this adds significantly to the processing cost. Selecting for low lipase will result in reduced cost for producing quality oil.

ECONOMIC ANALYSIS

Every percentage point change in FFA content results in approximately 0.7% reduction in the value of the crude palm oil (CPO).

Average FFA content of CPO is 3.7%.

Assuming reduction in average FFA content by 2.7% points to 1%, value of CPO will be increased by 0.7x2.7= 1.89%.

Based on RM 1200 t^{-1} CPO, value would be increased by 1.89% of RM 1200, *i.e.* RM 22.70 t^{-1}.

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