

Abstract

Situated on the northern shore of Lake Geneva, Vidy Bay is a small embayment measuring approximately 3km (wide) by 1.5km. Aside from the currents and the affluent Chamberonne river, a waste water treatment plant (WWTP) effluents input represent a major water source for this Bay. Despite treatment, various contaminants like pharmaceuticals, faecal indicator bacteria, organic micropollutants and metals were found in the Bay.

This study focuses on the spatial distribution of metals in surficial sediment. Considered as a sink through physico-chemical processes like adsorption, sediments can also be a secondary source through desorption or diffusion. Due to the non-biodegradable and toxic property when in excess levels, various trace metals should be carefully monitored. High concentration could be problematic for different aquatic species, like the benthic fauna.

In the collected sediment samples, ten metals (Al, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Ti and Zn) were analysed on ICP-OES (Inductively coupled plasma optical emission spectroscopy), after a pseudo-total digestion (PTD) with Aqua Regia solution. And mercury was analysed with a DMA-80 (Direct mercury analyser). No dry sieving has been done to avoid granulometric bias.

To better understand the spatial distribution geostatistics tools were used. Depending on the metal, the distribution shows different patterns, but it was observed that three main groups emerged with high positive correlation within the group. The first group (Cd, Cu, Hg, Pb, Zn) is highly impacted by the WWTP outlet pipe and their maximum concentration are near this input. A second group (Fe, Cr) shows a distribution impacted both by WWTP and the presence of fine fraction sediment. And the last group (Al, Mn, Ni, Ti) shows the highest concentration further from the WWTP input and their distribution is mainly determined by the granulometry. Enrichment factor (EF) analysis was used on the second and third metals group to evaluate the anthropic contamination.

Finally, in order to assess toxicity, Macdonald et al. (2000) thresholds were used on first group metals + Cr and Mn. Concerning single metal toxicity, Cu, Hg and Ni show “High” potential risk near the WWTP input. Lead maximal concentration was close to “High” category but is classified as “Moderate”. The calculation of the mean PEC quotient, done on nine metals, shows that a large part of the Bay’s sediment can be classified as “Moderate” for chemical quality, whereas the eastern part of the Bay and sites close to the shores are classified as “Good quality”.

Key words: *Trace metals, Vidy Bay, geostatistics, spatial distribution, contamination assessment, SQGs, WWTP*