

Sheet No. **NSX2100 FO 001** Food and Beverage

Determination of total chlorine in crude palm oil

Instruments : NSX-2100H system

Detection method : Coulometric titration

Introduction

Palm oil is one of the most versatile and productive oil and its production is increasing year by year within a sustainable framework. It has been widely used in processed food, or as raw material of industrial products and fuel. According to recent report, esters of 3-monochloropropane-1, 2-diol (3-MCPD esters) is generated as a contaminant during refining process of palm oil under existence of chlorine at high temperature, and 3-MCPD esters have a similar toxicological profile as 3-MCPD. For 3-MCPD and 3-MCPD esters singly or in combination, Tolerable Daily Intake (TDI) of 4 µg/kg body weight was set by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) in 2016. NSX-2100H system, which has automatic combination of oxidative combustion and coulometric titration with boat introduction technique, makes it possible to assess risk of 3-MCPD and its esters by monitoring accurate content of chlorine (Cl).

Method

Sampling was carried out after the sample is completely liquefied in water bath at about 100 °C. Standards and samples were measured using a ceramic boat without quartz cotton. A double tube was used as the reactor tube and the temperature of furnace was set to Inlet 1000 °C / Outlet 1100 °C. Standard sample size is usually up to 30 mg, but 60 mg was used in this measurement due to low chlorine content. The Automatic Boat Controller (ABC) program in this sheet was prepared for sample size of 60 mg. If more sample is required, ABC program needs to be further optimized.

Samples

Reference materials from MPOB (Malaysian Palm Oil Board)

- CRUDE PALM OIL x 2
- REFINED PALM OIL x 2

Results

1. Item to be measured : Total Chlorine
2. Analyzer unit : Total Organic Halogen Analyzer Model NSX-2100H
: Automatic Boat Controller ABC-210

3. Total chlorine content

No.	Sample Name	Content (mg/kg)				RSD (%)
		1	2	3	Average	
1	CRUDE PALM OIL 1	4.410	4.337	4.651	4.47	3.7
2	CRUDE PALM OIL 2	7.757	8.143	8.122	8.01	2.7
3	REFINED PALM OIL A	2.730	2.728	2.681	2.71	1.0
4	REFINED PALM OIL B	2.726	2.727	2.837	2.76	2.3

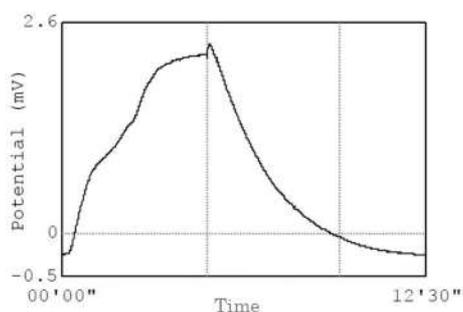
- 4. Temperature : Inlet ; 1000 °C , Outlet ; 1100 °C
- 5. Gas Flow Rate : Ar; 200 mL/min
: O₂; 200 mL/min
- 6. Reaction Tube : Double Reaction Tube
- 7. Sample Boat : Made of Ceramic
- 8. Standard Solution : Cl⁻ 35.4 µg/mL (1 mM HCl) × 20 µL
3.54 µg/mL (0.1 mM HCl) × 20 µL
- 9. Sample Pretreatment : Heat treatment to melt using hot water
- 10. Sample Size : approx. 60 mg
- 11. Measurement Time : 10 minutes

12. Automatic Boat Controller Setting :

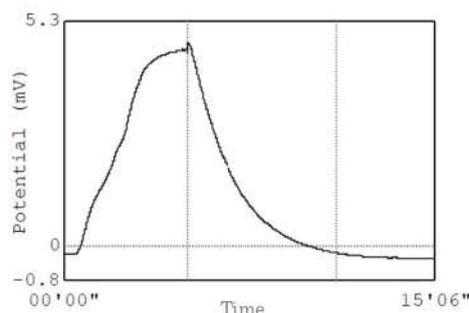
Sample Name	1st Pos. (mm)	Time (s)	Boat Speed (mm/s)	2nd Pos. (mm)	Time (s)	Boat Speed (mm/s)	3rd Pos. (mm)	Time (s)	Boat Speed (mm/s)	END Time (s)	Delay Time (s)
Standard Solution	150	10	20	0	0	0	0	0	0	180	180
Palm Oil	125	10	20	150	60	0.13	170	20	10	100	300

Sample Chart

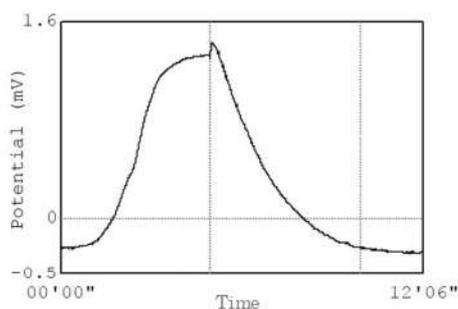
Sample ID : CRUDE PALM OIL 1



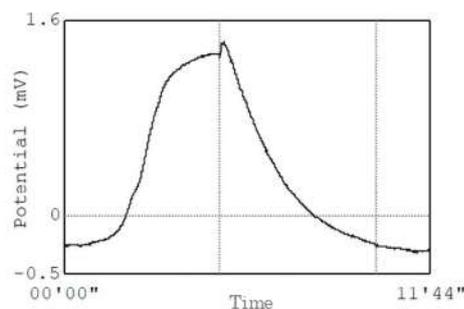
Sample ID : CRUDE PALM OIL 2



Sample ID : REFINED PALM OIL A



Sample ID : REFINED PALM OIL B



*This sheet is provided as a reference and does not guarantee analytical values. Optimal conditions may vary depending on external factors, such as the analysis environment, and the nature of the sample.