

Floating Treatment Wetlands is a relatively new approach in water treatment that consists of emergent wetland plants growing on floating rafts (mats) built of buoyant material. Wetland plant sections submerged in the water play a major role in the Floating Treatment Wetland treatment processes. The main application of Floating Treatment Wetland includes the treatment of stormwater, sewage, pond water, dairy manure effluent, the meat processing industry, and water supply reservoirs. Researchers highlight the removal of nutrients (nitrogen and phosphorus), and some of the works also document the effectiveness of removing heavy metals.

Every year, 119,000 km³ of precipitation is recorded worldwide. Only 61 % (72,000 km³) evaporates, and 39 % (47,000 km³) continues to flow on the earth's surface. Nowadays, the runoff from paved and soft surfaces (urban and agricultural lands, where contaminants in the form of fertilizers or as a result of dry deposition were introduced) is forming as a non-point source of pollution and poses a serious threat for receiving freshwater worldwide. Due to land-use restrictions (plots ownership rights), it is often impossible to make buffer reservoirs or constructed wetlands to reduce the supplied pollution load. Floating Treatment Wetlands offers a solution able to cope with these disadvantages. Among the urban and agricultural contaminants the biogenic substances (N and P) are the most characteristic. The elevated concentrations of N and P input leads to water quality impairment and in extreme cases to eutrophication. Heavy metal contamination in the aquatic environment in the last decades has attracted global attention due to its toxicity, abundance, and persistence in the environment. Another toxic and cancerogenic element that draws particular attention of researchers in the recent years is As metalloid. In the form of arsenate As (V) and arsenite As (III) prevail in the natural environment and are highly toxic and mobile. An important advantage of the proposed project is to provide information on the removal paths contained in runoff from urbanized and agricultural areas by four macrophyte species that have not yet been fully understood in the Floating Treatment Wetlands technology.

The proposed project assumes examining the pathways and mechanisms for the removal of biogenic compounds (nitrogen and phosphorus), heavy metals (Cu, Cd, Pb) and metalloid (As) by 4 macrophyte species (*Phragmites australis* Cav., *Iris pseudacorus* L., *Typha latifolia* L., and *Alisma plantago-aquatica* L.) characteristic for the climate of Poland. Research on the cognitive process will be carried out in two stages: microcosm studies, in which macrophytes will be exposed to various doses of nutrients, metals and metalloid to learn the individual properties of plants, and mesocosm studies, in which macrophytes will be randomly distributed on a floating island and the simulated surface runoff will be discharged to the Floating Treatment Wetland reactor in batch. The results of the project will allow to determine the level of phytoextraction of contaminants by plants and assess the degree of removal efficiency, which at the same time allows to assess the effect of pre-treatment. The results of this project will help to answer the following research questions: how much pollution accumulates in underwater and aerial macrophytes, how much pollution is deposited in bottom sediments and what is the microbiological characteristics of the rhizosphere and sediments?

Floating Treatment Wetlands belong to the promoted range of "best management practices". In addition, they are an environmentally friendly solution and adapt to the circular economy approach, especially due to the nitrogen and phosphorus circulation in the environment. The research will provide relevant information on the usefulness of four species of macrophytes generally available in Poland arranged on floating ecological islands for pre-treatment of runoff from urban and agricultural areas.