Organic matter sources and Soot-Black carbon contribution in sediments from the Guadiana estuary (SW Iberian Peninsula)

[a,b]De la Rosa J M, [a,c]Martins J M, [a]Soares A M, [a]Araújo M F

Black carbon (BC), the ubiquitous recalcitrant continuum of products from incomplete combustion processes, which includes char, charcoal or soot may be transported by wind, surface runoff or fluvial currents, being ultimately deposited in sediments and marine waters. Despite of the growing interest in the organic geochemistry of these particles, including sources, transport and accumulation in aquatic systems, quantitative measurement of BC in sediments is still very scarce, and consequently BC sinks remain fairly unknown. The heterogeneity of the BC-like material and the lack of a standardized method able to detect all types of BC contribute significantly to these uncertainties. To date, there are no universally accepted methods for BC determination.

The Guadiana River basin has an area of about 67,000 km^2, a length of 810 km and is the fourth largest on the Iberian Peninsula. Before reaching the estuary, the Guadiana crosses approximately 130 km of a rural region in the SW of the Iberian Peninsula. Its last 60 km correspond to the estuarine zone, located in a Mediterranean climate area. In 2001 the construction of the Alqueva dam produced the largest artificial lake in Southern and Western Europe. Since then, the river discharge into the estuary has been reduced significantly (from>80 $m^3\ s^{-1}$ to<20 $m^3\ s^{-1}$). In addition, the naturally high (annual and seasonal) variability of the system before dam closure (1995–2000: 333 ± 1096 $m^3\ s^{-1}$) disappeared. However, there is a lack of information concerning the changes into the sedimentary organic matter (OM) sources and BC stocks in this area after the dam construction.

Superficial sediment samples from the lower course of the Guadiana River were collected in 2008 and analyzed for total organic carbon (TOC), total nitrogen (TN), the C_{org}/N atomic ratios, stable carbon isotope ratios ($\delta\ ^{13}C$) and soot-black carbon (BC) contents.

Compared to values measured prior in Alqueva, the C_{org}/N ratios decreased. This could be due to a relative increase in the marine OM. Moreover, diagenetic processes must also be considered.

The $\delta\ ^{13}C$ values ranging from –25.0 ‰ to –27.6 ‰ (PDB), illustrate typical signature of C_3 plants predominant in the nearby area (*Cytisus grandiflurus, Cistus sp. Halimium halimiforum*). The lack of correlation of C/N ratios against $\delta^{13}C$ (r^2= 0.049) are probably due to the influence of decomposition processes of OM (e.g., autolysis, leaching and microbial mineralization).

Soot black carbon was quantified by the Chemothermal oxidation method (CTO–375). Soot content ranged 0.17–0.74 wt.% and comprised from 1.4 to 12.8 % of TOC. Higher soot-BC contents are found in samples located close to residential areas (Alcoutim and Ayamonte towns, Ayamonte Harbour). Carbon poor sediments contained a greater contribution of soot-BC, which confirms the selective preservation of soot carbon.

[a] *Instituto Tecnologico e Nuclear (ITN), Instituto Superior Técnico (IST) Estrada nacional 10, 2686-953, Sacavém, Portugal (jmrosa@itn.pt) (josemasev@hotmail.com) (faraujo@itn.pt)*
[b] *Instituto de Recursos Naturales y Agrobiología (IRNAS-CSIC), Avda. Reina Mercedes 10, 41012, Seville, Spain.*
[c] *Universidade do Algarve, CIMA, Faculdade de Ciências e Tecnologia, Campus de Gambelas, 8005-139 Faro, Portugal.*