

# Characterisation of natural organic matter from coastal seawater: polarity and compound families

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## INTRODUCTION

Natural organic matter (NOM) can be quantified by several analytical techniques: total and dissolved organic carbon (TOC and DOC), ultraviolet absorbance at 254 nm (UV<sub>254</sub>) or chemical oxygen demand (COD). However, those techniques do not permit to characterise precisely the organic matter. Specific analytical techniques developed for the characterization of NOM from surface water and wastewater, have been used in this study to characterize NOM from coastal seawater. XAD fractionation permits to distribute bulk organic matter into three different fractions characterized by their polarity (Martin-Mousset et al, 1996; Gong et al, 2008). LC-OCD is the combination of a size exclusion chromatography with continuous analyzers able to quantify organic carbon, nitrogen, ultraviolet absorbance at 254 nm (UV<sub>254</sub>) (Dittmar and Kattner, 2003; Bagtho et al, 2008). Those analysis complete the conventional quantification and should permit to evaluate better the impact of treatments application to seawater.

## OBJECTIVES

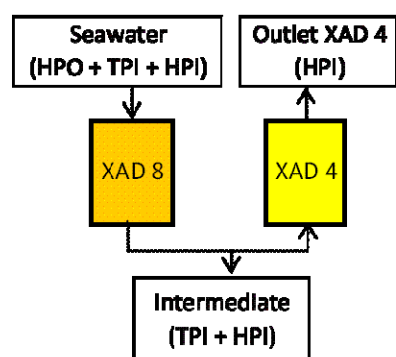
The main objective of this study is to evaluate, quantitatively and qualitatively, natural organic matter from Barcelona coast seawater.

## MATERIALS AND METHODS

### Conventional parameters

Analysis	Units	Method
DOC	mgC.L <sup>-1</sup>	Catalytic combustion
UV <sub>254</sub>	m <sup>-1</sup>	Spectrophotometry
SUVA	L.m <sup>-1</sup> .mgC <sup>-1</sup>	UV <sub>254</sub> /DOC

### XAD fractionation



## LC-OCD

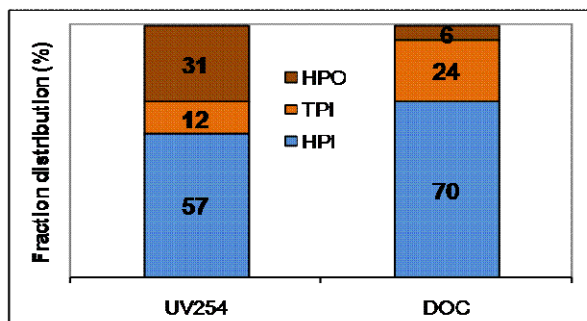
**Objective:** Characterization and quantification of dissolved organic carbon by separation. Organic matter is distributed in five different fractions depending on their molecular size but also on their polarity, UV absorbance and nitrogen content.

LC-OCD have been applied to seawater and its XAD fractions to determine the distribution of HPO, TPI and HPI over the LC-OCD fractions.

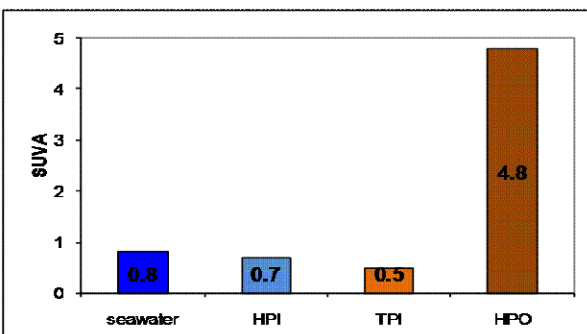
Fraction	Approx. molecular weight (g/mol)	Properties	Examples
Biopolymers	20 000	Not UV-absorbing, hydrophilic	Polysaccharides, proteins
Humics	1 000	Highly UV-absorbing, hydrophobic	Humic substances
Building blocks	300 - 500	Sub-units of Humics	Fulvic substances
LMW Neutrals	< 350	uncharged hydrophilic, amphiphilic	Alcohols, aldehydes, ketones
LMW Acids	< 350	negatively charged	Organic acids

**Objective:** distribution of organic matter into 3 different fractions by adsorption on XAD8 and XAD4 resins. DOM adsorbed on XAD 8 is defined as hydrophobics (HPO), DOM non-adsorbed on XAD 8 but adsorbed on XAD 4 are transphilics (TPI) and non-adsorbed DOM is defined as hydrophilics (HPI). DOC, UV 254 are measure for each fractions.

