Applications of Fluorescence Spectroscopy for dissolved organic matter characterization in wastewater treatment plants

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Dissolved organic matter (DOM) influences wastewater treatment plants efficiency (WTTP): variations in its quality and quantity can induce a foaming phenomenon and a fouling event inside biofiltration processes. Moreover, in order to manage denitrification step (control and optimization of the nitrate recirculation), it is important to be able to estimate biodegradable organic matter quantity before biological treatment. But the current methods used to characterize organic matter quality, like biological oxygen demand are laborious, time consuming and sometimes not applicable to directly monitor organic matter *in situ*. In the context of MOCOPEE research program (www.mocopee.com), this study aims to assess the use of optical techniques, such as UV-Visible absorbance and more specifically fluorescence spectroscopy in order to monitor and to optimize process efficiency in WWTP.

Fluorescence excitation-emission matrix (EEM) spectroscopy was employed to prospect the possibility of using this technology online and in real time to characterize dissolved organic matter in different effluents of the WWTP Seine Centre (240,000 m^3/day) in Paris, France. 35 sewage water influent samples were collected on 10 days at different hours. Data treatment were performed by two methods: peak picking and parallel factor analysis (PARAFAC). An evolution of DOM quality (position of excitation – emission peaks) and quantity (intensity of fluorescence) was observed between the different treatment steps (influent, primary treatment, biological treatment, effluent).

Correlations were found between fluorescence indicators and different water quality key parameters in the sewage influents. We developed different multivariate linear regression models in order to predict a variety of water quality parameters by fluorescence intensity at specific excitation-emission wavelengths. For example dissolved biological oxygen demand (r^2=0,900; p<0,0001) and ammonium concentration (r^2=0,898; p<0,0001) present good correlation with specific fluorescence peaks and indicators. These indicators derived from 3D spectrofluorescence could be used in order to characterize DOM online and thus to optimize process efficiency in WWTP.