Fluorescence imaging in environmental sciences

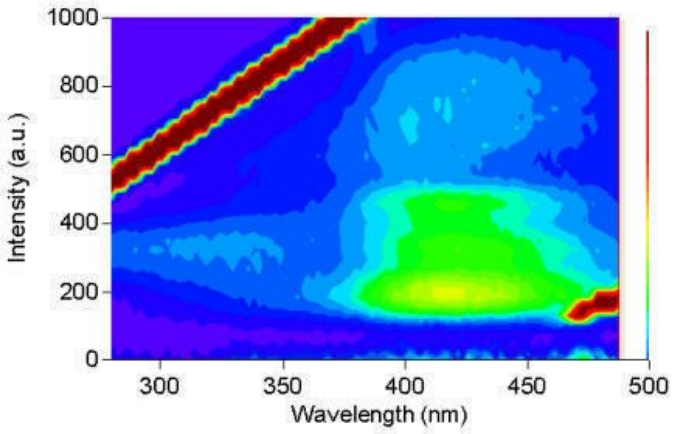
Fluorescence imaging using ultraviolet light sources and a combination of microscopy, spectrophotometry and image analysis have found widespread applications in the environmental sciences.

Liquids analysis: natural and anthropogenic organic matter in rivers and groundwaters.

Recent technological developments permit the rapid analysis of water fluorescence. Fluorescence properties can provide important information about both natural and anthropogenic organic matter, both of which fluoresce. Did you know that sewage, landfill leachates, farm wastes and pulp effluent all fluoresce, and that they all have different fluorescence properties so that you can tell them apart? In groundwater, the low detection limits of the fluorescence technique allows precise quantification of both natural and pollutant dissolved organic matter.

Solids analysis: Stalagmites, slurry, peat, coral, coal fluorescence. Any environmental sample that contains organic material may fluoresce. Applications have been diverse. For example, some cave stalagmites contain annual fluorescence rings from seasonal flushes of overlying soil derived organic matter, and this has been used in a manner similar to tree ring dating. Peat extracts have been analysed to understand the paleoenvironmental "humification" technique. Slurries, coal, coral samples have all been analysed.

Outside of 'our' world of visible reflected light many substances in the environment fluoresce. Dissolved organic matter, found in rivers, wastewaters and effluents in particular fluoresce at wavelengths of light that we can't see. Improvements in optical technology, driven by genomics, now allow us to 'see' this ultra-violet fluorescence and we can now map 'optical space' at nanometre (10-9 m or 1/100th of a human hair) resolution, the 'scale' used in nano technologies. The above 'map' shows fluorescence intensities of a river water at different locations in optical 'space'; the higher the contours, the greater the fluorescence intensity. Different organic substances have different 'maps' that can be used to fingerprint them within industrial processes and the environment.



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