Prevention of soya bean cargo claims

Background

Most soya bean cargoes are safely carried in bulk, with minimal deterioration in quality. However, from time to time such cargoes are damaged during the course of a voyage, resulting in degrading or other loss in quality. Soya beans are considered a valuable commodity and it is not unusual to see substantial cargo claims being made against the carrier – even where inherent vice is recognised as the most probable cause of the damage.[1] The purpose of this circular is therefore to raise awareness of the main risk factors involved in the carriage of soya beans and to stress the importance of securing evidence of the carriage conditions to defend expensive claims.

Inherent cargo conditions affecting safe carriage

The main factors affecting the quality of soya beans in bulk during storage and carriage are moisture content (MC), temperature and duration of storage. Unless these parameters are controlled, the consequences may be excessive growth of fungi/mould and heat damage.

During storage, moisture within the soya beans reaches equilibrium with the surrounding air, i.e., the air in the interstitial spaces between the beans. For safe storage of soya beans, the interstitial air equilibrium relative humidity (ERH) must generally be below 70%. Below this level most microbes are dormant and growth of fungi will be restricted. The ideal would therefore be to maintain the environment in which soya beans are stored at an ERH below 70% at all times. However, as the ventilation systems for cargo holds on bulk carriers cannot ensure an environmentally-controlled atmosphere, the cargo's MC at the time of loading normally serves as an important parameter for determining the potential for cargo deterioration during a voyage. A 13% MC is commonly assumed to constitute the upward limit for safe carriage of soya beans. Below this limit, the risk of deterioration of the cargo while on board is considered to be low. But the equilibrium MC for soya beans is not a constant value. Soya beans in storage are still 'live' and can absorb moisture from the surroundings, and, since warm air holds more water vapour than cold air, the temperature of the cargo loaded is equally important in order to assess a cargo's biological stability at its declared MC. At temperatures above 25°C, the MC must be lower than 13% for safe carriage, while at temperatures below 25°C it can be higher. Table 1 in the Annex to this circular illustrates how the equilibrium MC of soya beans varies at different temperatures and relative humidity levels.

Although moisture and temperature are probably the most important factors affecting the quality of soya beans during carriage, factors like age, pre-shipment storage conditions, bean soundness and the presence of foreign material can also influence fungal growth while on board. Fungi are more likely to occur if the soya beans are broken or split. The presence of foreign material may prevent proper air circulation during storage and can create local pockets where fungi or insects can grow. Because soya beans' MC and temperature have a close relationship with their safe storage period, a soya bean cargo that has been handled and stored under unfavourable conditions prior to loading (e.g., very close to the upper limit for safe storage) may have a drastically reduced safe storage time and an increased risk of deterioration while on board. As illustrated by Table 2 in the Annex to this circular, a soya bean cargo with 13% MC, stored for 35 days at 21°C prior to loading, could have reduced its safe storage time by half already before commencement of the voyage. Hence, the risk of cargo deterioration during a normal voyage cannot be completely eliminated even if the declared soya bean MC at the time of loading is as low as 12%.

Ventilation

A soya bean cargo can absorb and release moisture during a voyage, but damage caused by moisture absorption is more probable. Such damage is often encountered when a vessel with soya beans loaded in a warm and humid climate enters colder waters. Vapour will leave the cargo and unless the hold is properly ventilated, condensation may form on the steelwork of the cargo hold (ship sweat) and expose the cargo surface to moisture. Proper ventilation in this case means replacing warm moist air released from the cargo with drier outside air. The decision whether to ventilate or not will be made based on regular and appropriate measurements of the air conditions outside and inside the holds.[2] Natural ventilation as found on board many bulk carriers is, however, not effective in controlling spoilage deep within the hold. It therefore follows that the condition of a soya bean cargo, with the exception of its surface layers, will be almost entirely dependent on the condition of the cargo at the time of loading.

[1] See also article "Soybean claim in China" in GN 172 (2004)

[2] For information on proper hold ventilation practices, see article "Don't work up a sweat" in GN 173 (2004).

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Gard's experience

The majority of Gard's claims involving soya bean deterioration fall within the category 'moisture damage', characterised by general caking and discolouration of beans in a hold, often with an unpleasant musty odour. Common allegations by claimants in such cases are that the vessel's ventilation practices resulted in the development of ship sweat or that fuel oil in tanks adjacent to the cargo holds was overheated. It is, however, not uncommon for single parcels of soya beans loaded to have MCs or amounts of foreign material and broken/split beans much higher than the average values declared for the cargo as whole. This can create 'uneven conditions' in the stow and lead to moisture migration from one region of the hold to another during the voyage. The result is increases in local MCs within the hold that can serve as 'hot-spots' for growth of biological organisms. The consequential damage in such cases is typically identified as scattered areas/layers of caked beans at elevated temperatures, not only at the surface as would normally be the case for damage caused by ship sweat, but at different depths within the hold. In cases where overheated fuel in double bottom tanks is the cause of deterioration, damage is normally identified as discolouration of beans immediately next to the relevant tank. Above this, there can be a layer of caked beans as a consequence of moisture being driven upwards by the heat from the fuel, but, from experience, it is not usual to see such damage extending more than a metre or two upwards into the hold away from the fuel tank. And, significant overheating of the fuel is normally required in order to cause damage.

