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Palm Kernel Oil

Elaeis guineensis seed oil

CAS RN®: 8023-79-8.

DEFINITION

Palm Kernel Oil is the refined fixed oil obtained from the kernel of the fruit of the oil palm *Elaeis guineensis* Jacq. (Fam. Arecaceae). It may contain suitable antioxidants.

IDENTIFICATION

- **A.** It meets the requirements in *Specific Tests* for *Fats and Fixed Oils, Fatty Acid Composition ⟨401⟩*.
- **B.** It meets the requirements in *Specific Tests* for *Melting Range or Temperature ⟨741⟩*.

IMPURITIES

- **Limit of Lead**

[Note—For this test, use reagent-grade chemicals with as low a lead content as is practicable, as well as high-purity water and gases. Before use in this analysis, rinse all glassware and plasticware twice with diluted nitric acid and twice with diluted hydrochloric acid, and then rinse them thoroughly with Purified Water.]

Hydrogen peroxide–nitric acid solution: 10% hydrogen peroxide and diluted nitric acid (1:1). [Note—Use caution.]

Lead nitrate stock solution: Dissolve 159.8 mg of lead nitrate in 100 mL of *Hydrogen peroxide–nitric acid solution*. Dilute with *Hydrogen peroxide–nitric acid solution* to 1000 mL, and mix. Prepare and store this solution in glass containers that are free from lead salts. Each mL of this solution contains the equivalent of 100 µg of lead.

Standard lead solution: On the day of use, dilute 10.0 mL of *Lead nitrate stock solution* with *Hydrogen peroxide–nitric acid solution* to 100.0 mL, and mix. Each mL of *Standard lead solution* contains the equivalent of 10 µg of lead.

Butanol–nitric acid solution: Slowly add 50 mL of nitric acid to approximately 500 mL of butanol in a 1000-mL volumetric flask. Dilute with butanol to volume.

Standard solutions: Into five separate 100-mL volumetric flasks pipet 0.2, 0.5, 1, 2, and 5 mL, respectively, of *Standard lead solution*, and dilute with *Butanol–nitric acid solution* to volume. The *Standard solutions* contain 0.02, 0.05, 0.1, 0.2, and 0.5 µg/mL of lead, respectively.

Sample solution: [Caution—Prepare this solution in a fume hood, and wear safety glasses.] Transfer 1.0 g of Oil into a large test tube. Add 1 mL of nitric acid. Place the test tube in a rack in a boiling water bath. As soon as the rusty tint is gone, add 1 mL of 30% hydrogen peroxide dropwise to avoid a vigorous reaction, and wait for bubbles to form. Stir with an acid-washed plastic spatula if necessary. Remove the test tube from the water bath, and allow it to cool. Transfer the solution to a 10-mL volumetric flask, and dilute with *Butanol–nitric acid solution* to volume.

Tungsten solution: Transfer 0.1 g of tungstic acid and 5 g of sodium hydroxide pellets to a 50-mL plastic bottle. Add 5.0 mL of water, and mix. Heat the mixture in a hot water bath until complete solution is achieved. Cool, and store at room temperature.

Instrumental conditions

(See *Atomic Absorption Spectroscopy ⟨852⟩*.)

Mode: Graphite furnace atomic absorption spectrophotometry

Analytical wavelength: 283.3 nm lead emission line

Injection size: 20 µL

Lamp: Lead hollow-cathode

Furnace conditioning: Place the graphite tube in the furnace. Inject the *Tungsten solution* into the graphite tube, using an argon flow rate of 300 mL/min. Maintain the drying temperature at 110° for 20 s, the ashing temperature at 700°–900° for 20 s, and with the argon flow stopped, the atomization temperature at 2700° for 10 s; repeat this process once more using a second 20-µL aliquot of the *Tungsten solution*. Clean the quartz windows.

Analysis

Samples: *Standard solutions* and *Sample solution*

[NOTE—The sample injection technique is the most crucial step in controlling the precision of the analysis; the volume of each of the *Standard solutions* and the *Sample solution* must remain constant. Rinse the µL-pipet tip three times with either the *Standard solutions* or the *Sample solution* before injection. Use a fresh pipet tip for each injection, and start the atomization process immediately after injecting the *Samples*. Between injections, flush the graphite tube of any residual lead by purging at a high temperature recommended by the manufacturer.]

Concomitantly determine the absorbances of the *Samples*.

Atomize equal volumes of the *Standard solutions* and the *Sample solution* with an argon flow rate of 300 mL/min.

Maintain the drying temperature of the furnace at 110° for 30 s after a 20-s ramp time and a 10-s hold time; the ashing temperature at 700° for 42 s after a 20-s ramp time and a 22-s hold time; and the atomization temperature at 2300° for 7 s with the argon flow stopped.

Plot the absorbance of each of the *Standard solutions*, compensated for background correction, versus its content of lead, in µg/mL, and draw the best straight line fitting the five points. From this plot, determine the concentration, *C*, in µg/mL, of lead in the *Sample solution*.

Calculate the quantity, in µg/g, of lead in the portion of Oil taken:

$$\text{Result} = (C/W) \times V$$

C = measured concentration of lead in the *Sample solution* (µg/mL)

W = weight of the Oil taken to prepare the *Sample solution* (g)

V = final volume of the *Sample solution*, 10 mL

Acceptance criteria: NMT 0.1 µg/g of lead

SPECIFIC TESTS

- **FATS AND FIXED OILS,** *Acid Value* ⟨401⟩**:** NMT 2.0
- **FATS AND FIXED OILS,** *Fatty Acid Composition* ⟨401⟩**:** Palm Kernel Oil exhibits the composition profile of fatty acids shown in *Table 1*.

Table 1

Carbon-Chain Length	Number of Double Bonds	Percentage (%)
6	0	≤1.5
8	0	3–5
10	0	2.5–6
12	0	40–52
14	0	14–18
16	0	7–10
18	0	1–3
20	0	≤1
16	1	≤1
18	1	11–19
18	2	0.5–4

- **FATS AND FIXED OILS,** *Peroxide Value* ⟨401⟩**:** NMT 10.0
- **FATS AND FIXED OILS,** *Unsaponifiable Matter* ⟨401⟩**:** NMT 1.5%
- **MELTING RANGE OR TEMPERATURE** ⟨741⟩**:** 27°–29°
- **WATER DETERMINATION,** *Method I* ⟨921⟩**:** NMT 0.1%, 50 mL of chloroform being used instead of 35–40 mL of methanol as the solvent.

ADDITIONAL REQUIREMENTS

- **Packaging and Storage:** Preserve in well-closed containers. Do not store above 45°.
- **Labeling:** Label it to indicate the name and quantity of any added antioxidants.

Auxiliary Information - Please check for your question in the FAQs before contacting USP.

Topic/Question	Contact	Expert Committee
PALM KERNEL OIL	Documentary Standards Support	CE2020 Complex Excipients
REFERENCE STANDARD SUPPORT	RS Technical Services RSTECH@usp.org	CE2020 Complex Excipients

Chromatographic Database Information: Chromatographic Database

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