



APPLICATION BULLETIN 2: UV VS IR MONITORING FOR PPM OIL IN WATER(S)

The photometric techniques for measuring traces of oil in all water types are:

- 1 Straight UV absorption, done at 254 nm
- 2 UV fluorescence, done at 330 nm to 450 nm
- 3 Infrared absorption done at 2960 cm⁻¹ (3.4 microns)
- 4 Other non-specific methods sometimes used, depending upon the absence of particles in the water are turbidity analyzers, suspended solids analyzers, and total HC analyzers.

Teledyne's (TAI) UV absorption methodology is based upon crude oil sources containing aromatic fractions within the oil (typically 5 to 25% portion amounts). These aromatics (are complex bulky molecules) but all absorb at 254 nm. The Teledyne Model 6600 specifies that the unit be calibrated with the oil typical of what's expected in the process water being monitored. This improves the accuracy of calibration of the instrument to the oil specie in the water. Yes, aliphatic type Hydrocarbons (HC) do not absorb at 254 nm. This is good since these compounds if present do not imply that oil is also present (they would give false positive oil indications). Also, other non-oil organic compounds (simpler and less bulky or complex), which are dissolved in the background of waters may also absorb at 254 nm. These (non oil organics) will be removed from interference of the TAI 6600 readout each hour through the auto zero function of the updated calibration. TAI's special auto-zeroing specifically removes oil, but leaves in the non-oil organics to be cancelled out (auto-zeroing) each hour. Once this background bias is zeroed, the unit then measures the oil on top of the non-oil organic background more accurately than other methodologies.

IR method:

Online continuous Infrared monitors measure the absorption of all HC's that can be extracted from the water phase into an organic solvent phase. This extraction approach is highly dependent on the type of solvent used and its efficiency to remove HC's into its layered phase. One should look carefully at the intricacies or complexity of the IR sampling system to recycle and reuse chemical solvents for oil extraction.

Solvents used must be transparent at the required measuring wavelength (2900 to 3030 cm⁻¹ or 3.3 microns to about 3.45 microns). Not all solvents are. Recently the EPA recommended in the 1664 method that hexane be used for extraction of HC's (of which oil is only a small part) then gravimetrically weigh the vacuum dried residue which is then considered oil. Hexane is not transparent, so IR users are not happy about this recommendation. Previous solvents such as certain Freons, CCL₄, CH₂CL₂, Perk, etc. are carcinogenic and suspect as ozone killers and have been outlawed in certain countries.

Besides the toxic nature of these solvents, they must be regenerated or recycled within the IR analyzer on a continuous basis and must not be disposed of in large amounts. This gets very expensive to dispose of but also is very difficult to reuse within the instrument as the recycled solvent must be zero bias accounted for on each measurement as well as cleaned

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up for reuse using specialized scrubbers which are also questionable. On a continuous basis, this approach depletes the solvency or efficiency to extract or remove the oil from the water. Also, the water which has been analyzed (actually mixed with the toxic solvent) also contains high ppm residues of these solvents which are then returned to the process or dumped into estuaries, rivers, ponds, sea waters, etc., and might be considered just as dangerous as the oil effluents one is trying to monitor for environmental safety by regulating agencies.

TAI's approach to monitoring oil in offshore platforms must also address the physical state of the sample. **If the produced waters are known** to contain upset levels of sand say to 1 or 2%, and perhaps oil slugs well above the normal measuring ranges, then these conditions should be accounted for. The sample extracted from the process and returned with these unusual physical states must be prevented from entering a continuous process instrument. TAI has developed a sand removal system that also prevents oil slugs from entering the analyzer portion of the instrument. This very special filtering system is dependent upon the particle size amounts and size distribution of the sand. Oil can still be monitored up to 50 ppm under these conditions. The sand removal system must however be flushed copiously with utility water in the event this phenomenon occurs. The user must be able to detect these upset sand and oil slug conditions within their process by other means in order to undertake corrective cleaning action on the oil in water system. Consult Teledyne for particulars related to your specific operation.

Regards,

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