The Role of the Surveyor

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ABSTRACT

The surveyor provides guidance and assistance for cargo protection, besides ensuring that the palm, palm kernel and coconut oils conform to the contractual requirements. This involves quality and quantity check, inspection of storage facilities, conveying systems and transport vehicles and supervision of loading and discharge operations. Usually, the surveyor's findings form the basis for settlement of the transaction. With the ever-developing technology customer requirements have become more and more sophisticated, and consequently the need for complex and sophisticated service is considerably increasing. In order to achieve the desired objective the surveyor, besides being neutral and reliable, must be endowed with adequate technical know-how and facilities.

There are quite a few pitfalls that can occur during the course of manufacture, handling, transportation, transfer points, etc., and in order to prevent them, the surveyor should conduct a series of checks at various points to ensure that the quality of the oil is not affected. Adequate precautions and timely corrective measures would evidently ensure this requirement. Quality check is equally essential, with need for a well-equipped testing laboratory with accurate instruments, controlled and managed by adequately qualified and experienced chemists with the knowledge of updated technology.

The surveyor can also assist in arbitration, insurance claims, general, commercial and maritime information, as his opinions and recommendations are unbiased, reliable and accurate, which helps make decision-making a less difficult task. Besides the buyer and seller, the surveyor also protects the interests of the financier, underwriter, shipowners and in certain cases the government departments.

INTRODUCTION

Over the centuries merchants invariably accompanied their cargoes, thus personally exercising a controlling function at each stage of the transport. Overwhelmed by the magnitude of world trade the merchants were gradually compelled to concentrate on trading activities and, therefore, transferred the supervisory task to a neutral person or body. Thus an independent surveyor (or controller) was born.

The objective role of a surveyor is to provide guidance and assistance for the protection of cargo, besides ensuring that it conforms to the contractual requirements. The job of a surveyor when applied to palm, palm kernel and coconut oil includes a number of activities, such as quality and quantity check; inspection of storage facilities; conveying systems and transport vehicles; supervision of loading and discharge operations.

Most international commodity contracts provide for each party to be represented at various stages of the transport and handling by an independent controller or surveyor whose findings form the basis of the final settlement of the transaction.

With the ever-developing technology, customer requirements have become increasingly sophisticated. Consequently, the job of a surveyor is far from being limited to traditional supervisory work, and the need for complex and sophisticated services is considerably increasing. In order to achieve the desired objective the surveyor, besides being neutral and reliable, must have adequate technical know-how and facilities. The following six questions which determine the scope of survey must be kept in mind:

1. What—quality, quantity, loading, etc.
2. Why—purpose
3. When—timely action
4. Where—place of action
5. How—technology, technique
6. Who—knowledge, experience

By carrying out a reliable and accurate performance a surveyor contributes to the growth of exports and thus serves as a catalyst to the promotion of international trade.

PITFALLS AND PRECAUTIONS

There are quite a few pitfalls that can occur during the course of manufacture, handling, transportation, transfer points, etc., and in order to prevent them, the surveyor has to conduct a series of checks at various points to ensure that the quality of the oil is not affected. Adequate precautions and timely corrective measures would evidently ensure this requirement, and that is where an absolutely unbiased and reliable surveyor becomes the pivotal figure in any transaction.

Some of the common pitfalls in regard to quality are:

- Rise in FFA (free fatty acids)
- Collection of impurities at various stages
- Contamination
- Adulteration

Free Fatty Acids (FFA)

The lower the FFA content, the better is the quality of the oil. Although three oils under consideration are inherently of rancid taste and susceptible to oxidation in the crude stage, palm and coconut oils have certain natural attributes that arrest the growth of rancidity. For example, palm oil has a high content of natural antioxidant, such as tocotrienols which contribute to oxidative stability, especially in the refined state. Coconut oil is also resistant to development of rancidity, because of the low level of unsaturation. Nevertheless, under adverse conditions a number of factors, such as moisture, impurities, metals and carotene (in palm oil) combine to cause deterioration. One remedy is to use antioxidant, as is quite common in several countries.

