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Understanding the Codex Standard to Ensure Safety and Quality of Palm Oil

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ABSTRACT

Indonesia is the number one producer and exporter of palm oil globally. About 85% of palm oil is used for food applications. Consequently, issues related to food safety and nutrition have always been a major concern, both for producers and consumers of palm oil. In this respect, the palm oil industry must put serious effort to comply with food safety and quality standards, such as those of Codex standards, especially specified at Codex Standard for Named vegetable Oils (CXS 210-1999).

Key words: International trade.

INTRODUCTION

Indonesia is situated nicely at the equator so that the climate is suitable for the optimum growth of oil palm trees, tropical crops producing edible oil. Potentially, productivity of palm oil tree may reach about 8 tons oil/hectare /year in most regions. However, current average actual yields are about 3.3 tons/hectare /year.

This productivity is much higher as compared to that of soybean oil (only 0.4 tons/hectare) and sunflower seed oil (0.5 tones/hectare). Not only that the productivity is high, but palm oil also has a longer productive life span (≥25 years). Palm oil also have a cheaper production costs, of about US$ 160/ton, compared to that of soybean of about US$ 300/ton (Wisena *et al*. 2014).

According to the Indonesian Palm Oil Association (GAPKI 2020), Indonesia's palm oil production in 2019 was 51.8 million tons, comprising of crude palm oil (CPO) for about 47.2 million tons, and palm kernel oils (PKO) for about 4.6 million tons. This number, as presented at Table 1, is an increased by about 9 percent as compared to the 2018 production of 47.4 million tons.

Currently, Indonesia is not only the biggest producer, but also the main exporter of palm oil and palm derivative products, amounted up to 23.175 million tons of

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Table 1 Indonesian palm oil production and utilization (GAPKI 2020)

Year	Production (million tons)			Domestic market	Export (million tons)			Stock
	Total	CPO	PKO		Total	CPO	Derivative Products*	
2018	47.388	43.108	4.280	13.491	34.707	6.561	28.145	3.261
2019	51.828	47.180	4.648	16.673	36.175	7.065	29.110	4.597

*Include oleochemicals and biodiesel

palm oil product in 2019. Driven by an increase in global population and economic growth, the demand for vegetable oil over the next decade will continue to increase. According to Oil Market Research (2020), the palm oil sector will continue growing, and anticipated to reach a total of 98.82 million tons in 2024, with growing rate at about 5.9% (for the period of 2019 to 2024).

THE IMPORTANCE OF CODEX STANDARDS FOR PALM OILS

Globally, most of the palm oil produced (around 85%) is currently used for food applications, especially as a cooking oil and other food ingredients for most margarine, ice cream and many varieties of ready-to-eat meals. This paper suggests, first thing first, that palm oil sector need to ensure the safety aspect of their product.

Food and Agricultural Organization (FAO 2019) has advocated that “if it isn’t safe; it isn’t foods.” This suggests that palm oil used for food application must comply with the food safety standard. For Indonesia, since palm oil is internationally traded, then complying with international food safety standard, i.e., Codex Standards which are developed by the Codex Alimentarius Commission or CAC, is paramount important. The following section of the paper will discuss several selected Codex standards relevant to ensure safety and quality of palm oil.

CODEX STANDARD FOR NAMED VEGETABLE OILS, CXS 210-1999

This standard (CXS 210-1999) cover many kinds of named vegetables oil. Especially for palm oil, this standard also provide specific provision for several type of palm oil commonly traded, such as palm oil, palm olein, palm stearin, palm kernel oil, and including the specialty kind such as super olein and palm oil with a higher content of oleic acid (Table 2). The provision described at this Standard applies to the palm oils presented in a state for human consumption, meaning that this standard specifically applicable for palm oil for food applications.

