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Tracer tests made easier with field fluorometers

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Several years of practice with field fluorometers have shown that they could advantageously replace water samplers (SCHNEGG AND DOERFLIGER 1997). The obvious benefits are: absence of contamination, no sample ageing, and limited manpower required. Experience gained during the last few years allowed improving the detection limit of the sensors in presence of turbidity. A dedicated red (660 nm) LED and photodiode provide an accurate value of the water turbidity, even when water contains a substantial amount of tracer. Once turbidity has been measured, its response can be calculated and discarded from the signal channels. This step is very beneficial for the true signal of the tracer since it makes it possible to distinguish sub-ppb dye concentrations from turbidity (SCHNEGG 2002). Sample illumination is carried out by three superbright LEDs (370, 470, 525 nm). The spectrum spans over the full visible band. All known dye tracers can be employed. For an optimum use however, sodium naphtionate would require excitation at a still lower wavelength, not yet available with LEDs, and therefore cannot be recommended as a tracer.

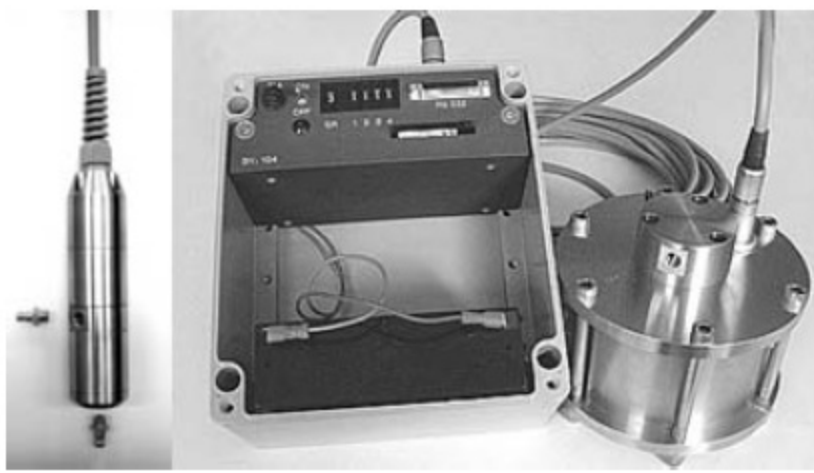

Figure 1: Fluorometer with datalogger, downhole probe (left) and surface device (right).

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Figure 1 shows the field fluorometer with its datalogger. Depending on the use, a surface or a downhole (2" dia.) device (SCHNEGG AND BOSSY 2001) can be fitted to the 4-wire logging cable. Two weeks and more of unattended data acquisition are recorded on fully PC-compatible media (Compact Flash card) at selected rates between 5 and 1,800 seconds. A total of 30,000 sampling cycles can be recorded on four channels as well as water temperature. The fluorometer is not a spectrofluorometer in which both excitation and detection occur in monochromatic bands. Instead, it is a filter fluorometer. Due to relatively broad spectral bands, the three light sources excite the fluorescence of the dye tracers with a varying efficiency. This differential sensitivity is the key for tracer separation. Figure 2 shows the results of a simple test in which three tracers were injected into a small stream

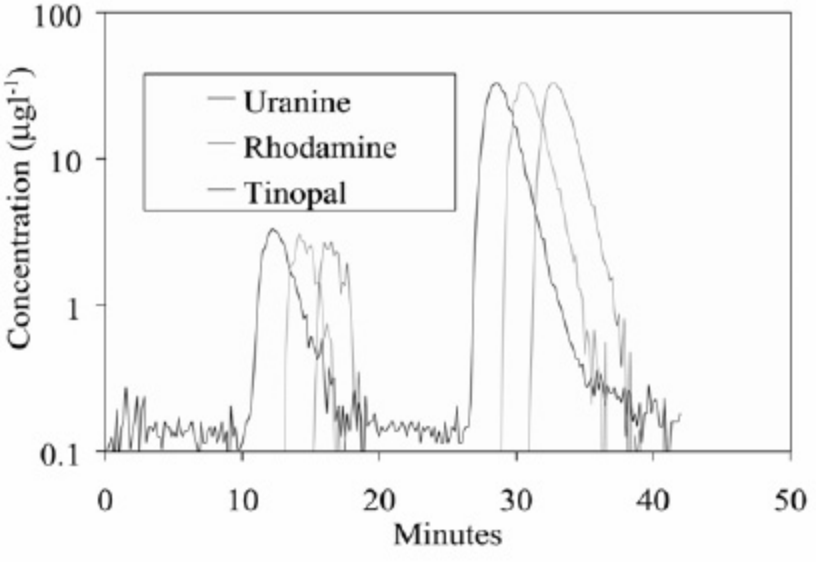

Figure 2: Tracer test made for testing the separation capability with three dye tracers.

with a lap-time of two minutes. The second injection used 9 times the quantity of the first one. The method shows a good efficiency at separating the tracers.

References

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