Collection of Impurities

Gradual addition of impurities at the various stages of handling is a common problem. Therefore it is essential to ensure at every stage that cleanliness is maintained.

Contamination

Contamination can occur from brass and bronze fittings in tanks, sampling instruments and thermometer casings; iron from screw presses and from improper pigging. This can lead to oxidation or other chemical reactions. Abrupt excessive heating is equally dangerous, as it would lead to oxidation, and in certain cases discoloration. Similarly, abnormal presence of water, either in quantity or in duration, will also adversely affect the quality causing rise in rancidity. Care should be taken to prevent such contamination.

Adulteration

Palm oil and palm kernel oil do not face this problem except by accidental admixture. But in the case of coconut oil, due to similar properties, palm kernel oil may sometimes be added. Price is the major factor for such adulteration.

Precautions

- Use stainless steel tanks, fittings, etc., as far as practicable and feasible.
- Give a suitable antioxidant protective coating if mild steel is used.

- Use stainless steel, plastic, HDP, glass implements.
- Avoid use of brass, copper or bronze fittings, but if used these should be plated with chromium and nickel.
- Clean regularly all items coming in contact with oil.
- Keep constant vigil to prevent contamination by external elements.
- Maintain impeccable cleanliness.
- Avoid excessive heating.
- Avoid undue exposure to air.

The above are general comments, but hereafter specific recommendations concerning precautions, preventive and corrective measures are given while discussing each item or subject. However, one very important recommendation is to ensure smooth fall or flow of oil while pumping into a tank. If the gush of oil is allowed to spray from an abnormal height, moist air has a tendency to dissolve in the sprayed particles of the column, resulting in gradual but slow oxidation, increasing the acid value. Additional precaution is necessary in the case of water accumulation in the tanks during storage, which must be drained off regularly.

TECHNICAL AND COMMERCIAL ASSISTANCE

One need not emphasize the fact that quality check is essential and this needs a well-equipped testing laboratory with accurate instruments, controlled and managed by adequately qualified and experienced chemists with the knowledge of updated technology.

The surveyor is also in a position to provide assistance in arbitration, insurance claims, general, commercial and maritime information. Being an independent body or person, the surveyor's opinions and recommendations are unbiased, reliable and accurate, which helps make decision-making a less difficult task.

It is rather an understatement that a surveyor protects the interest of a buyer or a seller, but on the contrary his umbrella of protection shades not only the seller and buyer, but also the financier, underwriter, shipowners and, in certain cases, government departments.

INSTALLATIONS

Installations comprise storage tanks with ancillary equipment, such as multi-pipelines, pumping and delivery facilities. Heating systems, suitability and cleanliness, distinguishing marks on pipelines, valves, tanks, etc. are essential requirements. As this subject has already been discussed in detail elsewhere in the conference, no description is given here.

TRANSPORTATION

Transportation is carried out by road and rail tank cars on land and by sea-going or coastal vessels or tank barges on water. Suitability and cleanliness are equally essential factors as in the case of installations. Stainless steel is ideal for tanks, but if mild steel is used for economic reasons, protective coating (and insulation in temperate and cold zones) is highly recommended.

QUALITY CONTROL

Sampling

The object of sampling is to obtain a small, manageable quantity from all or part of a larger quantity, which is representative of the whole or part and whose properties correspond to the whole or the designated part of the total.

It must be remembered that a sample of perhaps only half a liter may represent many thousands of liters. Correct and careful sampling to obtain the truest representation is, therefore, a most important requirement.

In the case of bulk liquids samples are drawn by a special type of sampling equipment (stainless steel cans or caged bottles) (Figs. 1,2) from different levels of the storage tanks or the ship's tanks, and the sample materials so collected are mixed and composite samples prepared.