## RESULTS AND DISCUSSION



NOM distribution over HPO, TPI and HPI fractions in terms of UV254 absorbance and DOC.



SUVA of seawater and each XAD fractions.

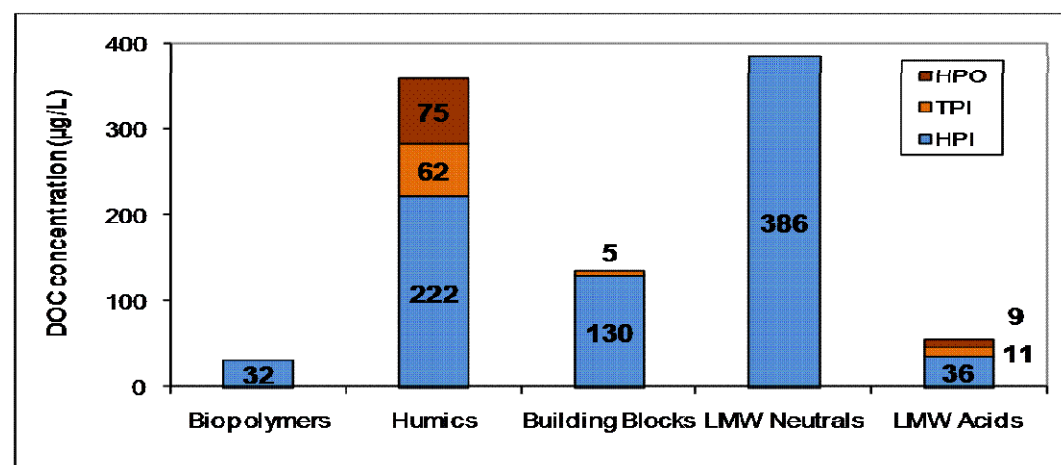
Analysis	Units	Value
DOC	mgC.L <sup>-1</sup>	0.72 - 0.82
UV <sub>254</sub>	m <sup>-1</sup>	0.54 - 0.64
SUVA	L.m <sup>-1</sup> .mgC <sup>-1</sup>	0.76 - 0.78

### XAD fractionation

Natural organic matter from coastal seawater is mainly **hydrophilic** (2/3) and slightly **transphilic** (1/4).

The distribution of UV-absorbing compounds varies from DOC distribution: more HPO, but less TPI and less HPI.

HPO matter is defined to be mainly composed of humic-like substances rich in aromatic moieties, whereas TPI and HPI are composed with less refractory molecules with low UV-absorbing moieties. The SUVAs of each fraction reflect also their different characteristics (Martin Mousset, 2006).



HPO, TPI and HPI fractions distribution over LC-OCD fractions (µgC/L)

## LC-OCD

NOM is mainly composed of *humics* and *LMW neutrals* (37 and 40% of DOC, respectively). *Building blocks* are the 3<sup>rd</sup> most important fraction of seawater organic matter with 14 % of DOC. *Biopolymers* and *LMW acids* are very small fractions of seawater organic matter (less than 5%). *LMW neutrals* are described to be amphiphilic DOM recalcitrant to biodegradation such as metabolic intermediates and bacterial membranes moieties (Dittmar and Kattner, 2003).

*LMW neutrals* and *biopolymers* are exclusively HPI. HPO and TPI are mainly *humics* and a slight part of *LMW acids*. *Humics*, usually classify in HPO, fall in this case in majority in HPI and also in a lower way in TPI fraction, moreover *building blocks* are only HPI.

## CONCLUSIONS

NOM from Mediterranean coastal seawater have been characterized to be essentially **hydrophilic** that is coherent with low SUVA. NOM distribution over LC-OCD fractions is close to freshwater one (Bagtho et al., 2008). In comparison, NOM from surface water is described to contain in majority hydrophobic matter (Martin-Mousset, 1996). The more hydrophilic nature of seawater NOM is confirmed by the large fraction of HPI-humics and by the absence of HPO-*building block*. This difference could be explain by very long residence time of NOM in seawater that could lead to hydrolyzation of originally HPO *humics* to form smaller and more hydrophilic compounds, via bacterial biodegradation and photochemical oxidation.

## REFERENCES

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