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Hydrolysis of triglycerides in oil palm fruits induced by freezing

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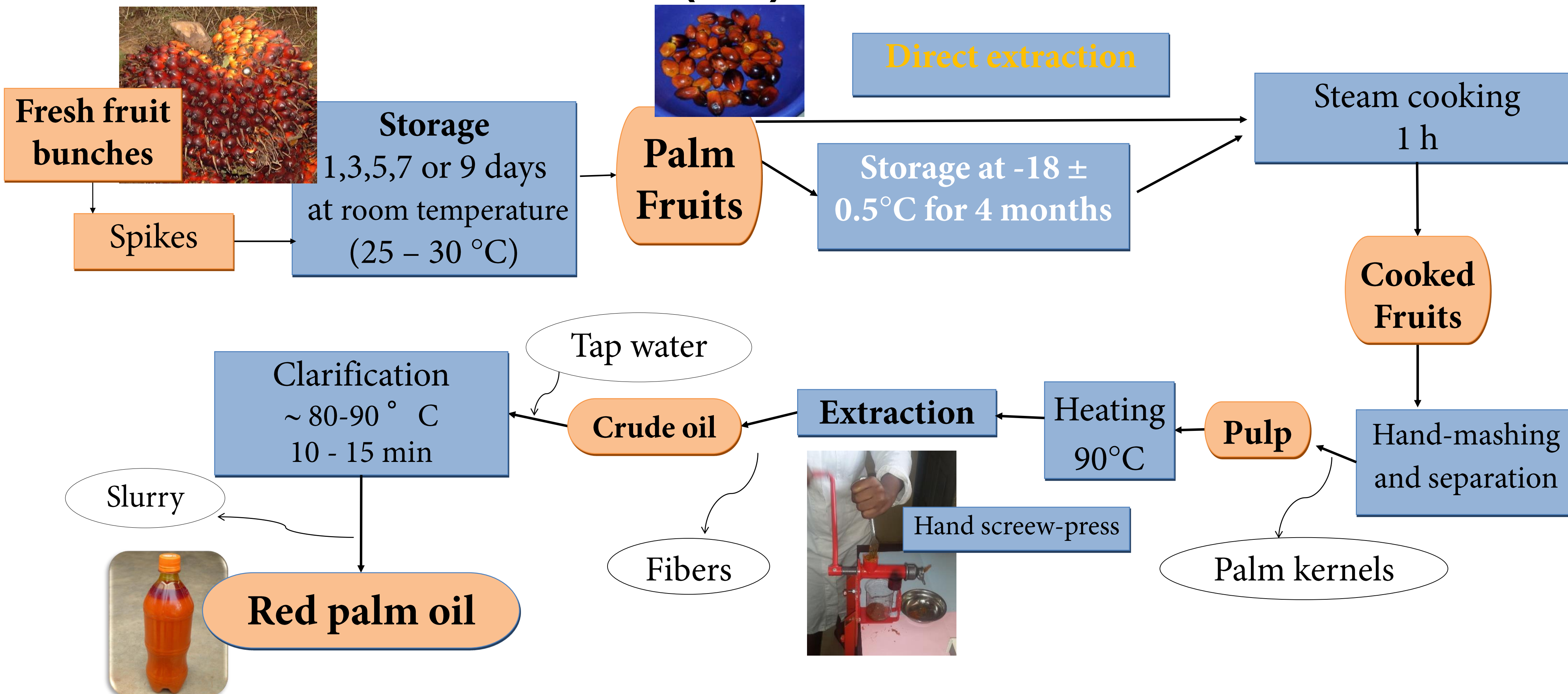
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Introduction : After harvest, when the palm fruits are kept at ambient temperature, the triacylglycerols of palm oil are subjected to the hydrolytic action of mesocarp and fungi lipases [1-3]. In Cameroon, in the course of artisanal palm oil extraction process, storage of palm bunches or fruits during several days is currently performed because it facilitates palm fruit processing and oil extraction. This explains the high free fatty acid (FFA) levels often found in artisanal crude red palm oils (RPO) [4]. To study the effect of freezing palm fruits after their storage at ambient temperature on the hydrolysis level of RPO and its quality, several analytical parameters were assessed on RPOs prepared at lab-scale from frozen and unfrozen fruits.