The standard also provides description of essential composition of fatty acid for each type of palm oil product (expressed as percentages) as determined by gas liquid chromatography, as described at Table 3. It was mentioned that palm oil product having fatty acid composition within the appropriate ranges specified in Table 3 follow this Codex standard. It is noted as well that in trade practice, it is customary that a supplementary criterion, for example national geographical and/or climatic variations, may be considered, as necessary, to confirm that a sample

Table 2 Several type of palm oil covered at the Codex Standard for Named Vegetable Oils (CXS 210-1999)

Type of palm Oil Products	Description of product	Essential quality factors
Palm oil	Oil derived from the fleshy mesocarp of the fruit of the oil palm (*Elaeis guineensis*)	
Palm olein	The liquid fraction derived from the fractionation of palm oil	Slip melting point of not more than 24 ºC
Palm stearin	The high-melting fraction derived from the fractionation of palm oil	Slip melting point of not less than 44 ºC
Palm super olein	The liquid fraction derived from palm oil (described above) produced through a specially controlled crystallization process to achieve an iodine value of 60 or higher	Slip melting point of not more than 19.5 ºC
Palm kernel oil	Oil derived from the kernel of the fruit of the oil palm (*E. guineensis*).	
Palm kernel olein	The liquid fraction derived from fractionation of palm kernel oil	Slip melting point between 21 to 26 ºC
Palm kernel stearin	The solid fraction derived from fractionation of palm kernel oil (described above).	Slip melting point between 31 to 34 ºC
Palm oil with a higher content of oleic acid	Oil derived from the fleshy mesocarp of hybrid palm fruit (OxG) (*E. oleifera* x *E. guineensis*)	Palm oil with a higher content of oleic acid must contain not less than 48% oleic acid (as % of total fatty acids)

is following the Codex Standard. In addition to several essential composition and quality factors for each type of palm oil described at Table 2 and Table 3, the standard also provides detail provision, including food additives, contaminants, hygiene, labelling and methods of analysis and sampling.

This standard also comes with appendix containing other quality and composition factors of palm oil product, added as a supplementary information necessary to the essential provision in the standard. A palm oil product, which meets the essential provision but does not meet this supplementary information, may still be considered to conform to the standard. These supplementary quality factor and composition of palm oil products can be seen at Table 4, 5 and 6.

Beside information regarding the physical and chemical composition, the appendix of the standard also stated that the colour, odour, and taste of each product shall indicate the.characteristic of the designated product. It shall be free from foreign and rancid odour and taste. Specifically, the maximum level of Fe at crude

palm kernel olein and crude palm kernel stearin also specified as 5.0 and 7.0 mg/kg, respectively. Provision of free fatty acid also given for virgin palm oil (5.0% as palmitic acid) and crude palm kernel oil (4.0 % as lauric acid). Specific requirement for the total carotenoids (as beta-carotene) was also stated, especially for unbleached palm oil, unbleached palm olein and unbleached palm stearin, and should be in the range of 500-2000, 550-2500 and 300-1500 mg/kg, respectively.

OTHER RELATED CODEX STANDARDS

Other than Codex Standard for named vegetable oils (CXS 210-1999) reviewed above, palm oil industry shall also comply with two (2) code of practices, namely (i) code of practice for the storage and transport of edible fats and oils in bulk (CXC 36 – 1987) and (ii) code of practice for the reduction of 3-monochloropropane-1,2-diol esters (3-MCPDE) and glycidyl es-

Table 3 Essential composition of fatty acid of palm oil products as determined by gas liquid chromatography from authentic samples (expressed as percentage of total fatty acids)

