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Remediation and recovery of potential valuable compounds from dredged sediments – Case of Malmfjärden bay, Sweden

Laura Ferrans (1), Yahya Jani (1), Ling Gao (2), Fabio Kaczala (3), and William Hogland (1)

(1) Department of Biology and Environmental Science, Linnaeus University, Kalmar, Sweden (laura.ferrans@lnu.se), (2) Department of Environmental Science and Forestry College, Beihua University, Jilin City, China, (3) Kalmar Municipality - Service and Administration Department, Kalmar, Sweden

Millions of tons of bottom sediments are dredged annually. Ports and bays need to extract the sediments to guarantee the navigation levels, retain minimum ecological water volumes or remediate the aquatic ecosystem. Removed material is commonly disposed of at open oceans or landfills. These disposal methods are not yet part of the circular economy and additionally are unsuitable due to their possible contaminant pathways, limited space capacity, and lack of long-term stability, and economic, legal and environmental compatibility. New disposal routes for sediments are challenging. The composition of marine sediments depends on the surrounding environment and potentially includes organic matter, heavy metals, nutrients and other possible pollutants. Recovery of valuables represents a way to eliminate dumping and contributes towards the sustainable extraction of secondary raw materials. Nevertheless, the recovery varies on a case-by-case basis and depends on the sediment composition and their chemical bonds. Therefore, the first step is to analyze and identify the sediment composition.

Malmfjärden is a shallow semi-enclosed bay located in Kalmar, Sweden. Currently, the water body is slightly polluted by heavy metals and nutrients as well as an unwanted re-growth is a threat. Dredging of sediments is required to recuperate the water body. It is intended to recover nutrients and/or heavy metals from the dredged sediments to contribute to achieving a circular economy in the region. This study focuses on characterizing the dredged sediments from the bay to underline possible recovery paths. During summer of 2018, bottom sediments from Malmfjärden bay were extracted by using a core manual sampler. The sediment cores were divided into top (0-20 cm) and bottom (21-60 cm) layers. Samples were analysed in external laboratories to determine particle size distribution and concentration of nutrients, heavy metals and organic pollutants. The results showed that the sediments are mainly constituted by silt and clay and have high levels of nitrogen and phosphorous. Additionally, the sediments have none or little presence of organic pollutants (PAH, PCB and aliphatic components) and low-medium concentration of heavy metals. The characterization of the sediments displays a potential for nutrient extraction. Future studies will focus on using sediments as a soil amendment for forestry and gardening. Experiments will be carried out in a greenhouse and will assess the rate of nutrient uptake.