Introduction

Refined fuels such as benzene, toluene, ethylbenzene, and xylenes (BTEX) are volatile organic compounds (VOC's) found in petroleum derivatives. These compounds are harmful to humans and animals if absorbed through the skin, ingested, or inhaled. There are many pathways that lead to environmental contamination by refined oils or fuels, primarily through leakage from broken or degraded storage tanks, pipelines, or containers. These compounds can adsorb onto soils or particles, evaporate, and/or biologically degrade at a very slow rate. The slow degradation rate allows for accumulation causing high concentrations which may result in a health risk to communities, both animal and human.

Quantification of Refined Oils (Fuels) in water is typically done using Gas or Liquid Chromatography and the instrumentation required, reagents, and methods can be expensive. Turner Designs developed a cost-efficient Refined Oils (Fuels) Cyclops-7 Submersible Fluorometer which provides data for rapid *in situ* detection of these compounds. The C7 is ideal for researchers who are interested in detecting the presence or absence of VOC's and measuring relative fluorescence changes that can be used as an indication of increasing or decreasing concentrations.

In situ Measurement of Refined Oils (Fuels) in water

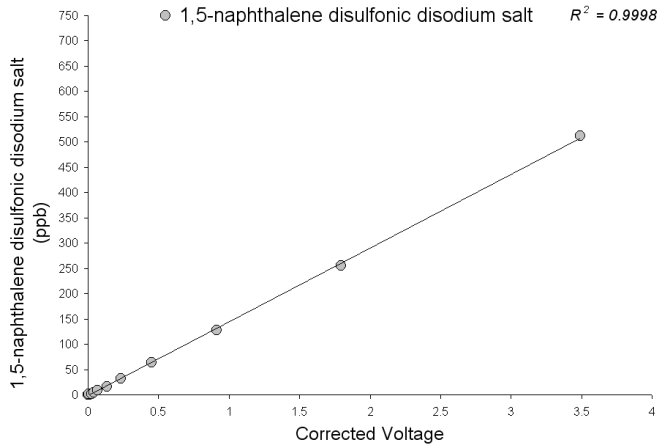
The Refined Oils (Fuels) Cyclops-7 *in situ* fluorometer uses deep UV wavelengths for excitation (<300nm). A broadband emission filter is used for detection between 300 and 400nm. It outputs an analog signal based on the relative fluorescence intensity of Refined Oils (Fuels) in water. Three sensitivity settings allow the C7 to detect a broad range of concentrations. It can be integrated into any datalogger, CTD, or multi parameter system that accepts a 0-5 volt signal. Certain dataloggers, such as Turner Designs' DataBank, help maximize the performance of the Refined Oils (Fuels) Cyclops-7 *in situ* fluorometer by providing auto-ranging and user-defined calibrations used for converting analog signal to concentrations.

Calibration Standards

1-5, naphthalenedisulfonic acid disodium salt is a highly fluorescent compound that readily dissolves in water to produce a standard solution used for calibrating the Turner Designs' Refined Oils (Fuels) Cyclops-7 *in situ* fluorometer. This solution contains naphthalene, an aromatic hydrocarbon ($C_{10}H_8$), which has similar fluorescence characteristics to many Refined Oils (Fuels). It is useful as a calibration standard for fluorometers because of its high fluorescence yield, low cost, and availability. NOTE: Please read the MSDS for this compound prior to using it as a calibration standard.

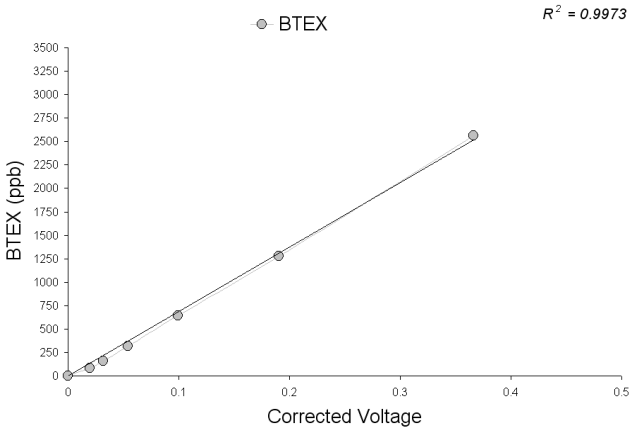
Calibration Curve for 1-5, naphthalenedisulfonic acid disodium salt

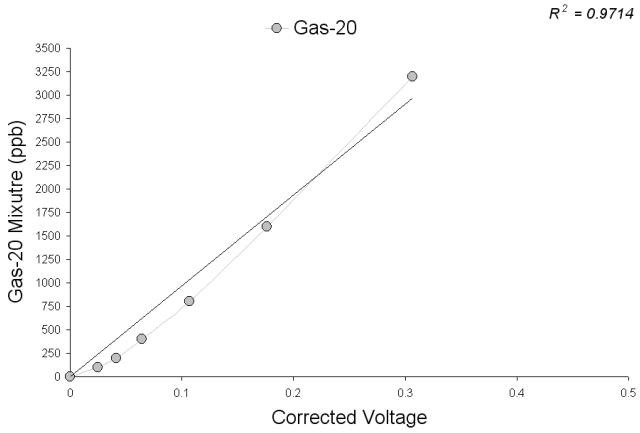
1-5, naphthalenedisulfonic acid disodium salt was dissolved in ultra pure water to make a stock standard solution with concentration of 5000 ppb. Serial 2x dilutions were made to low (<5 ppb) concentrations. The C7 was set to the most sensitive setting (100x) and measurements were made for dilutions in this series. The maximum concentration detected for the 100x sensitivity setting was 500 ppb. The C7's calculated maximum range of detection is 50,000 ppb. The minimum detection limit is ~2.5 ppb.



Typical Response Curves for Refined Oils (Fuels)

Two refined fuel compounds (BTEX and a Gas mixture) were diluted in ultra pure water to low (<3500 ppb) concentrations and the resulting solutions were measured using the Refined Oils (Fuels) Cyclops-7 Fluorometer with sensitivity set to 100x. The fluorometer was able to linearly detect low end concentrations of both refined fuels measured. Minimum detection for both compounds analyzed was ~0.1 ppm.





Toxic Effects of Refined Oils (Fuels)

There are many harmful effects that result from exposure to oil and fuel compounds, ranging from mild effects such as dizziness, nausea, headaches, and drowsiness or life threatening effects such as anesthesia, convulsions, delirium, or coma. Knowing the threshold effects for exposure to various concentrations of refined oils and fuels is important in maintaining a safe and healthy lifestyle, business, or research.

Reference:

Interim Final Petroleum Report: Development of Health-Based Alternative to the Total Petroleum Hydrocarbon (TPH) Parameter. Prepared by, Office of Research and Standards Massachusetts Department of Environmental Protection and ABB Environmental Services, Inc. (1994).