# Characteristics of chromophoric and fluorescent dissolved organic matter in coastal waters of the Gulf of Gabès (Tunisia, Southern Mediterranean Sea)

**Rania Fourati[1], Marc Tedetti[2], Madeleine Goutx[2], Hatem Zaghden[3], Sami Sayadi[3], Boubaker Elleuch[1]**

[1] Laboratoire de Génie de l'Environnement et d'Ecotechnologie, ENIS, Université de Sfax, BP 1173, 3038 Sfax, Tunisie

[2] Aix Marseille Univ., Université de Toulon, CNRS, IRD, MIO UM 110, 13288, Marseille, France

[3] Laboratoire des Bioprocédés Environnementaux, Centre de Biotechnologie de Sfax, Route de Sidi Mansour km 6, PO Box 1177, 3018 Sfax, Tunisie.

Chromophoric and fluorescent dissolved organic matter (CDOM and FDOM, respectively) were investigated in the coastal areas of the Gulf of Gabès (south-east of Tunisia, Mediterranean Sea). Samples were collected in surface waters off Sfax and Gabès cities from December 2012, October-November 2014 and in March 2015 (Fig. 1). CDOM was characterized by absorption coefficient at 350 nm ($a_{CDOM}(350)$) and spectral slopes (S), whereas FDOM was characterized by excitation-emission matrices (EEMs) coupled to parallel factor analysis (PARAFAC).

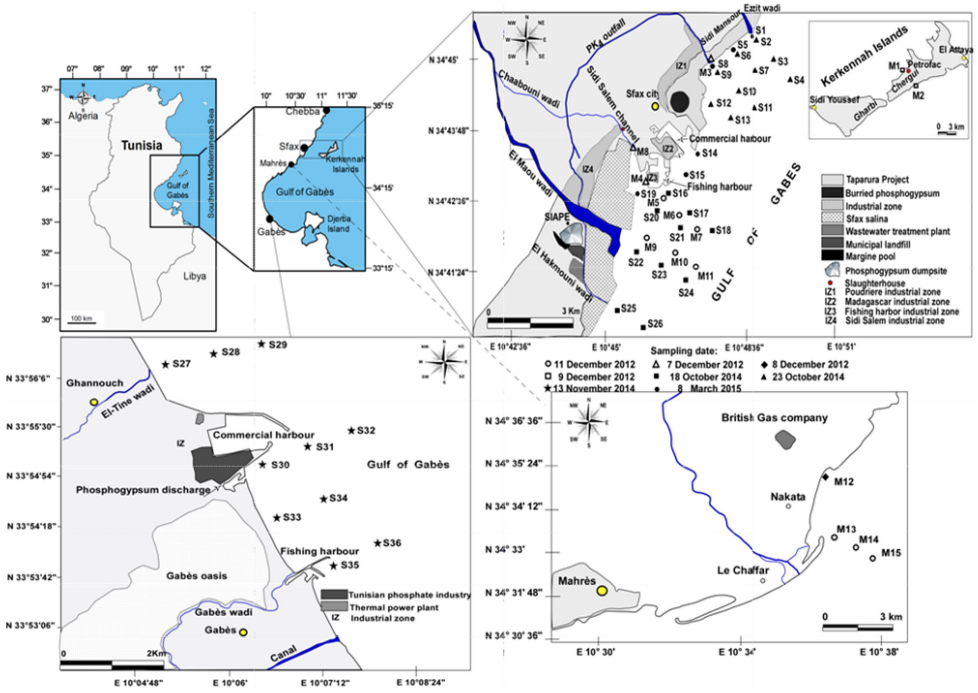


Figure 1. Location of the study stations in the Northern and Southern coasts of Sfax city, Kerkennah Islands, Mahrès delegation and Gabès-Ghannouch area, in the Gulf of Gabès (Southeastern Mediterranean Sea, Tunisia)

The $a_{CDOM}(350)$ varied between 0.03 and 1.81 $m^{-1}$, with the highest values were associated to low $S_{350-400}$ (0.018 ± 0.002 $nm^{-1}$) and $S_{290-500}$ (0.020 ± 0.003 $nm^{-1}$), reflecting a high aromatic content in CDOM related to humic substance. However, high $S_{275-295}$ (0.024 ± 0.002 $nm^{-1}$) were recorded leading to high $S_R$ (>1). This combination of high $a_{CDOM}$ (λ) and $S_R$ values underline the presence of marine humics and new biological CDOM with a significant contribution of aged CDOM content. The lowest $a_{CDOM}(350)$ were associated to high $S_{350-400}$ (0.031 ± 0.013 $nm^{-1}$) and $S_{290-500}$ (0.025± 0.016 $nm^{-1}$), suggesting a loss of

higher molecular weight compounds through photobleaching or due to microbial degradation activities. Nevertheless, no remarkable changes in $S_{275–295}$ (0.022 ± 0.003 $nm^{-1}$) were observed suggesting that photobleaching is not the dominant process in eliminating the aromatic CDOM. Indeed, microbial activities could lead to low absorption coefficient and high slope through consumption of more available CDOM after their alteration by photochemical processes. Therefore, these samples undergo an intense photobleaching and/or microbial degradation processes.

