Trilogy™ Laboratory Fluorometer

Application Note:
Refined Oil

Overview

Refined oil is produced by the fractional distillation of crude oil. Fractional distillation is a process that uses heat to vaporize crude oil. The vapor is then captured at different temperatures and condensed to form refined products such as Gasoline, Kerosene, Jet Fuel, Naphtha, Motor oil, etc. Many of the products, which come from this refining process, are carcinogenic and can cause harm to both humans and animals.

There are a countless number of oil products that are manufactured that may inadvertently get released into the environment. Boat fuel leaking into lakes/rivers, machine lubricants found in wastewater released from industrial plants, or the average person forgetting to recycle their motor oil waste are all sources of contamination. Monitoring of aquatic environments for refined oils and/or oil products will provide awareness of increasing contaminations so that protocols may be implemented to avoid hazardous situations.

Trilogy Lab Fluorometer: Short UV Module

Turner Designs has developed a Module (P/N: 7200-062), for the Trilogy Lab Fluorometer, which uses a deep UV Light Emitting Diode (LED) and UV bandwidth filter to accurately detect refined oil and oil products in water.

Refined Oil Standard: 1-5, naphthalenedisulfonic acid disodium salt

1-5, naphthalenedisulfonic acid disodium salt is dissolved in water to produce a standard solution that can be used for calibrating Turner Designs' refined oil fluorometers. This solution contains naphthalene, an aromatic hydrocarbon ($C_{10}H_8$) and product of the crude oil refining process, which has similar fluorescence characteristics to many other products produced from refining crude oil. It is used as a calibration standard for fluorometers because of its high fluorescence yield, low cost, and accessibility. Although naphthalene can be found in common household items, it is toxic and has been known to cause illness at high concentrations.

Results

Performance and Dynamic Range

Plastic (methacrylate, P/N: 138-0152) and Quartz (P/N: 7000-956) square 10x10mm cuvettes were analyzed to determine performance and instrument specifications. Using plastic cuvettes we were able to detect a maximum concentration of 50,000 ug/L (microgram/Liter) naphthalene. Using Quartz 10x10mm square cuvettes will increase the upper detection limit of the instrument and allow a detection maximum of 70,000 ug/L naphthalene.

	Methacrylate	**Quartz**
Dynamic Range	50,000 RFU	70,000 RFU
Linear Range	1,000 RFU	6,000 RFU
MDL	0.5 ug/L	0.2 ug/L

Minimum Detection Limits

MDL is defined as the lowest concentration of a substance in a sample that can be measured with a known level of confidence. Our MDL's are calculated based on a 95% confidence level. Naphthalene can be detected down to 0.2 ug/L concentration using the Short UV Module for the Trilogy Lab Fluorometer.

Linearity

The linear range is affected by the transmission of light through the surface of the cuvette. If the cuvette allows 100% transmission of UV light, then the linear range would depend on the solution or instrument saturation point. The linear range for the Short UV Module, using a Quartz cuvette, is 0.2 – 6000 ug/L (figure 1). This is because Quartz cuvettes allow 100% transmission of UV light. Using cuvettes that reduce maximum transmission of UV light will affect the linear range.

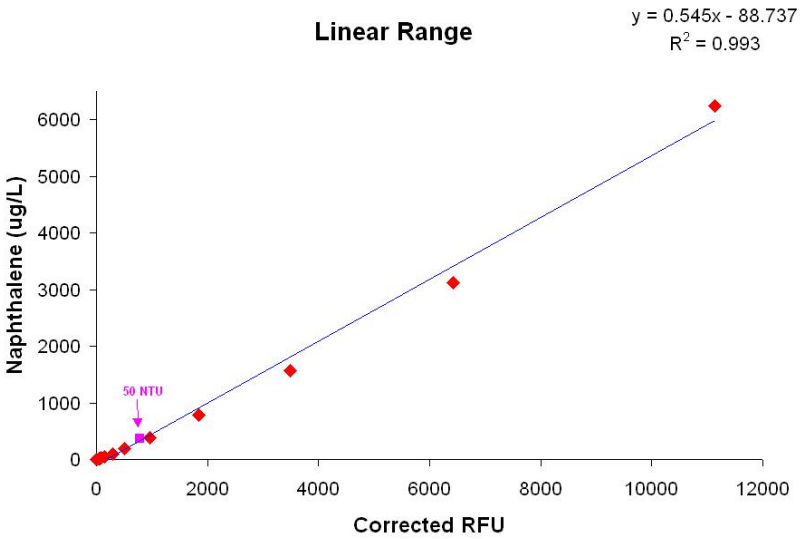

Figure 1. Linear range for Naphthalene detection using Quartz cuvettes (r2=0.993). Minimum turbidity interference from a high turbidity standard (50 NTU = 350 ug/L).

References

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