It is equally important to draw representative samples at each stage of the operations—from the shore tanks or delivery tanks, vehicles, barges, etc.—if possible from any pipeline used in moving the cargo from one bulk container to another, and finally from the vessel's tanks. If loaded through ship's lines, initial pumped material should be inspected. If found in sound condition, loading may then be resumed, but if the oil proves to be contaminated it should be discharged and set aside in a separate tank and the lines and the ship's tanks recleaned and reinspected before resuming further pumping.

Separate "contamination" samples must be drawn from each ship's tank jointly with the Master or the Chief Officer of the vessel.

Sample Testing

Samples collected are subjected to organoleptic tests for texture, visual color and odor. Laboratory analyses may include:

- Acid value, FFA
- Insolubility in alcohol
- Saponification value
- Unsaponifiable matter, saponifiable matter
- Peroxide value
- Iodine value
- Specific gravity
- Moisture
- Color (where limits specified)

INSPECTION AT LOADING (See Figs. 3,4)

Vessel's Tanks

Tanks should withstand a 2 PSI 30 min. airtest. Heating coils should be tested at full working pressure. If there are double bottoms beneath the tanks they must be tested, using a height of fuel oil or water equivalent to the height of the tank.

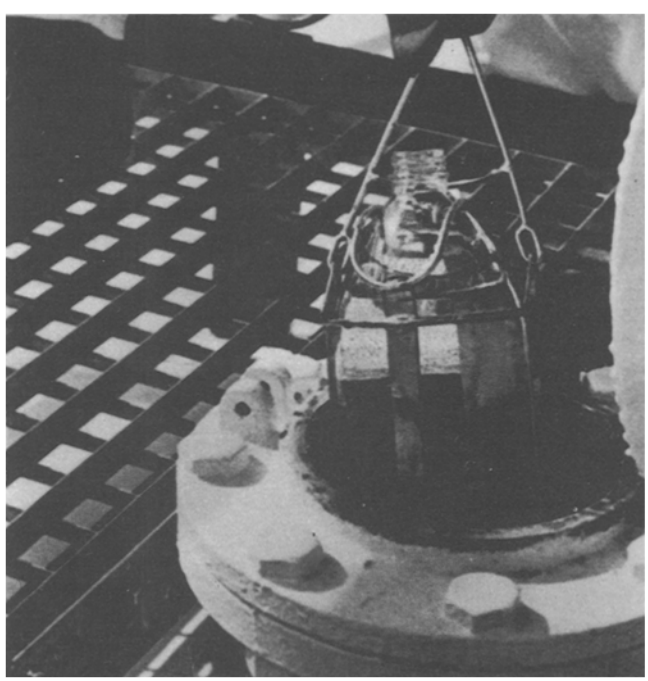

FIG. 1. Caged sampler.

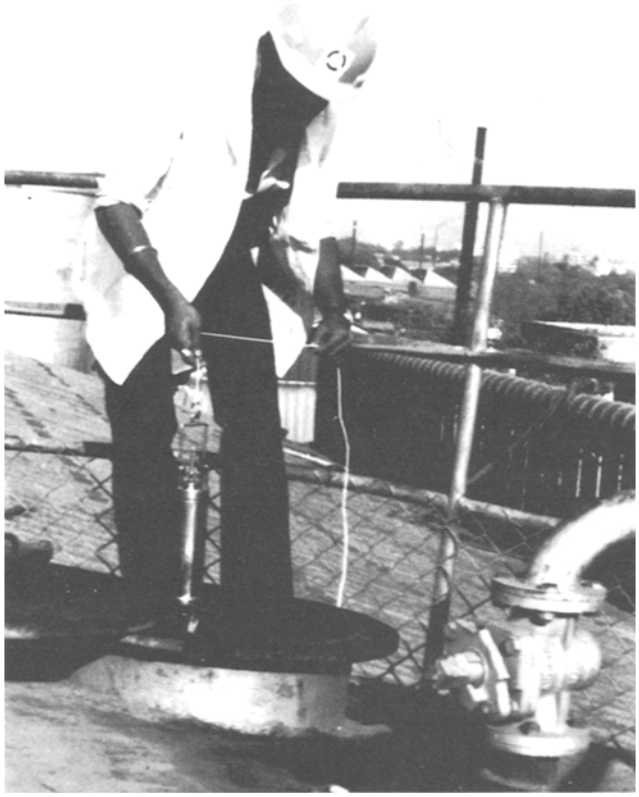

FIG. 2. Stainless steel sampler.

