Carriage of palm kernel shells

Palm kernel shells are commonly perceived as a “non-hazardous” cargo, however a number of recent incidents have demonstrated that this cargo can be a hazard to the ship and its crew.

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Palm kernel shell (PKS) is a by-product in the production of palm oil and is commonly used in the natural biomass energy industry. PKS is a fibrous material, brownish-yellow in colour and with particle sizes normally ranging between 5 mm and 40 mm. Due to its high calorific value, averaging 4000 Kcal/kg, and low ash content, it is considered an attractive source of fuel in the production of energy from renewable sources. Each year the palm oil industry produces over 5 million tons of PKS. Although the cargo is frequently carried by ship, there is currently no schedule for the cargo in the IMSBC Code. Although a draft schedule for PKS has been proposed to the IMO's working group, there is currently no firm date for when the amendments, if any, will be incorporated into the Code.

Cargo properties and handling

The practice in most exporting countries is for PKS to be loaded from open stockpiles exposed to the weather. The cargo declarations and MSDS sheets provided by shippers state various moisture contents, usually in the range of 20% to 23%. However, actual moisture certificates or moisture declarations based on pre-loading sampling are usually not provided by shippers. Actual moisture contents may or may not be in excess of the above range. Once loaded, excess water may drain downwards within the stow during the voyage and accumulate on the tank-top and in the bilges. As a result, the moisture content of the cargo at the bottom of the stow is likely to be much higher than the average for the entire cargo. The oil content of the PKS is likely to be below 1%, although it is difficult to obtain firm evidence of this.

Potential hazards

PKS should not be confused with palm kernel expellers, which can contain more residual oil and are therefore regulated in the appropriate section of the IMSBC Code under "seed cake" Group B cargoes, i.e. cargoes that present a chemical hazard. However, while the properties of PKS may not match either of the established IMSBC Code schedules, PKS is associated with the following potential hazards:

• PKS undergoes microbiological self-heating as a result of being routinely loaded with a moisture content well above the point where mould spores and/or bacteria can proliferate. Reportedly, temperatures above 70°C are commonly measured inside the holds during loading.

• The cargo undergoes oxidative self-heating, most likely through oxidation of the oil residues, and this can lead to an element of combustion, as evidenced by rapid oxygen depletion and high carbon monoxide levels measured in PKS cargoes.

• Oxygen depletion and high carbon monoxide levels present a serious risk to the safety of the crew and/or any stevedores entering the cargo spaces. It is necessary to undertake extensive ventilation and gas monitoring to ensure safe working conditions prior to entering the cargo spaces or accesses.

• In at least two cases, very high methane levels were measured in the holds, most likely produced by an anaerobic fermentation process related to the high moisture content. Not enough is known about the factors resulting in methane production to say whether there is a safe moisture content below which there will be no significant methane production or whether it is possible to keep the methane levels within safe limits by natural ventilation during the voyage.

Shipping documents

As PKS is not listed by name in the IMSBC Code, and does not have a Bulk Cargo Shipping Name (BCSN) under Section 1.3 of the IMSBC Code, a special certificate must be provided by the Competent Authority of the country of shipment prior to loading. Such certificates are not normally provided as the majority of shippers declare the cargo “non-hazardous” and/or “Group C”. Such declarations are in breach of Section 1.3 of the IMSBC Code and should not be accepted.

Summary and recommendations

When the carriage of PKS is proposed by the charterer, ship-owners and operators are recommended to:

1. Request cargo information in accordance with section 1.3 of the IMSBC Code. This should include a certificate issued by the competent authority of the port of loading, stating the characteristics of the cargo and the required condition for carriage and handling of this shipment. If the competent authority at the port of loading is of the view that the cargo poses a hazard, the flag state should be consulted to set the preliminary suitable conditions for the carriage of this cargo. For example, the flag state may require a vessel’s holds to be equipped with mechanical ventilation when cargoes emitting flammable gases are carried.

2. Monitor the cargo surface temperature at the time of loading. The cargo shall be accepted for loading only if the temperature does not exceed 55°C and the moisture content does not exceed 11%.

3. Measure and record methane, oxygen and carbon monoxide levels during the voyage with a gas meter operating on either infrared or thermal conductivity. Catalytic sensors do not operate correctly below ~10% oxygen.

4. Ventilate cargo spaces immediately if methane levels exceed 1% by volume of 20% LEL.

5. Ban smoking and use of naked flames on deck while the cargo is on board.

6. Do not permit personnel to enter the cargo holds and spaces adjacent to the cargo holds unless a proper risk assessment has been carried out and a permit for entry into an enclosed space has been issued.

7. Apply water and/or CO2 in the event of a fire in the hold, as both are considered as suitable extinguishing media for the cargo. Bear in mind, however, that sealed holds may have an accumulation of methane gas which can ignite if the holds are opened during fire-fighting.

The need to ensure sufficient ventilation to prevent a flammable atmosphere in the holds take precedence over considerations to keep the cargo dry or to maintain fumigation. If the methane level increases despite proper ventilation, Gard should be informed immediately and expert advice should be sought.

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