



Exceeding Expectations

Sampling Containers and the effect on Product Integrity

There are many contributing factors why product test results either come up off test or not what is expected. As previously outlined in past TECHTALK issues, sampling techniques, proper circulation of the product blends, instrument calibration and malfunction, repeatability & reproducibility, technician error etc... all need to be examined prior to calling product off-specification.

The type of **sample container utilized in sampling** also needs to be questioned.

Aviation Fuel Sample Containers for Tests Affected by Trace Contamination (ASTM D4306) is the standard that addresses any and all of these concerns regarding jet fuel. The composition and the construction of the sample container has a significant impact on quality. Ultraviolet exposure and trace amounts of common welding materials used to fabricate steel cans are detrimental to fuel quality.

Epoxy lined cans are the preferred containers for jet fuel, but are often not practical in a field setting. In this case, the best option is amber quart bottles. The containers themselves are important, but it is also critical to emphasize the importance of rinsing the container as prescribed in the standard (ASTM D4306) as well as rinsing it with the product being sampled in the field.

Failure to adhere to this standard may result in the laboratory producing "false negative" results. As stated in **Table 1**, the most common analysis to be affected by this is as follows:

- MSEP (WISM) – ASTM D3948
- Electrical Conductivity – ASTM D2624
- Lubricity – ASTM D5006
- Thermal Stability (JFTOT) – ASTM D3241
- Trace Metals – ASTM D3605
- Copper Corrosion – ASTM D130

In review, the recommendations of this standard are based on the findings of many studies throughout the years. This standard has been in publication for decades, and yet, we still have issues with jet fuel that are a direct result of the failure to comply with this standard. It is critical that refineries and inspection companies alike emphasize the significance of sample container and it's cleaning before sampling a jet fuel or kerosene.

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Any jet fuel samples that are delivered to the laboratory received in improper containers should be immediately rejected, and supervision should be notified in order to acquire proper samples to avoid the above mentioned problems.

Independent studies have shown that..."brass sampling tubes / bombs placed in the vessel's closed sampling system will contaminate the sampled jet with copper. This can and has caused failing JFTOT results on the jet removed from these brass sampling tubes/bombs, while in reality the bulk jet in the vessel compartments is on-spec for JFTOT.

"To avoid JFTOT failures which are not representative of the actual jet in the vessel compartments, it was requested all inspection companies stop using brass or other copper alloy sampling equipment when sampling jet fuel via a vessel's closed sampling system. It was also recommended all inspection companies instead use stainless steel sampling tubes/bombs when sampling jet fuel via a vessel's closed sampling system."

This is a direct quote from the Octane standards: ASTM D2699 (RON) & ASTM D2700 (MON)

9.3 Protection from Light—Collect and store sample fuels in an opaque container, such as a dark brown glass bottle, metal can, or a minimally reactive plastic container to minimize exposure to UV emissions from sources such as sunlight or fluorescent lamps.

Adherence to this requirement is necessary do to the fact that octane ratings can drop significantly even after a short period of exposure to either UV or direct sunlight.



Sampling Containers (clear / amber bottle / epoxy can)

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Equipment Cleanliness:

The sampling equipment should be clean prior to commencing the sampling operation. Any residual material left in a sampling device or sample container from a previous sample or cleaning operation may destroy the representative character of the sample. It is good practice with light petroleum products to rinse the sample container and equipment with the product to be sampled prior to drawing samples.

Sample Containers:

Sample containers come in a variety of shapes, sizes, and materials. To be able to select the right container for a given application, one must have knowledge of the material to be sampled to ensure that there will be no interaction between the sampled material and the container that would affect the integrity of either. Additional considerations in the selection of sample containers are the type mixing required to remix the contents before transferring a sample from the container and the type of laboratory analysis that are to be conducted on the sample. To facilitate the discussion on proper handling and mixing of samples, sample containers are referred to as either primary or intermediate containers. Regardless of the type of sample container used, the sample container should be large enough to contain the required sample volume and sufficient ullage space for thermal expansion and mixing of the sample.

Bottles (Glass) ... Clear glass bottles may be examined visually for cleanliness, and they allow for visual inspection of the sample for free water cloudiness and solid impurities. The brown glass bottle affords some protection to the samples when light may affect the test results.

Cans ... When cans are to be used, they must have seams that have been soldered on the **exterior surfaces** with a flux of resin in a suitable solvent. Such a flux is easily removed with gasoline, whereas many others are very difficult to remove. Minute traces of flux may contaminate the sample so that results obtained on tests such as dielectric strength, oxidation resistance, and sludge formation may be erroneous. Internal epoxy lined cans may have residual contamination and precautions should be taken to ensure its removal. ASTM D4306 should be used when taking samples for aviation fuels.

Bottles (Plastics)... Plastic bottles made of suitable material may be used for handling and storage of gas oil, diesel oil, fuel oil, and lubricating oil. Bottles of this type should not be used for gasoline, aviation jet fuel, kerosene, crude oil white spirit, medicinal white oil, and special boiling point products unless testing indicates there is no problem with solubility, contamination, or loss of light components. In no circumstances shall nonlinear (conventional) polyethylene containers be used to store samples of liquid hydrocarbons. This is to avoid sample contamination or sample bottle failure. Used engine oil samples that may have been subject to fuel dilution should not be stored in plastic containers. Plastic bottles have an advantage. They will not shatter like glass or corrode like metal containers.

(Sources include API manual chapter 8 – Sampling section 1)

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