

Alfreton/Somercotes Fishing Ponds

Preliminary Soluble Hydrocarbon survey

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Instrument used: Enviroflu-HC in-situ PAH analyser from Trios GmbH

Principle of detection: UV fluorescence

Introduction:

Hydrocarbons are a common and natural occurrence in the environment and varying concentrations in effluent waters are not unusual. Hydrocarbons can be found as free floating, emulsified, dissolved or adsorbed to suspended solids.

By definition, a hydrocarbon is a group of chemical compounds composed only of hydrogen and carbon. Typically they are divided into 3 major classes: aliphatic, alicyclic and aromatics.

Hydrocarbons in water are generally increasing, mainly due to industrial processes and man induced activities. The natural abilities of the water to decompose the hydrocarbons become overwhelmed and the resulting effect on the environment may affect drinking water, fish and micro-organisms.

Typical sources of man induced hydrocarbons include the refining processes of crude oil into gasoline, lubricating oils, kerosenes, diesel, etc. Also the resulting commercial products find their way into the environment through spills from road asphalts, fueling depots (e.g. airports, maintenance facilities), transportation, cooling water systems, manufacturing facilities such as automotive, plastic and steel production, and many others.

UV-fluorescence is a sensitive method to determine aromatic hydrocarbon compounds in the water. It is a phenomenon whereby a portion of the absorbed wavelength in the targeted compound is re-emitted at higher wavelength. When the water is excited at specific wavelength of UV light, certain compounds, including hydrocarbons, will absorb energy. Some compounds will re-emit this light at a higher wavelength, like the aromatic hydrocarbons (PAH's). The wavelength range which is re-emitted is a unique characteristic of the single compound. By measuring the fluorescence intensity at this wavelength, they can be determined. In natural environments interferences may occur due to humic and fulvic acids (also known as yellow substance, Gelbstoff or colored dissolved organic matter (CDOM)) Hence a correction for these effects is required to get accurate results.

This can be done either by a fixed correction factor or by the use of a second fluorometer (e.g. TriOS microFlu-CDOM) with specific wavelength set for humic and fulvic acids.

For the purposes of this preliminary study a fixed approximate correction has been used.

Instrument:



The enviroFlu-HC miniature fluorometer allows the user to monitor online polycyclic aromatic hydrocarbons (PAHs) concentrations by directly measuring the amount of fluorescence emission from a given sample volume. PAH's are excited by a high efficiency Xenon flashlamp. The required wavelength for PAHs excitation is selected by the use of an interference filter centred at 254nm.

A small percentage of the excitation light is reflected by a dichroitic beam-splitter (Short Wave Pass SWP) and is used as a reference signal to evaluate variations of the excitation energy.

The excitation beam is focused approx. 2 mm in front of the window by a small lens.

Fluoresced light is collected by the same lens, reflected by the dichroitic beam-splitter due to the longer wavelengths of the fluoresced light and detected by a large area photodiode. An interference filter (CWL 360nm) is used in front of the photodiode to discriminate stray-light and to select the fluorescence light.

A specially developed circuit eliminates the influence of ambient light, which is normally present in surface waters. The principle optical configuration is shown in fig.1.

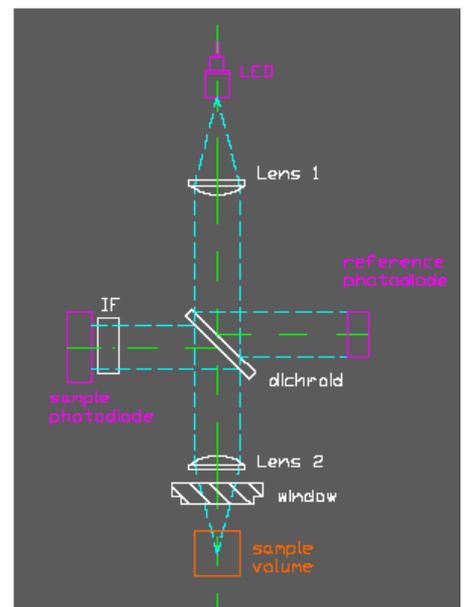


Fig.1 General optical layout of TriOS fluorometer

Field Method :

As described previously interferences occur due to other fluorescing compounds, primarily humics and fulvics. Without using other instrumentation and/or laboratory analysis it is not possible to accurately take account of these interferences. However as an approximation, readings were taken on:

- a. Derby Drinking Water,
- b. Uncontaminated pond water, the latter being subtracted from the readings obtained at the test site.

Site measurements were taken at the following locations:

1. Outlet of the "top" pond
2. Outlet of the 2nd pond
3. Outlet of the 3rd pond
4. Bankside at approx half length of 4 th pond
5. Overflow at Outlet of 4 th pond

The instrument was set to use its "high" gain with a max concn level of 500ug/l. The sensor was lowered at each location into the water such that the sensor end was just submerged, care being taken to ensure a minimum depth of liquor of 10cm to be available.

The sensor was cleaned after each measurement and the reading in air taken as a cross check that no fouling had occurred.

Results:

Hydrocarbon measurements using the Trios Enviroflu-HC

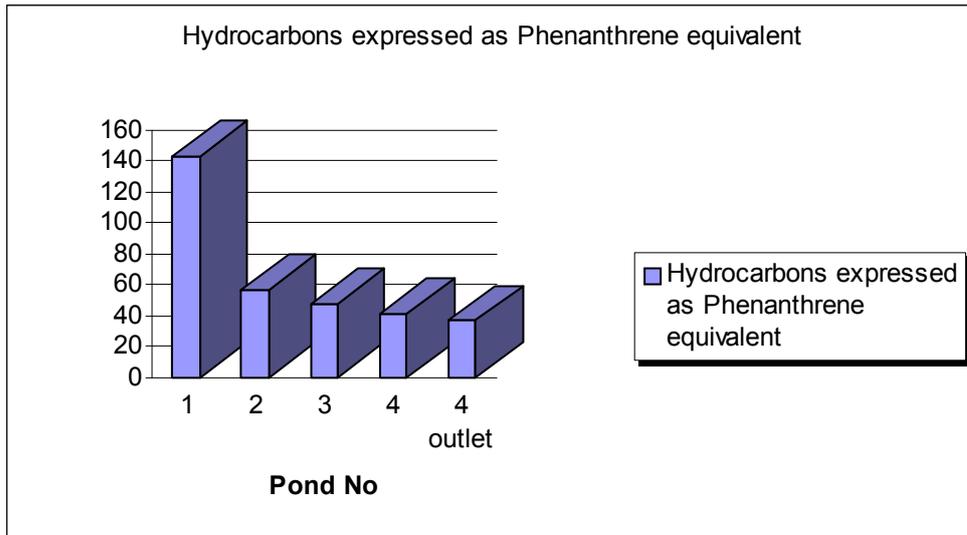
Date : 24/5/07

Offsets:

3 ug/l in air

30 ug/l tap water 57 ug/l pond v

location	raw	corrected
1	200	143
2	114	57
3	105	48
4	98	41
4 outlet	94	37



Conclusions:

1. The top pond shows significant levels of soluble PAH contamination
2. Lower ponds are of significantly better quality but still have measurable levels of PAH
3. There is a sequential decrease of PAH from pond to pond.

Acknowledgements:

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