The surveyor must verify that the ship's tanks are adequately clean and dry for carrying the type of oil to be carried. Vessel's pipelines, as far as possible, mud boxes and pumps should be opened for this purpose.

Cleaning. Cleaning of ship's tanks will essentially depend upon the previous product or products carried in the tanks and, keeping this aspect in view, the recommended procedure for cleaning with reference to palm oil, palm kernel oil and coconut oil, is a combination of three or more of the procedures mentioned below:

- Butterworthing with hot water (80 C) for about 1 hour
- Butterworthing with hot water (80 C) and 1% cleaning-solution (detergent emulsifier) or 3% caustic soda-solution (if coating permits) and an emulsifier for about 2 hours
- Butterworthing with fresh water for about 1 hour
- Steaming with toluene
- Butterworthing with fresh water for about ½ hour
- Draining of tank, line and pump
- Drying

Steaming with toluene is not recommended if it can be avoided. If the tanks are heavily contaminated this step is considered essential, a maximum of 1 vol% of toluene is used. All residues of solvent must be removed.

Note: Vessels usually carrying toxic liquids may not be used for edible oils, because even after cleaning toxicity may affect edible oils adversely.

Shore Lines

The shore lines (pipelines) through which the loading will take place, including the flexible hoses, should be inspected for their suitability to convey the declared oil. All valves leading elsewhere than to the vessel must be closed and in principle secured with seals. It will be necessary to find out whether the pipeline leading to the vessel is full, empty or partly full since its contents need to be considered when calculating the loaded weight of the cargo.

Cleaning. Pigging facilities for clearing and cleaning pipelines with a closely fitted plug launched through the pipeline with compressed air or inert gas may also be used.

Shore Tanks

Shore tanks should be checked for internal cleanliness. Moreover, the type of oil stored before the new arrival, if not compatible, could lead to contamination, hence this aspect should be thoroughly checked before tanks are passed or accepted. The tanks, in such cases, should be thoroughly cleaned. Heating coils should be checked to ensure proper working.

Cleaning. For cleaning shore tanks, both lined and unlined, and which are only interchangeably used for storing palm oil products, the following steps as described in (1) are required:

- The tank walls and heating coils are manually cleaned by cloth and soft brushes.
- The tanks are flushed and rinsed with hot and cold water.
- Draining and drying-water is drained and the tanks are dried by using compressed air.
- For more thorough cleaning, an additional flushing step using hot detergent solution followed by hot water and cold water flushing and rinsing is useful.

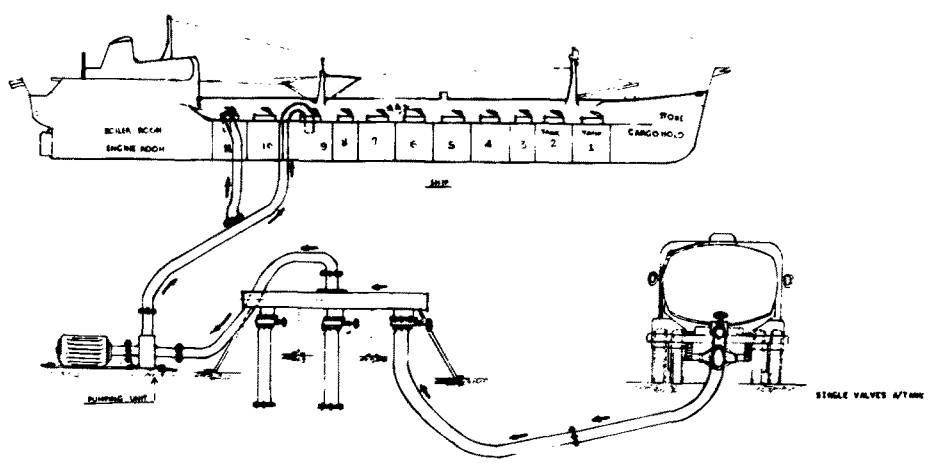

FIG. 3. Loading and unloading of oil: Flowsheet A.

