



## Chapter 21 – Liquid Natural Oils, Fats and Fatty Products

This chapter includes crude vegetable, animal and marine oils as well as fats. Some of the oils are edible and others are used in the production of soap, paint, lacquer, cosmetics and medicines. When these products are transported by sea, a variety of difficulties may be encountered, the causes of which generally fall into two categories:

- Handling (usually temperature control)
- contamination.

### 21.1 Handling

Claims frequently arise that involve allegations of unsatisfactory handling by ships. It is sometimes necessary to apply heat to these cargoes as the temperatures encountered during a sea voyage are likely to be lower than those recommended by the shippers. Many products of this type are adversely affected by heating, so some deterioration is inevitable. The extent of the damage depends on the nature of the product and the length of the voyage.

Unsatisfactory temperature control can cause additional deterioration, usually because the carrying temperature has been too high for all or part of the voyage. It is possible to estimate the level of unavoidable damage, so the extent of further damage caused by poor temperature control can be calculated.

Damage may also result if the carrying temperature is allowed to fall below that recommended by the shippers. The normal procedure for heating this type of product is through the use of heating coils at the tank bottoms and lower sides, with heat being transferred throughout the oil, mainly by convection current. The heat transfer becomes progressively less efficient as viscosity increases. The viscosity of liquid natural fatty products is greatly affected by temperature and a reduction of only a few degrees can have a serious effect. If the heating process is inadequate to maintain sufficient fluidity within the bulk of cargo, the liquid in the vicinity of the heating coils can become overheated.

During the discharge of cargo, if the environmental temperatures are very low, further problems may arise as a result of solidification, which most commonly occurs when a tank is almost empty and the liquid level has fallen below the level of the heating coils. Under such circumstances, the final residues may be removed by sweeping or by steam stripping, provided the receivers are able to accept the fat and water mixture that is produced. Ship's officers responsible for discharging heated products in cold climates should ensure that the maximum pumping rate is maintained and that there are no interruptions during discharge.

## 21.2 Contamination

The most common contaminant resulting in claims is water, originating from shore or ship tanks, pumps or lines at the time of loading, or introduced by mistake or due to leakage. Some products contain a significant quantity of water when shipped, but the presence of excess water in others may accelerate deterioration.

Traders and governmental authorities also have concerns about the contamination of edible products by traces of chemical substances. Often, but not always, these contaminants have come from residues of previous cargoes.

It is normal practice for samples to be drawn by independent surveyors during loading, or immediately after loading, and at least one set of these samples will be given to the ship. It is important that the ship has a set of loading samples, since most claims are based upon differences in analytical parameters in samples drawn at loading and discharge. If the Master is instructed to deliver a set of samples to the receivers on arrival at the discharge port, it is recommended that the Master requests that the shippers provide a second set of samples for the use of the shipowners. Any such samples handed to the ship should be properly stored during the voyage, preferably in a refrigerated store.

At the time of discharge, samples are always drawn by the receivers or their surveyors. Normal analyses conducted at both load ports and discharge ports are quite straightforward and the typical parameters determined are water, free fatty acid, unsaponifiable matter and odour. If there is evidence or suspicion that, on delivery, the cargo does not conform to either a specification or to the loading samples, more

detailed chemical analysis may be performed. Contaminants can be identified and determined at levels as low as 10 parts per billion (ppb); contamination at this level will result from admixture of 10 g of contaminant with 1,000 T of cargo. Most chemical contaminant can be identified and determined at levels of 100 ppb, or 100 g per 1,000 T of cargo.

When cargo is loaded or transshipped, it is essential to consider the nature of previous cargoes. In some cases, it is virtually impossible during tank cleaning to remove all traces of previous cargo to a level that is not detectable by modern laboratory equipment. For this reason, restrictions are laid down in the contracts of sale regarding the immediate previous cargo carried in each of the ship's tanks. Shippers and charterers should be notified in good time of the nature of the three previous cargoes carried in each individual tank. The restrictions are imposed by such bodies as FOSFA (The Federation of Oils, Seeds and Fats Associations) and NIOP (National Institute of Oilseed Products) and their rules should always be checked for periodic updates.

