ENVIRONMENTAL MONITORING OF A DREDGING PROJECT WITH A FOCUS ON THE DEWATERING TREATMENT SYSTEM

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Introduction

Multiple dredging projects are implemented worldwide to increase water levels in harbours and bays or restore aquatic ecosystems. Dredging is required in several water bodies. However, the actions may cause severe environmental impacts on the bays due to the potential resuspension of particles. Sediments are the final sink of compounds entering water bodies. Hence, their extraction could also be associated with releasing contaminants such as nutrients, metals, and organics (Akcil et al., 2015). Knowing the potential damage to the environment leads to the importance of implementing monitoring programs for dredging activities. Moreover, the dredged masses from bays have a high content of water. Therefore, the dewatering of sediments is required to prepare the material for further management (Ali et al., 2014). Treatment systems commonly include dewatering units and clean-up technologies to reduce pollutants in the sediment and water phases. The monitoring programs of dredging systems shall also focus on the dewatering system to guarantee the proper operation of the treatment units and compliance with water discharge and sediment quality regulations (CEDA, 2018). This study aims to highlight the need for environmental monitoring programs in dredging projects and shows preliminary results of the monitoring system at Malmfjärden bay, Sweden.

The water body is located in Kalmar (Sweden). It is crucial for the municipality and the community due to its central location that hosts wildlife and leisure activities. The LIFE SURE project is an initiative that aims to develop an environmental-friendly dredging technique that avoids the resuspension of particles while operating. The project is joined by Linnaeus University (as the monitoring and research entity), Kalmar Municipality (as project managers) and contractors (as technical supporters). Currently, the stakeholders are dredging Malmfjärden bay since this is shallow and presents nutrient pollution. The dewatering system is shown in Figure 1 and includes an equalization tank to homogenize the inlet, the addition of an organic-cationic polymer, geo-tubes to dewater the sediments and soil infiltration to polish the outlet. The dredged sediments will be employed in beneficial uses to improve the implementation of a circular economy in the region. The environmental program includes the monitoring of the bay and the dewatering system. The section of the bay comprises the determination of its baseline conditions (before operations), measurement of turbidity during activities, and assessment of the environment after the end of the project. The monitoring of the dewatering facilities focuses on measuring the quality and quantity of sediments/water entering and exiting the system.

Figure 1. Dewatering site at Malmfjärden Bay. Photo ©: Kalmar Municipality

Methods

The turbidity of the bay water was measured by taking samples from the water body and analyzed with a turbidimeter. Regarding the dewatering system, the samples were taken manually from Oct 2020 to Aug 2021, collecting samples from the inlet three times per week and daily for the outlet of the geotubes. Sediment samples were taken manually from inside the bags. The samples were analyzed for nutrients, metals and oil index in an external laboratory.

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Results
Before starting the project, the turbidity of the water bay ranged from 4 to 35 NTU, and during the dredging operations, the measurement was kept low (2-4 NTU). Concerning the dewatering system, the concentrations of metals and nutrients in the water phase were low in the inlet and outlet. The oil index C12-16 increased in the system. The solid content of the sediments with the geotubes increased from 5-10% to 25-30%. The obtained sediment presented a quality with high content of nutrients, medium-low content of nutrients and low content of organic pollutants.

Discussion
The turbidity in the water bay was low according to WHO guidelines, where the value of normal water bodies is between 10 to 100 NTU. Additionally, it was shown that during dredging, the turbidity was kept low, suggesting that the environmental impact caused to the bay was reduced. The treatment system showed that the quality of the water phase is reduced after dewatering. Potentially, the sediments release the compounds, increasing the concentration of nutrients in the outlet. The oil index is increased due to the addition of the polymer. The compounds are expected to be reduced after the polishing with soil infiltration. Hence, the local regulation discharge is expected to be fulfilled. The accumulated polymer in the soil is expected to be degraded by microorganisms due to its organic nature. However, the exact polymer impact in the environment shall be measured in further studies. Moreover, the system was effective in removing water from the sediments. The obtained product could be transported by trucks to the final places for beneficial use, like covering landfills. The sediments complied with the Swedish legislation for employing the material in non-sensitive uses.

Key words: monitoring, dredging, circular economy, turbidity, dewatering system

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