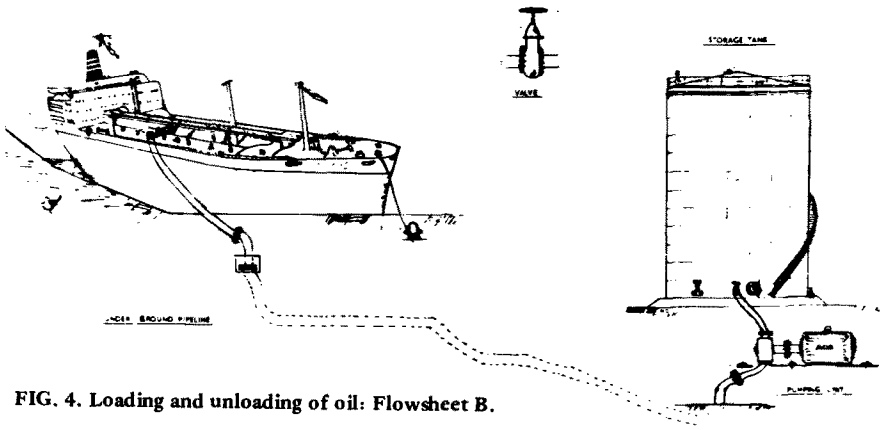

FIG. 4. Loading and unloading of oil: Flowsheet B.

QUANTITY CHECK/WEIGHT CONTROL

Shore Tanks

Shore tank measurements are taken jointly with the installation personnel and/or interested parties. When only part of the contents of a shore tank is delivered to a vessel the volume of oil in the shore tank before and after delivery is determined. Temperature and density (or specific gravity) are ascertained before commencement and after completion of loading. The corresponding weights are calculated, based on the tank calibration chart, the difference between the two results being considered as the loaded weight. Periodical verification of calibration tables should be made, and whenever distortions in tanks (such as expansion, contraction, sagging, etc.) are noticed, a recalibration must be made.

Vessel's Tanks

After loading has been completed, ullages or sounding of all the vessel's loaded tanks are recorded jointly with the ship's officer (see Fig. 5). At the same time the temperatures of the oil (at the top, middle and bottom levels) of each ship's tanks are also taken. A record of the vessel's aft and forward draft and list is made. An ullage and temperature report agreed on with the vessel's Chief Officer and showing the volumes of oil in each tank is completed.

If the weights are ascertained by calibration, detailed calculations showing soundings, volumes, temperatures, densities (or specific gravity) are to be made. The state of shore and ship's lines before and after loading, i.e., whether blown clear or left full, should be reported. After loading all empty spaces should be inspected in order to check whether any signs of leakages are found. Tank lids may be sealed for safety reasons.

INSPECTION AT DISCHARGE (See Figs. 3,4)

Heating

Upon arrival at the port of discharge the ship's temperature log should be consulted in order to check whether or not the heating instructions have been followed. A special check should be made to see whether or not the oil is rendered pumpable down to the bottom which should be the case if the heating instructions have been properly followed.

Discharge should not start until the entire oil has reached the minimum temperature required for smooth discharge, because once any liquid cargo has been pumped away, it will become more and more difficult, not to say impossible to melt any hardened cargo located beneath the heating coils, with the result that a substantial portion of the oil will have to be removed from the tank by manual or semi-mechanical means.