Material: extraction of Red Palm Oil (RPO)



Methods

1. Extraction yield

g RPO / 100 g palm fruit

2. Nutritional composition

- Fatty acid composition (GC of FAME; NF T60-233)
- Carotene content (UV-Vis spectrophotometry; A464 nm)
- Tocopherol + tocotrienol content (vit E) HPLC – fluorescence; Kabri et al., 2013 [5]; AOCS Ce-8-89

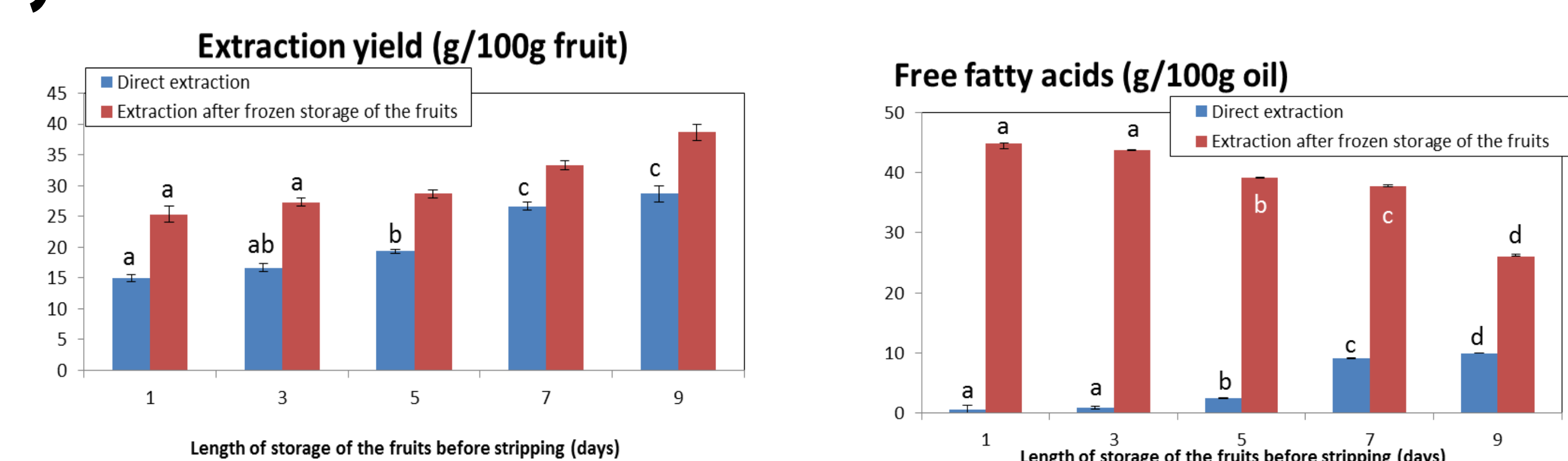
3. Lipolysis

- Acid value (NF T60-204, 1985)
- Free fatty acid content and composition (Needs et al. 1983 [6]; Kabri et al., 2013 [5])

4. Oxidation

- Peroxide value (NF T60-220, 1968)

Results 1. Freezing of palm fruit increased RPO extraction yield and RPO FFA content



