Avoiding contamination in shipping biodiesel

Careful cleaning, sampling ensures integrity of fuel during, after transit

by Kurt Tyssen

Biodiesel is shipped internationally by sea. It is important to understand the risks so that products can be carried without contaminating the cargo.

A major problem in shipping fatty acid methyl ester (FAME), or biodiesel, by sea is the issue of water contamination. FAME is a hygroscopic product, which means that it absorbs water very easily from its surrounding environment, including the atmosphere.

Water content according to the current EN 14214 specifications is a maximum of 500 milligrams (mg) per kilogram (kg). Typical commercial sales specifications are set at 300 mg per kg. High concentrations of water leads to formation of fatty acids and corrosiveness, and may attack exposed material surfaces. Obviously the increase of fatty acids also has a negative effect on the stability of the product.

The presence of FAME and water interfacing also are ideal conditions for unwanted microbiological growth, which may lead to severe filter blocking problems.

TANK CLEANING

It is essential that ship tanks and shore tanks are free from water. Ship tanks must be dried after every water cleaning. Where it is available, de-humidified air may be used for drying.

FAME can absorb into the walls of tanks and de-absorb into subsequently carried products, causing problems for multi-product pipelines or storage tanks. Great care with tank cleaning is absolutely required during biodiesel shipments.

The nature of the coating should be inspected during ship tank inspection as FAME can be a strong solvent that can withstand non-resistant coatings. Suitable coatings are zinc, stainless steel and bare steel. Specific epoxy coatings should

be inspected to see if they are suitable for FAME.

If there is doubt about the suitability, it is recommended to check for coating residues in the wall wash solvent, obtained by a wall wash test.

Trace metals can cause degradation reactions of the biodiesel (copper heating coils or zinc coating tank coatings have the potential to cause deterioration in quality) and can cause stability issues if the FAME is stored next to heated tanks (e.g. bunker fuel tanks). Degradation reactions lead to formation of insoluble sediments and gums which lead to filter-blocking issues or further decompose to other corrosive species.

To monitor the quality of biodiesel during shipment, it is mandatory that samples are drawn at every stage.

Previous cargos should be checked, and depending on the type of product, washing procedures are required. Methanol and oxygenates are some examples of products that will require a tank be washed prior to loading FAME into it.

There is also a potential danger for FAME cargos shipped from a warm, humid climate to an extremely cold climate, if the correct heating instructions are not applied. There is a risk of formation of unwanted waxy precipitates, which may lead to pumping problems. The Federation of Oils, Seeds and Fats Association (FOSFA) has now included heating instructions for FAME into its published heating recommendations.

SAMPLING

To monitor the quality of biodiesel during the shipment, it is mandatory that samples are drawn at every stage during loading and discharging operations for further laboratory testing. Shore tank, end of line samples, manifold samples, first-foot samples and individual ship tank samples are required. Sampling procedures are described in ASTM D 4057 and ISO 3170.

The basis for accurate results produced by the laboratory starts with representative samples. Shore tank sampling requires, at minimum, running upper, middle and lower samples. Bottom samples especially should be visually inspected for the presence of particles and free water.

Shore line samples should be taken from the jetty head or as close as possible to the loading/discharging arms. These samples should be visually inspected for appearance and further tested for water content in the laboratory. The samples should be bright and clear, and free from sediments. Loading or discharging operations should wait for the results of water content before proceeding.

Ship manifold samples should be taken at the start of loading and visually inspected for appearance and tested for water content. Loading operations should wait for the results of water content before proceeding.

It is essential that tanks are free of water. Photos courtesy of Intertek.

Foot samples should be visually examined and tested for water. Further loading operations should wait for the water results before proceeding.

Ship's samples are taken from each ship tank at all levels. Testing in the laboratory is performed on a theoretical composite based on cargo figures.

The samples should not be exposed to direct sunlight. Sample bottles should be flushed with nitrogen beforehand to reduce the risk of humidity contamination, which can lead to an increase of water in the drawn samples.

Overseas vessels transporting FAME are inserted with a nitrogen blanket to eliminate humidity contamination and oxygen during the voyage. Typical oxygen content in the gaseous phase is 2.5% maximum oxygen and can be measured with oxygen meters in the gaseous phase. These nitrogen blankets are maintained until the discharge port is reached.

Sampling always needs to be performed under safety regulations, and these must not be compromised so as to protect the safety of personnel. BB

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