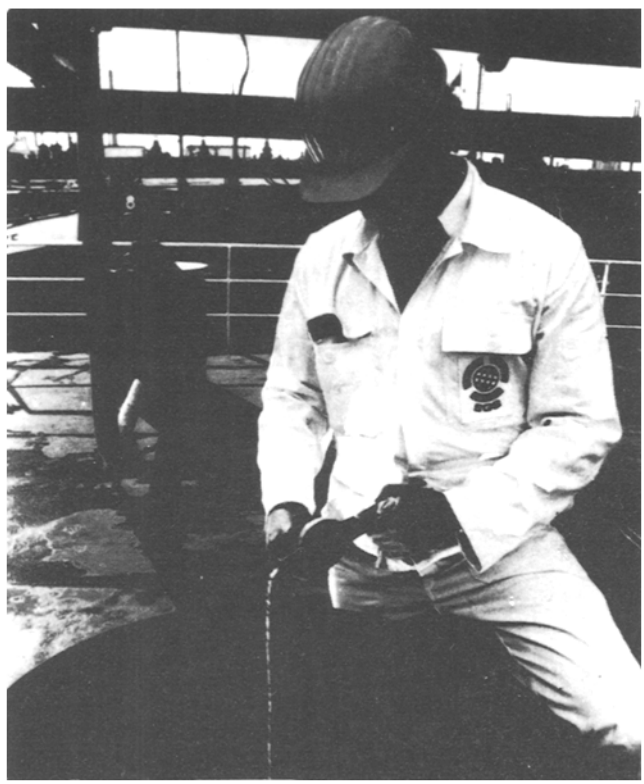

FIG. 5. Ullaging

Some oils require no heating in normal handling conditions, while some may require heating in conditions which only apply at one end of an ocean voyage. Others (such as palm oil) always require heating before they can be pumped. For oils that cannot normally be discharged at ambient temperature, but need some heating in transit (as is the case of palm oil) appropriate heating instructions are given. It is highly recommended, almost essential that at the commencement of discharge a small quantity of the product is slopped in order to get rid of any latent impurities in the pipelines.

Ullages/Soundings

Prior to the discharge operations ullages (sometimes soundings) of all the ship's tanks are taken together with the top, middle and bottom temperatures. These data are to be ascertained jointly with the ship's officer for comparison

TABLE I

Coefficients of Expansion

	Coefficient of temperature correction for wt by vol. per 1 C	Coefficient of expansion	
		Temperature range, ° C	Expansion coefficient per 1 C
Coconut oil	0.00071	20 to 60	0.00078
Palm oil	0.00068	42 to 70	0.00077
Palm kernel oil	0.00070	20 to 60	0.00078

with those ascertained at the port of loading.

The volumes will have to be corrected, if necessary, for trim and list of the vessel. The ullages data will then have to be interpreted. Broadly speaking the coefficient of expansion marginally varies for different types of edible oils (see Table I). The coefficients of expansion shown are approximations. More accurate data can be obtained by calculating the coefficient of expansion over the range of observed temperatures.

By checking, from the ship's calibration tables it should normally be possible to calculate how much oil is missing, if any. If the difference between the onboard volumes and weights at the port of loading and discharge is suspect, the ship's log should be scrutinized for possible explanations and all ship's spaces inspected for traces of leakage. If necessary a wider search will have to be initiated including the measurement and sampling of bunker and double bottom tanks and checking of the steam returns of heating coils.

Contamination Samples

Contamination samples are drawn from all vessel's tanks jointly with the vessel's representative. Separate bottom samples from each tank are drawn and a water test is made at the same time as the ullages are measured.

The comparison of loading and discharge contamination samples may possibly indicate whether the oil is contaminated. In case of contamination such oil should be discharged in a separate shore tank.

Completion of Discharge

Upon completion of discharge, all relevant ship's tanks should be inspected in order to verify whether they have been entirely emptied. Shore lines should be checked in order to verify whether they are full, empty or partly full. Only valves on the lines leading directly from vessel to the receiving shore tanks should be opened (others should be closed and sealed).