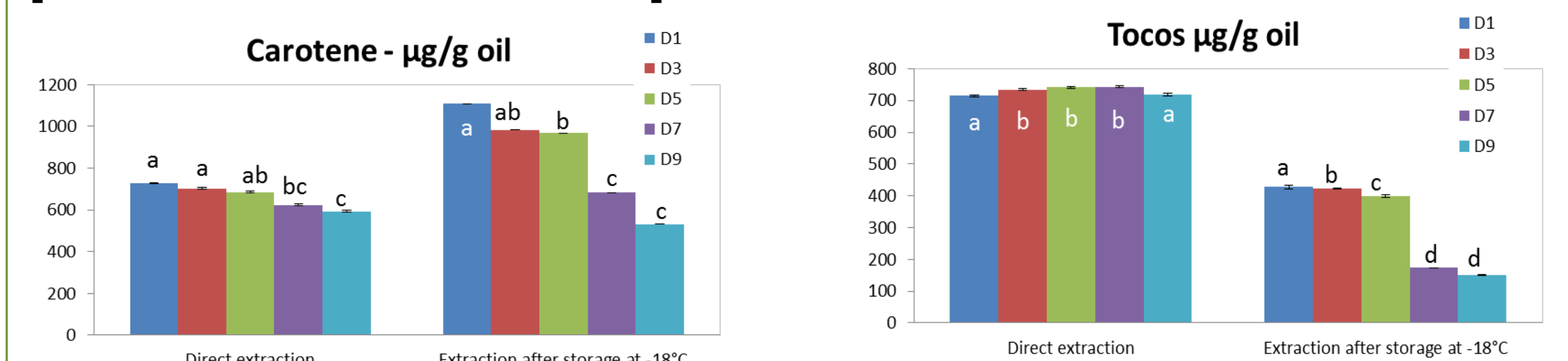
As compared to control, freezing resulted in an increase of 35 to 69% of the oil yield.

FFA content was multiplied by 86 to 2.6 for fruits frozen from 1 to 9 days after harvest.

The increase of acidity of palm oil with length of bunches storage after harvest is well known [6]. It results from the hydrolysis of TAGs by fungi and mesocarp lipases. Freezing makes more available the lipids to lipases due to the rupture of oleosomes, while these enzymes remain active after and likely during freezing of palm fruit [3].

Fatty acid composition of FFA of the oil was only marginally affected by freezing. At room temperature palmitic acid tended to be more released than other FA, during freezing, it would concern more unsaturated fatty acids (C18:1 and C18:2).

Results 2. Freezing favoured carotenoid extraction but provoked losses of tocopherols



Fruit freezing led to a large increase of RPO carotene content (D1). This effect was reduced when duration at room temperature increased.

Vitamin E content was always lower in frozen fruits. It decreased by 37.5% for fruits frozen from 1 to 9 days after harvest while at room temperature it was not affected.

Peroxide value were very low (0 to 0.81 meq. active oxygen/kg oil) at room temperature. Otherwise, we observed a slightly increase (1.53 (D1) to 2.06 (D9) meq. active oxygen/kg oil) with freezing.

The results obtained on carotene could indicate at better release of carotenoids during extraction after fruit freezing while tocopherols and tocotrienols could have been partly degraded during the frozen storage, protecting unsaturated fatty acids against oxidation. These micronutrients would be more degraded upon combined storage at ambient (> 5 days) and frozen temperature.

Conclusions and Further prospects : Our results showed few differences in FFA compositions for frozen or control fruits evidencing limited specificity of the lipases at frozen or room temperature. Freezing induced breakage of palm fruit cell structures resulting in a facilitated extraction of the oil and carotenoids and but also favored deteriorative reactions (lipolysis, and to a small extent, oxidation especially for fruits frozen after > 5 days from room temperature), leading to an overall decrease of RPO quality (FFA, antioxidants).

References

- Ngando et al 2006. Assaying lipase activity from oil palm fruit (*Elaeis guineensis* Jacq.) mesocarp. *Plant Physiol Biochem.*, 44, 611–617.
- Morcillo et al. 2013. Improving palm oil quality through identification and mapping of the lipase gene causing oil deterioration. *Nature Communications*.
- Henderson and Osborne, 1991. Lipase activity in ripening and mature fruit of the oil palm - stability in vivo and in vitro. *Phytochemistry* 30, 1073-1078.
- Kabri et al. 2013. Formulation of stable phospholipid-based food-grade sub-micron emulsions with DHA located either in triglycerides or in the phospholipids. *Eur J. Lipid Sci. Technol.* 115, 1294–1308
- Needs, et al. 1983. A method for the quantitative determination of individual free fatty acids in milk by ion exchange resin adsorption and gas-liquid chromatography. *J. Dairy Res.* 50(3), 321-329
- Kansci, Genot et al. 2003. Composition et niveau d'oxydation de quelques huiles végétales consommées au Cameroun. *Sc. Aliments*, 23 (3), 425-441 ; Ngando et al., 2011. Assessment of the quality of crude palm oil from smallholders in Cameroon. *J. Stored Products and Postharvest Res.*, 2(3): 52-58.

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