Fatty acid	Palm oil	Palm stearin[2]	Palm olein[2]	Palm superolein	Palm kernel oil	Palm kernel stearin[3]	Palm kernel olein[3]	Palm oil with a higher oleic acid
C6:0	ND	ND	ND	ND	ND-0.8	ND-0.2	ND-0.7	ND
C8:0	ND	ND	ND	ND	2.4-6.2	1.3-3.0	2.9-6.3	ND
C10:0	ND	ND	ND	ND	2.6-5.0	2.4-3.3	2.7-4.5	ND
C12:0	ND-0.5	0.1-0.5	0.1-0.5	0.1-0.5	45.0-55.0	52.0-59.7	39.7-47.0	ND-0.5
C14:0	0.5-2.0	1.0-2.0	0.5-1.5	0.5-1.5	14.0-18.0	20.0-25.0	11.5-15.5	ND-0.8
C16:0	39.3-47.5	48.0-74.0	38.0-43.5	30.0-39.0	6.5-10.0	6.7-10.0	6.1-10.6	23.0-38.0
C16:1	ND-0.6	ND-0.2	ND-0.6	ND-0.5	ND-0.2	ND	ND-0.1	ND-0.8
C17:0	ND-0,2	ND-0.2	ND-0.2	ND-0.1	ND	ND	ND	ND-0.2
C17:1	ND	ND-0.1	ND-0.1	ND	ND	ND	ND	ND
C18:0	3,5-6.0	3.9-6.0	3.5-5.0	2.8-4.5	1.0-3.0	1.0-3.0	1.7-3.0	1.5-4.5
C18:1	36.0-44.0	15.5-36.0	39.8-46.0	43.0-49.5	12.0-19.0	4.1-8.0	14.4-24.6	48.0-60.0
C18:2	9.0-12.0	3.0-10.0	10.0-13.5	10.5-15.0	1.0-3.5	0.5-1.5	2.4-4.3	9.0-17.0
C18:3	ND-0.5	ND-0.5	ND-0.6	0.2-1.0	ND-0.2	ND-0.1	ND-0.3	ND-0.6
C20:0	ND-1.0	ND-1.0	ND-0.6	ND-0.4	ND-0.2	ND-0.5	ND-0.5	ND-0.4
C20:1	ND-0.4	ND-0.4	ND-0.4	ND-0.2	ND-0.2	ND-0.1	ND-0.2	ND-0.2
C20:2	ND	ND	ND	ND	ND	ND	ND	ND-0.5
C22:0	ND-0.2	ND-0.2	ND-0.2	ND-0.2	ND-0.2	ND	ND	ND-0.3
C22:1	ND	ND	ND	ND	ND	ND	ND	ND
C22:2	ND	ND	ND	ND	ND	ND	ND	ND
C24:0	ND	ND	ND	ND	ND	ND	ND	ND-0.2
24:1	ND	ND	ND	ND	ND	ND	ND	ND

ND - non detectable, defined as < 0.05%; [2]Fractionated product from palm oil; [3]Fractionated product from kernel oil.

Table 4 Chemical and physical characteristics of crude oil (see Appendix of the Codex Standard for Named Vegetable Oils (CXS 210-1999))

Chemical and physical characteristics of crude palm oil	Palm Oil	Palm Olein	Palm Stearin	Palm Superolein	Palm Kernel Oil	Palm Kernel Olein	Palm Kernel Steain	Palm Oil with higher oleic acid
Relative density (X°C/ water at 20°C)	0.891-0.899 X=50°C	0.899-0.920 X=40°C	0.881-0.891 X=60°C	0.900-0.925 X=40°C	0.899-0.914 X=40°C	0.906-0.909 X=40°C	0.902-0.908 X=40°C	0.896-0.910 X=50°C
Apparent density (g/ml)	0.889-0.895 at 50°C	0.896-898 at 40°C	0.881-0.885 at 60°C	0.886-0.900 at 40°C	-	0.904-0.907	0.904-0.906	ND
Refractive Index (ND 40°C)	1.454-1.456 at 50°C	1.458-1.460	1.447-1.452 at 60°C	1.459-1.460	1.448-1.452	1.541-1.453	1.449-1.451	1.459-1.462
Saponification value (mg KOH/g oil)	190-209	194-202	193-305	180-205	230-254	231-244	244-255	189-199
Iodine value	50.0-55.0	56	< 48	≥ 60	14.1-21.0	20-28	4-8.5	58-75
Unsaponifiable matter (g/kg)	≤ 12	≤ 13	≤ 9	≤ 13	≤ 10	≤ 15	≤15	≤ 12

ters (GE) in refined oils and food products made with refined oils (CXC 79-2019).