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REFERENCE

1. Storage, Handling and Transportation of Palm Oil Products, PORIM technology publication No. 7, August 1982.

APPENDIX: CHARACTERISTICS, STORAGE, TRANSPORT RECOMMENDATIONS, RISKS AND PRECAUTIONS FOR OILS

COCONUT OIL

Description

Organoleptic Characteristics. Solid, greasy, somewhat crystalline fat with a certain degree of brittleness, whitish to yellowish in color, usually creamy white.

Current Official Standards.

- British Standards
- AOCS (American Oil Chemists' Society)
- NIOP Standards (National Institute of Oilseed Products, San Francisco).

Storage

Conditions

- Cleanliness: essential
- Limited access to air

Tolerable Storage Period. In large tanks with limited access to air: considerable period without serious detriment to stability.

Risks. Since its unsaturation is low, coconut oil is extremely resistant to development of rancidity, however, very prolonged storage period is undesirable because of deterioration that could occur through oxidation:

- Decrease in stability
- Changes that impair the color of stored oil, especially in the crude form. However, the color is reduced without difficulty by the usual refining and bleaching treatment
- Increase in foots
- Presence of moisture, generating biological activity (enzymes, microorganisms, bacteria, molds), will also affect the quality of the stored oil
- Contamination: in case of error in pumping or insufficiency in cleanliness of tanks, pumps and lines before a transfer.

Remark: The percentage of coconut oil in a mixture of coconut oil and tallow or other ordinary fats usually is calculated from the saponification value of the mixture.

Stowage and Transport

Inherent stowage and transport risks

- Contamination
- Foots, moisture, impurities, FFA increase

Precautions to Be Taken

- Cleanliness inspection of ship's tanks, pumps and lines
- Sweeping and squeegeeing at discharge
- Blowing of the lines and pumps
- Whenever possible avoid use of water to blow the lines and pumps empty (use of air is preferable).

Remarks (heating precautions):

- The temperature of the oil during delivery into the ship's tank shall be that usual at the port of loading and if heat is applied the temperature shall not exceed 46 C.
- During the voyage the oil must be kept at temperature of minimum 27 C to maximum 32 C.
- In sufficient time prior to arrival at port of discharge, heat should be applied *gradually* to ensure that the temperature of the oil at time of discharge shall not be less than 41 C and not more than 46 C. The cargo should be maintained within this range of temperature throughout the discharge.
- The increase in temperature of the oil during a period of 24 hours *must never exceed 5 C.*
- In order to avoid any damage to the quality of the oil, it is essential that the heat should be applied gradually. A sudden increase in temperature must be avoided as it will almost certainly result in damage to the oil.
- Top and bottom temperatures should be maintained as nearly equal as possible.
- No large differences, say exceeding 5 C, in the temper-

ature of the oil in different parts of the tank should be permitted.

PALM OIL

Description

Organoleptic Characteristics. Granular, yellow orange (when heated) to brown (when cold), pleasant and characteristic odor.

Current Official Standards

- British Standards
- NIOP
- (AOCS has also recommended standards).

Storage

Conditions

- Cleanliness: essential
- Limited access to air

Tolerable Storage Period. In large tanks with limited access to air: considerable period without serious detriment to stability.

Note: After a month's storage, a slight increase of FFA content is noticed (0.18% to 0.27%).

Risks. Very prolonged storage period is undesirable because of the deterioration that could occur through oxidation:

- Decrease in stability
- Changes that impair the color of stored oil, especially in the crude form
- Increase in foots
- Presence of moisture, generating biological activity (enzymes, microorganisms, bacteria, molds) will also affect the quality of stored oil
- Contamination: in case of error in pumping or insufficiency in cleanliness of tanks, pumps and lines before a transfer.