It is important that, before loading, every care and attention is paid to the proper preparation of tanks, pumps and pipelines. It is very important that the tank coating is maintained to a high standard. The coating covering all sections of the tank must be sound because, where any breakdown of the coating takes place, particularly where epoxy and polyurethane coatings are concerned, there is a risk that the remains of previous cargoes may accumulate, creating a potential source of contamination. The breakdown of epoxy coating usually manifests itself in the form of open or closed blisters, forming pockets that cannot be reached by cleaning water. In these areas, there is also a risk that rust may form, which is again likely to trap cargo residues and lead to contamination.

It is not possible to properly clean tanks with damaged coatings. Cases have been recorded where traces of the third previous cargo have been found when samples of damaged coatings were tested.

Another possible source of contamination is the penetration and softening of epoxy and polyurethane coating by a previous cargo, which may later find its way into newly loaded products. Masters should always consult the cargo resistance list provided by the manufacturers of the tank coating, which will list cargoes to which the tank coating is resistant. For cargoes not included in the list, or for cargoes without resistance indicators, or when deviating from the maximum temperatures indicated on the list, the manufacturers should always be consulted.

### Tank cleaning

The precise method of cleaning will depend on the previous cargo carried and the state of cleanliness required for the products to be loaded. The relevant tank cleaning guides should always be consulted. Generally, the most important part of the tank cleaning process is 'Butterworthing' with hot or cold seawater at sufficient pressure and at the appropriate tank levels. This should be followed by fresh water washing to remove seawater residues. Tanks that may have contained monomer or drying oils should first be washed with sufficient quantities of cold water to avoid polymerisation of cargo residues. In some cases, it is necessary to employ tank cleaning chemicals, but their use is generally limited as it may be difficult to dispose of slops.

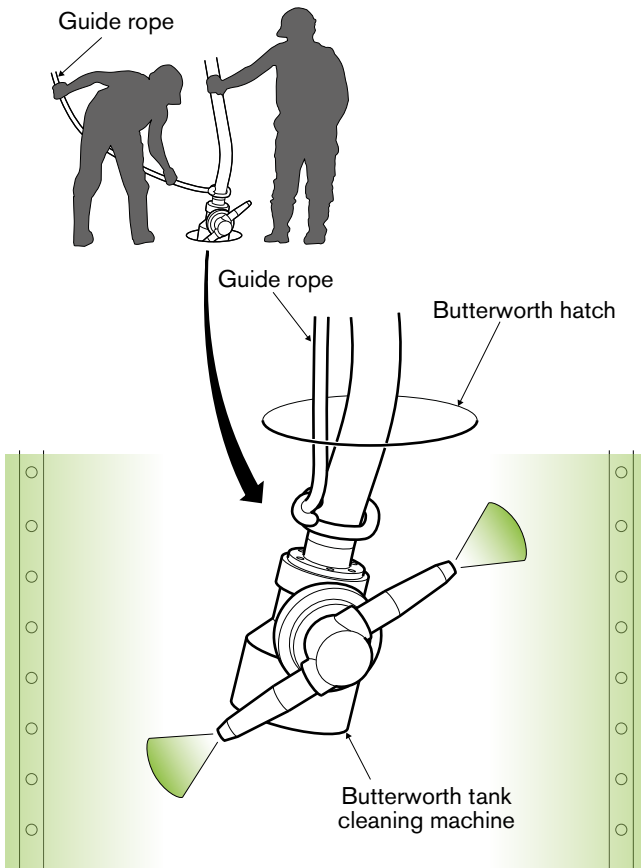


Figure 21.1: Tank 'Butterworthing'.

On completion, the tanks should be clean, dry and free from residual odours. It may also be desirable to take wall-wash samples and have them analysed for traces of previous cargoes, although this requires skilled inspectors. The presence of an odour in a tank that has been cleaned indicates the presence of cargo residues and also indicates the need for further cleaning. When checking for residual odours, it is advisable to do so after the tank has been closed for a period. In any case, checking should be carried out by personnel who have not been working in or near the tanks for at least one hour.

When cargo with a high melting point has been carried, tanks should be washed with hot water. If possible, steam should be used to ensure the residues are effectively melted and cleared. The cleaning process must also include the tank lines, tank lids and vent lines, including pressure vacuum valves and risers. Examples of cargoes with high melting points include phenol and waxes.

