Cargo oil heating practices

Rahul Sapra
Senior Surveyor
+65 6506 1435
rahul.sapra@ctplc.com

Claims can arise when cargo is not carried at the recommended temperature. Handling of cargo during transit is the responsibility of the vessel crew and owner. In this article, we look at two cargo types and the issues that can arise.

Sudden and rapid changes to cargo temperature should be avoided.

Introduction

It is sometimes essential to apply heat during transit to maintain or raise the temperature of cargo. Over or under heating of cargo can adversely affect the property of the cargo and, on many occasions, this change in the cargo quality is irreversible. Improper temperature control can lead to deterioration in the cargo quality or poor pumping performance leading to excess cargo remaining on board (ROB).

Petroleum cargo

Highly viscous petroleum cargo or cargoes with a high pour point or wax content require heating during transit because heating reduces the viscosity of the cargo and enables it to flow better. Heating also leads to a constant circulation of cargo within the tank. This leads to a reduction in wax formation and sedimentation, and helps in the outturn at the discharge port.

Usually, it is wise to heat early to maintain the temperature during the voyage, rather than to be forced to raise the temperature of the cargo significantly at the end of the voyage. The rule of thumb is that the cargo temperature should be at least 10°C above the pour point during the entire voyage. Heating should not be stopped during the voyage and should be adjusted to gradually change the temperature of the cargo to the desired level and then to maintain it.

Heating instructions are often too vague, with the charterers relying on the experience of the master. This is especially important if the cargo is loaded at a temperature higher than that requested as per the charterparty. In this case, it is recommended to wait for the temperature to fall to the desired level and then start the heating to maintain this temperature. It is important to note that if the pour point of the cargo is high and the required temperature as per the charterparty is less than 10°C above the pour point, then the charterer should be consulted and the agreed temperature should be maintained to minimise any shortage claims. When crudes with high wax content requiring heating are carried, it is important that the charterer provides clear instructions for heating both on the voyage and throughout discharge. The temperature of the cargo at any stage should not be higher than the ship is designed to carry. At the discharge port, the ship staff should ensure that the cargo is stripped immediately after it reaches the level of the heating coils in the cargo tanks.

Edible oil cargo

Edible oils such as the various categories of palm oil and vegetable oils are highly viscous in nature and require special attention during discharge. Each cargo of this type will have specific transportation and handling requirements. Shipowners should ensure that the supplier or

charterer provides all the necessary information about the cargo such as specific gravity, colour, moisture content, impurities, melting point and free fatty acid (FFA) content.

Heating instructions should also be detailed and these should state the in-transit temperature, loading/discharging temperature and the allowed daily rate of increase of temperature. Rapid heating of certain grades can cause scorching of the cargo, and overheating the cargo can promote oxidation, hydrolysis, scorching and discolouration of the cargo. Rapid heating can also cause an increase in FFA content, which causes the cargo to turn sour, and is used as a measure of cargo quality, especially for palm oil.

It is therefore important to monitor the temperature of the cargo carefully and, if increasing, raise the temperature of the cargo at a gradual pace. Proper planning is required for heating these cargoes, especially when a significant rise in the temperature is required over a short voyage prompting a higher rate of heating. To avoid overheating or scorching, small parcels should be stowed in a tank of suitable size and the use of larger tanks, with a large heating coil surface area, should be avoided.

Crew should remember that carriage of heated edible oil cargoes into cold climates may cause the cargo vapours to solidify inside the cargo tank ventilation piping, effectively preventing the pressure in the cargo tank to equalise. This could potentially result in a catastrophic failure of the cargo tank.

The Food and Agriculture Organization of the United Nations (FAO) recommends the practice for storage and transport of edible fats and oils *(CAC/RCP 36-1987)*. It gives guidance on the maximum temperature required for the various grades during transit and while loading and discharging.

These are as follows overleaf:

The acid value (AV) of the cargo is used as a measure of quality. The acid value should not be too high as it denotes an excessively high content of FFA, which causes the cargo to turn sour. Fat is combined with glycerine and fatty acid. When the fat is hot, it decomposes to free fatty acid (FFA) and glycerine (hydrolysis). An increase of FFA means that the cargo will become worse in quality. The quality of palm oil cargo is largely determined by its acid value. Rapid heating results in an increase in FFA content or discolouration.

Cargo oil heating practices continued

Temperatures during storage, transport, loading and discharge

	Storage and bulk shipments		Loading and Discharge	
Oil or fat	**Min °C**	**Max °C**	**Min °C**	**Max °C**
Castor oil	20	25	30	35
Coconut oil	27	32	40[1]	45[1]
Cottonseed oil	Ambient	Ambient	20	25[4]
Fish oil	20	25	25	30
Grapeseed oil	Ambient	Ambient	10	20[4]
Groundnut oil	Ambient	Ambient	20	25[4]
Hydrogenated oils	Various	–	Various	–[2]
Illipe butter	38	41	50	55
Lard	40	45	50	55
Linseed oil	Ambient	Ambient	10	20[4]
Maize (corn) oil	Ambient	Ambient	10	20[4]
Olive oil	Ambient	Ambient	10	20[4]
Palm oil	32	40	50	55
Palm olein	25	30	32	35
Palm stearin	40	45	60	70[3]
Palm kernel oil	27	32	40[1]	45[1]
Palm kernel olein	25	30	30	35
Palm kernel stearin	32	38	40	45
Rapeseed/low erucic acid rapeseed oil	Ambient	Ambient	10	20[4]
Safflower oil	Ambient	Ambient	10	20[4]
Sesame oil	Ambient	Ambient	10	20[4]
Sheanut butter	38	41	50	55
Soyabean oil	Ambient	Ambient	20	25[4]
Sunflower oil	Ambient	Ambient	10	20[4]
Tallow (for voyages of 10 days or less)	Ambient	Ambient	55	65
Tallow (for voyages of more than 10 days)	35	45	55	65

Notes to table

(1) For warmer climates, the loading and discharge temperatures for coconut oil and palm kernel oil are min 30°C, max 39°C or ambient temperature.

(2) Hydrogenated oils can vary considerably in their slip melting points, which should always be declared. It is recommended that during the voyage, the temperature should be maintained at around the declared melting point and that this should be increased prior to discharge to give a temperature of between 10°C and 15°C above that point to effect a clean discharge.

(3) Different grades of palm stearin may have wide variations in their slip melting points and the temperature quoted may need to be adjusted to suit specific circumstances.

(4) It is recognised that in some cases the ambient temperatures may exceed the recommended maximum figures shown in the table.

Conclusion

1. The desired temperature of the cargo should be maintained throughout the loading/discharging operation and during transit.
2. Cargo tanks should be stripped as soon as the liquid is below the level of the heating coils.
3. Clear heating instructions should be given to the master. Any doubts should be addressed sooner rather than later.
4. The cargo plan should include instructions for stripping heated cargo. Sufficient trim and temperature of the cargo should be maintained. Shippers should be aware that heat loss increases as the level of the cargo drops.
5. Heat loss is also accelerated if the cargo tank is in contact with the ballast in the adjoining ballast tank. Ballasting should be deferred until the stripping is completed, if it is safe to do so.
6. Cargo temperature should always be raised gradually.
7. Overheating of the cargo should be avoided.
8. Cargo should not be loaded at a temperature higher than the ship is designed to carry.
9. Cargo temperatures should be checked daily at different levels and the temperature log must be maintained.
10. Over-reliance on remote temperature reading equipment should be avoided and temperature should be compared with other means to check accuracy.