Precautions to Be Taken

- Heating of palm oil prior to storage should be avoided (transfer should be carried out at ambient temperature, if possible).
- Tanks must be filled as completely as possible to reduce exposure to air (ratio of surface exposed to air: weight of stored oil is to be reduced to a minimum).
- Heat must not be applied to oil during storage. (Heating prior to loading will be done in such a manner that desirable temperature for pumping will not be attained too long before transfer).
- To prevent oxidation of oil during storage, some Malaysian producers are installing coolers in the mill after the vacuum-drying stage to reduce temperature of the oil to 45 to 50 C before discharge into storage tanks.
- Blanketing the oil with inert gas is a commendable precaution that is practiced by modern tank farm operators.
- Tank must not contain any copper, copper alloy or any unacceptable metals that are harmful to crude palm oil.
- In common with other vegetable oils, palm oil should not come in contact with copper, and excessive iron content is harmful. Some iron may originate from the soil, and iron contact with processing machinery is inevitable, but prolonged storage in uncoated steel tanks is harmful, especially if the FFA of the oil is high.
- Palm oil has good natural resistance to oxidation, due to its relatively high content of tocotrienols, but the heavy metals act as catalysts, and once oxidation takes place, bleaching becomes more difficult, because the carotene, which is easily oxidized, becomes degraded and increasingly difficult to bleach.

Note: In the purified but unrefined and unbleached stage, palm oil retains a good keeping quality.

Stowage and Transport

Inherent stowage and transport risks

- Contamination
- Oxidation
- Moisture, impurities, FFA increases.

Precautions to Be Taken

- Cleanliness inspection of ship's tanks, pumps and lines
- Sweeping and squeegeeing at discharge
- Blowing of the lines and pumps
- Whenever possible avoid use of water to blow the lines and pumps empty (use of air pressure is preferable).

Remark: Peroxide values taken at time of shipment give a good measure of the quality of the oil and when compared with values at time of arrival at destination, give a good check on the standard of care and attention given to the oil in ship's tanks.

Heating Precautions

- The temperature of the oil during delivery into the tank(s) of the ship shall be that usual for the type of oil in question at port of loading, and if heat is applied the temperature shall in no case exceed 52 C (125 F).
- For tanks with heating coils: ship's coil must be completely covered by the oil on completion of loading.
- Heating shall be effected by hot water or, if this is impracticable, by low-pressure steam. Any pressure up to 3½ kg/cm^2 gauge reading is acceptable. During the voyage the oil must be kept at a temperature of minimum 32 C (90 F) to maximum of 35 C (95 F).
- In sufficient time prior to arrival at port of discharge, heat should be applied *steadily*, to ensure that the temperature of the oil at time of discharge should not be less than 49 C (120 F) and not more than 52 C (125 F). The cargo should be maintained within this range of temperature throughout the discharge.
- The increase in temperature of the oil during a period of 24 hours *must never exceed* 3 C (5 F).
- In order to avoid any damage to the quality of the oil, it is essential that heat should be applied gradually. A sudden increase in temperature must be avoided as it will almost certainly result in damage to the oil.
- Top and bottom temperatures should be maintained as equal as possible. No large differences, say exceeding 5 C (9 F) in the temperature of the oil in different parts of the tank should be permitted.
- The temperature referred to above is the average of top, middle and bottom readings. The top reading will be taken at about one foot (30 cms) below the surface of the oil. The bottom readings will be taken:
- in tanks with bottom coils at one foot (30 cms) above the level of the coils
- in tanks with side coils but no bottom coils, at a point about two feet (60 cms) from the bottom of the tank and about one foot (30 cms) from the side coils
- in tanks with heat exchangers instead of heating coils, one foot (30 cms) above tank bottom.

PALM KERNEL OIL

Description

Organoleptic Characteristics. Granular, creamy color, consistency less brittle, taste and smell strong, characteristic and tenacious.

Current Official Standards

- British Standards BS 652:1967
- NIOP Rules 150-153, 167.

Storage (See entry under palm oil)

Stowage and Transport (See entry under palm oil)