Four components were identified by PARAFAC: two humic-like fluorophore, C1 ($\lambda_{Ex1}$, $\lambda_{Ex2}$, $\lambda_{Ex3}$/ $\lambda_{Em}$: 225, 255, 350/472 nm) and C2 ($\lambda_{Ex1}$, $\lambda_{Ex2}$/ $\lambda_{Em}$: 240, 305/394 nm), and two protein-like fluorophore, C3 ($\lambda_{Ex1}$, $\lambda_{Ex2}$/ $\lambda_{Em}$: 220, 275/328 nm) and C4 ($\lambda_{Ex1}$, $\lambda_{Ex2}$/ $\lambda_{Em}$: 230, 290/346 nm) (Fig. 2).

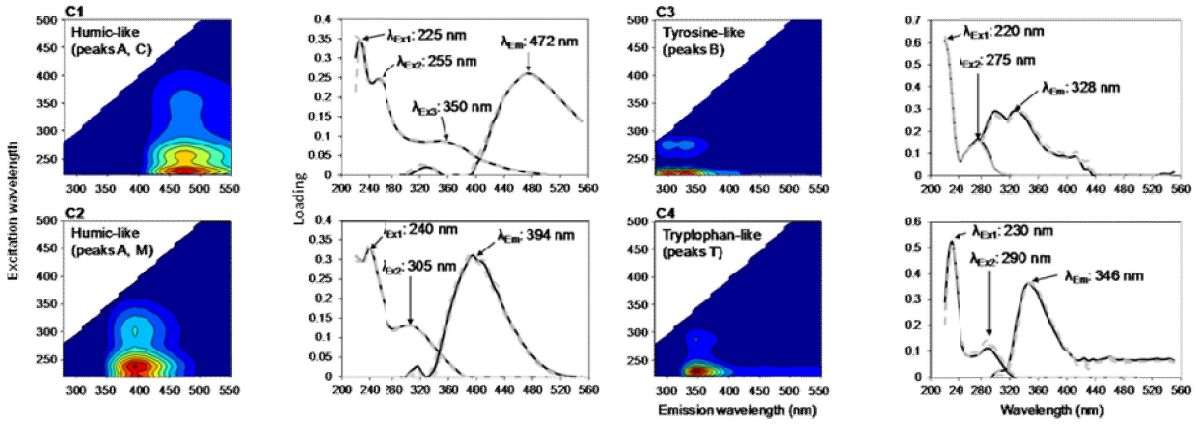


Figure 2. Spectral characteristics of the four FDOM components (C1–C4) validated by the parallel factor analysis (PARAFAC)

The highest autochthonous signatures of CDOM and FDOM (high contribution of marine humic- and protein-like fluorophores) were observed in stations from Sfax Southern coast and were associated to high concentrations of total chlorophyll *a*, nutrients and dissolved organic carbon. Allochthonous signatures of CDOM and FDOM (high contribution of terrestrial humic-like fluorophores) were more pronounced in stations from the Northern Sfax area, very likely due to inputs of terrestrial OM from Ezzit wadi and sediment resuspension. For the coastal area of Gabès, the DOM optical properties highlight a dominance of humic-like components, particularly those with marine signature, highlighting microbial activities in the area. Despite this local terrestrial inputs, CDOM and FDOM in the Gulf of Gabès seemed to have a major autochthonous origin in relation to eutrophication, and to be affected by abiotic factors (mainly photobleaching) and microbial degradation. Interestingly, the impact of eutrophication and microbial degradation has also been observed for hydrocarbons (AHs and PAHs) in this area (Fourati et al., 2018a, b).

## References:


Fourati, R., Tedetti, M., Guigue, C., Goutx, M., Garcia, N., Zaghden, H., Sayadi, S., Elleuch, B., 2018a. Sources and spatial distribution of dissolved aliphatic and polycyclic aromatic hydrocarbons in surface coastal waters of the Gulf of Gabès (Tunisia, Southern Mediterranean Sea). Prog. Oceanogr. 163, 232-247. doi:10.1016/j.pocean.2017.02.001

Fourati, R., Tedetti, M., Guigue, C., Goutx, M., Zaghden, H., Sayadi, S., Elleuch, B., 2018b. Natural and anthropogenic particulate-bound aliphatic and polycyclic aromatic hydrocarbons in surface waters of the Gulf of Gabès (Tunisia, southern Mediterranean Sea). Environ. Sci. Pollut. Res. 25, 2476-2494 doi:10.1007/s11356-017-0641-7