In addition, to ensure the general safety and quality provision of palm oil as food, several other general Codex guidelines, code of practices and/or standards shall also be consulted and implemented. Specifically, palm oil stakeholders should pay closer attention to the latest revised version of General Principles of Food Hygiene (CXC 1-1969) including Good Hygiene Practices (GHPs) and the Hazard Analysis and Critical Control Point (HACCP) System, General Principles for the Addition of Essential Nutrients to Foods (CXG 9-1987), General Standard for Contaminants and Toxins in Food and Feed ▪(CXS 193-1995), and also General Standard for Food Additives (CXS 192-1995). Complying to those general Codex guidelines, code of practices and/or standards will not only provide better assurance of safety but also facilitate international trade of palm oil.

CONCLUSIONS

The opportunities and potentials for the palm oil sector to play a strategic role in Indonesia's development are enormous. However, this potential can only be realized by appropriately complying the Codex standards, especially in ensuring safety and quality of palm oil. This is not only importance for Indonesia as the biggest palm oil exporting country, but also as the palm oil consuming country. All palm oil stakeholders need

Table 5 Levels of desmethylsterols in crude vegetable oils from authentic samples as a percentage of total sterols

Level/ composition	Pam oil	Palm olein	Palm stearin	Palm superolein	Palm kernel oil	Palm kernel olein	Palm kernel stearin	Palm oil with higher olein acid
Cholesterol	2.6-6.7	2.6-7.0	2.5-5.0	2.0-3.5	0.6-3.7	1.5-1.9	1.4-1.7	1.7-4.7
Brassicasterol	ND	ND	ND	ND	ND-0.8	ND-0.2	ND-2.2	ND-0.4
Campesterol	18.7-27.5	12.5-39.0	15.0-26.0	22.0-26.0	8.4-12.7	7.9-91	8.2-9.7	16.6-21.9
Stigmasterol	8.5-13.9	7.0-18.9	9.0-15.0	18.2-20.0	12.0-16.9	13.4-14.7	14.1-15.0	11.2-15.5
Beta-sitosterol	50.2-62.1	45.0-71.0	50.0-60.0	55.0-70.0	62.6-73.1	67.1-69.2	67.0-70.0	57.2-67.0
Delta-5-avenasterol	ND-2.8	ND-3.0	ND-3.0	0-1.0	1.4-9.0	3.3-4.6	33-4.1	ND-1.9
Delta-7-stigmastenol	0.2-2.4	ND-3.0	ND-3.0	0.0.3	ND-2.1	ND-0.6	ND-0.3	ND-0.2
Delta-7-avenasterol	ND-5.1	ND-6.0	ND-3.0	0-0.3	ND-1.4	ND-0.5	ND-0.3	ND-1.0
Others	ND	ND-10.4	ND-5.0	0-2.0	ND-2.7	2.9-3.7	1.0-3.0	ND-3.8
Total sterol (mg/kg)	300-700	270-800	250-500	100	700-1400	816-1339	775-1086	519-1723

to work together to establishing safety and quality assurance system, covering the entire supply chain (production, handling, transportation, and service chains) to ensure safety and quality of palm oil produced, consumed, and traded.

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Table 6 Levels of tocopherols and tocotrienols in crude vegetable oils from authentic samples (mg/kg)

Level/ composition	Pam Oil	Palm Olein	Palm Stearin	Palm Superolein	Palm Kernel Oil	Palm Kernel Olein	Palm Kernel Stearin	Palm Oil with higher olein acid
Alpha- Tocopherol	4-193	30-280	ND-100	130-240	ND-44	ND-11	ND-10	49-188
Betta-Tocopherol	ND-234	ND-250	ND-50	ND-40	ND-248	ND-6	ND-2	ND
Gamma-Tocopherol	ND-526	ND-100	ND-50	ND-40	ND-257	ND-3	ND-1	4-138
Delta- Tocopherol	ND-123	ND-100	Nd-50	ND-30	ND	ND-4	ND	ND-31
Alpha-tocotrienol	4-336	50-500	20-150	170-300	ND	ND-70	ND-73	74= 256
Gamma-Tocotrienol	14-710	20-700	10-500	230-420	ND-60	1-10	ND-8	406-887
Delta-tocotrienol	ND-377	40-120	5-150	60-120	ND	ND-2	ND-1	33-86
Total (mg/kg)	150-1500	300-1800	100-700	400-1400	ND-260	ND-90	ND-89	562-1471

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