Cargo pumps, usually of the hydraulic deep well type, should be dismantled and inspected as recommended by the manufacturer. The pumps should be purged to test the seals that separate the cargo and the hydraulic oil from the void space in the pump. This procedure should always be followed after tank cleaning, before loading and discharging, and after repairs. The results should always be properly recorded in the ship's logbook or other formal records. Where defects to the seals are suspected, cargo should not be handled until corrective measures have been taken. When cleaning pumps, consideration must be paid to the trim of the ship to ensure that any contaminated product is properly drained away. Portable pumps should be tested before being lowered into the cargo tank.

If heating coils are not to be used, before loading commences they should be thoroughly purged and blanked both at the supply and the return ends. Even though coils may have been in use for some time, they should be pressure tested before loading to avoid the possibility of contamination through leaks that might have developed. Pumps not required for cargo handling should always be isolated.

Special attention should be paid to the cleanliness of vent lines, as they may contain residues of previous cargoes, both in a liquid and a solidified state. Vent lines, when not cleaned after discharge, may drain into a newly loaded tank when the vessel changes trim or when encountering heavy weather. Solidified cargo residues in a vent line may melt, due to the heat emitted from a heated cargo, and the melted product may drain back into the tank, causing contamination. The practice of steaming vent lines after the carriage of heated cargoes is recommended as blocked lines may result in overpressuring of cargo tanks.

Drain cocks fitted at the lowest parts of deck and manifold lines, as well as plugs at the bottom of cargo valves, should be opened and rinsed in order to remove any trapped cargo residues. These drain cocks may contain sufficient liquid to result in serious contamination. When clearing deck and drop lines, it is important to ensure that the dead ends of these lines and drop lines are not overlooked. They should be opened and thoroughly cleaned.

Mild steel tanks are sometimes used for the carriage of natural oils and fats but their use is in decline as cargo charterers more frequently stipulate the use of stainless steel or coated tanks. When used, mild steel tanks should be free from rust and scale, since remnants of previous cargoes are likely to be trapped and transferred into subsequently loaded cargoes. Where sensitive cargoes have been carried in mild steel tanks, contamination has been known to occur from the residues of hydrocarbon (petroleum products) cargoes.

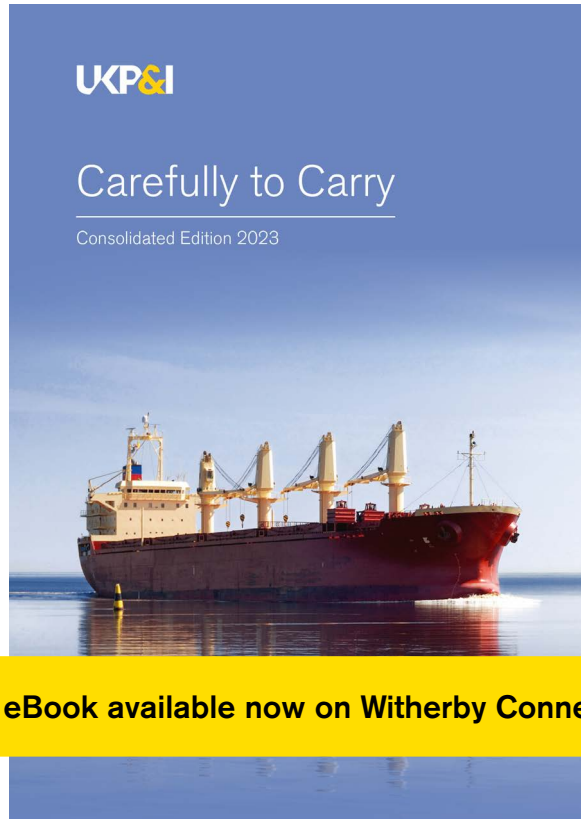
The importance of proper tank cleaning procedures and the correct preparation of tanks and all related equipment prior to loading cannot be overemphasised. Masters may wish to consider appointing an independent surveyor to verify the condition of the tank coating, heating coils and hatch openings after the tank preparations have been completed.

On completion of loading, an ullage survey by an independent surveyor may be appropriate, and thereafter valves and hatches should be sealed. This process can be repeated at the discharge port. The practice of taking onboard samples at all stages of the loading and discharging operation is also highly recommended.

Should contamination occur at some stage in the course of transit, it may be possible, by analysis of such samples, to identify the source of contamination. By ensuring that the cargo is carried to the highest standards, the product should be well protected.



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