Arenes Total Concentration in Wastewaters Determined by UV Spectrometric Analysis

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Brief Note

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BRIEF NOTE

In analytical chemistry, ultraviolet spectroscopy is a frequent analytical method. This absorption spectroscopy approach is based on the notion that when radiation travels through a substance, the latter may absorb some of it. The varied electronic energy levels shown by the molecules present in the material are responsible for the absorption of different levels of energy (wavelengths) of radiation. Depending on their chromophores, various compounds have distinct energy transitions. Light is generally emitted when electrons return to their ground states. The result is termed fluorescence if it occurs immediately and phosphorescence if it occurs later.

Alkanes, unfortunately, do not absorb UV in the range that the sensor detects. Other organic molecules, such as aromatics, alkenes, alcohols, and carbonyls, can be characterised using UV spectroscopy. Another advantage of UV spectroscopy and absorption spectroscopy in general, is that it may be used to quantify the presence of a component in a solution using the Beer-Lambert law concept. For determining the total concentration (cAr) of the most hazardous hydrocarbons (arenes) in wastewaters, two techniques are recommended. The processes involve extracting petroleum products using n-hexane, purifying the extract from phenols using adsorption, and measuring the absorbance of arenes in the UV area. There is no need to separate alkanes and cycloalkanes. For screening purposes, the first technique allows for quick estimate of cAr in terms of the standard substance Xst (o-xylene or m-xylene).

The absorption is measured at 250 nm, which reduces the influence of intragroup selectivity and the amount of phenols left in the extract. The total concentrations of arenes in n-hexane solutions are calculated very correctly using this approach (error c 7% at RSD 5%). However, in the range of cAr from 0.1 to 50 mg/L, analysis of aqueous solutions (wastewater simulant solutions) yields c > 50%. Because arenes are lost during sample preparation, the findings of cAr estimation in simulations and wastewaters are understated. The absorbance of the extract is measured at seven wavelengths in the range of 240–280 nm using the second (more accurate) technique. Multiple linear regression is used to find the cAr value, which is then recalculated to Xst. Extracts from 25 simulated solutions (training set) are used to create multivariate calibrations, which reduces analyte loss by passing them across all sample preparation procedures. The error in the analysis of simulants from the test set does not surpass 20% at RSD 12% when cAr > 1 mg/L. The analysis will take 1 hour. The technique was put to the test by analysing wastewater from various types of businesses. The findings are consistent with chromatographic studies of the same samples.