Even if independent surveys and investigations conclude that a) the inherent condition of the soya beans at the time of loading was the most probable cause of the deterioration, and b) the ship's ventilation practice would have had no effect on deterioration within the stow, the carrier often finds it difficult to defend claims. The Hague Visby Rules include an inherent vice defence but it is the carrier who bears the burden of proving the cause of the damage to the cargo. And without evidence (e.g., in the form of records showing adherence to proper ventilation practices during the entire voyage) this has shown to be a challenge. If details of ventilation practices are missing or if available records could be interpreted as evidence of bad or insufficient ventilation practices (e.g., if ventilation has been performed only in daylight hours), it can be difficult to argue that reasonable care was taken by the carrier and that the effective cause of the loss was the nature of the cargo.

Recommendations

Gard's Members and clients involved in the carriage of soya beans in bulk should carefully evaluate their strategy for prevention of cargo claims and consider the following advice:

At the load port:

- Make sure cargo holds are clean and dry and verify the watertightness of all cargo hold openings, e.g., sounding pipes, hatch covers and associated access points.
- As far as practicably possible, secure all available information about the cargo's condition and history, e.g., date of harvesting, storage conditions and quality certificates.
- Perform odour and visual checks of each individual parcel loaded to detect abnormal conditions, e.g., germination, presence of insects, lumping/caking, changes in colour and request that shippers replace any obviously moulded or low quality cargo with sound.
- Be particularly careful during checks if the declared cargo MC is close to or exceeds 13%, especially if loading in warm climates.
- Consider measuring the cargo temperature in order to assess the biological stability of the cargo at its declared MC, e.g., by measuring and recording the temperature across the surface of the stow and at a depth of 1m after completion of loading.
- If in doubt as to whether the cargo is fit for shipment, consider obtaining assistance from an experienced surveyor or cargo expert.
- Ensure that the charterparty does not prescribe ventilation requirements which may be difficult or even impossible to comply with. Where the vessel is fitted with natural ventilation only, it could be useful to obtain written acknowledgment from the shipper.

During the voyage:

- Make sure that the engine room personnel understand the character of the cargo carried and operate the fuel oil heating system within normal operational limits.
- Ventilate the cargo day and night, unless the outside air has an unsuitable dew point or adverse weather/sea conditions are imminent.
- Duly record the ventilation control measures implemented for each hold. Air and sea temperature readings should be recorded together with the time of commencing, ceasing or resuming ventilation, and reasons for doing so. Also record visual inspections of hold, e.g., any sweat observed.
- Take and record bilge soundings as these too can be evidence of moisture within a hold.

At the discharge port:

- Notify Gard immediately if there is any suggestion by the receivers that all or a substantial part of the cargo in a hold is damaged by fungi and/or heat. The immediate appointment of a cargo expert to observe the pattern of damage in the hold and to take samples for analysis could be crucial in order to defend the carrier in case of a claim.

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Annex: Relationship between soya beans' MC, temperature and safe storage period

The tables below demonstrate the importance of understanding how variations in moisture content (MC) and temperature can affect the potential for deterioration of a soya bean cargo. There may be individual differences between types of soya beans. The numbers must therefore not be considered as conclusive for all soya bean cargoes loaded under all conditions but merely as an illustration of the soya beans vulnerability to various parameters over time.

"Safe storage" herein means storage without loss in quality.

Table 1 Equilibrium MC of soya beans at different temperature and relative humidity levels

Temperature		Relative Humidity (%)									
		10	20	30	40	50	60	65*	70	80	90
°C	F	Equilibrium MC (%)									
1.7	35	4.2	5.3	6.5	7.8	9.4	11.5	12.8	14.4	19.1	28.9
4.4	40	4.1	5.3	6.4	7.7	9.3	11.3	12.6	14.2	18.9	28.7
10	50	4.0	5.2	6.3	7.6	9.1	11.1	12.4	14.0	18.6	28.2
16	60	4.0	5.1	6.2	7.4	8.9	10.9	12.2	13.7	18.3	27.8
21	70	3.9	5.0	6.1	7.3	8.8	10.7	11.9	13.5	17.9	27.3
25	77	3.8	4.9	6.0	7.2	8.6	10.6	11.8	13.3	17.7	27.0
32	90	3.7	4.8	5.8	7.0	8.4	10.3	11.5	13.0	17.3	26.5

* Mould growth is suppressed during storage when the environment is maintained at a relative humidity level of 65% or lower.

Source: University of Kentucky, Biosystems and Agricultural Engineering

Table 2 "Approximate" safe storage times for soya beans depending on temperature

MC (%)	Temperature (F)					
	30	40	50	60	70	80
	Approximate safe storage time (days)					
11	*	*	*	*	200	140
12	*	*	*	240	125	70
13	*	*	230	120	70	40
14	*	280	130	75	45	20
15	*	200	90	50	30	15
16	*	140	70	35	20	10
17	*	90	50	25	14	7
19	190	60	30	15	8	3
21	130	40	15	10	6	2
23	90	35	12	8	5	2
25	70	30	10	7	4	2
27	60	25	5	5	3	1

* Safe storage time exceeds 300 days

1) Airflow through the soya beans permits maintaining the temperature, but does not extend the allowable storage time beyond that listed in the table.
2) Allowable storage time is cumulative. If 16% moisture soya beans were stored for 35 days at 50F, one half of the storage life has been used. If the soya beans are cooled to 40F, the allowable storage time at 40F is only 70 days.

Source: North Dakota State University

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