PREVENTION OF POLLUTION WITH HEAVY METALS OF HYDROECOSYSTEMS – ONE OF THE WAYS IN REALIZATION OF SUSTAINABLE DEVELOPMENT

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The content and migration of heavy metals in the water of the left inflows of the Dniester - the Seret River, Ternopil region, Ukraine was investigated. It was established that the water quality behind the content of heavy metals does not correspond to the maximum permissible concentration. It indicates the increasing pollution of this hydroecosystem and the loss of river self-cleaning ability, which, eventually, may lead to pollution of the Dniester aquatic ecosystem of regional importance. To improve the environmental situation, it is proposed to use coastal-aquatic and aquatic plants as biological filters that are capable of adsorbing heavy metals.

Keywords: Seret River, hydro-ecosystem, heavy metals, pollution, maximum permissible concentration.

On the assumption of the goals of sustainable development, which adopted at the United National Summit on Sustainable Development, is to ensure the availability and sustainable management of water resources and sanitation. This involves the protection and restoration of aquatic ecosystems such as forests, mountains, swamps, and rivers and is essential for mitigating water scarcity. Regional pollution of small and medium rivers by heavy metals leads to a deterioration of water quality in large rivers, which poses a serious danger to public health [1].

Clean, accessible water for all is an essential part of the world we want to live in and there is sufficient fresh water on the planet to achieve this. Due to Report of the Secretary-General, Special edition: progress towards the Sustainable Development Goals, 2019 session [2], despite progress, billions of people still lack safe water, sanitation and handwashing facilities. Data suggests that achieving universal access to even basic sanitation service by 2030 would require doubling the current annual rate of progress.

The purpose of the study is to analyze the degree of pollution of the river Seret by heavy metals and to propose ways to solve the problem of pollution of the reservoirs of Ternopil region due to the absorption capacity of coastal water and aquatic plants.

We have conducted a research of content and migration of heavy metals in water left inflows of Dniester - the Seret River, the Ternopil Region, Ukraine. River length within an area - 248 km; along the river it is located about a third of all industrial enterprises of the region. 128 samples of water from the River Seret were analyzed, which were selected during May-September 2016. The content of the heavy metals was determined by the atomic absorption spectrophotometry method on the spectrometer C-115 M1, C-600 at the corresponding wavelengths. To determine the content of HM in samples of higher aquatic plants, they were dried in a drying oven at a temperature of 60-65 °C to air-dry state. The mineralization of plant's samples was carried out by wet ointment, after which heavy metals was determined in ash solutions of plant samples by an atomic absorption spectrophotometer at the corresponding wavelengths.

It is established that the quality of water behind the maintenance of heavy metals doesn't correspond to the maximum allowable concentrations admissible levels. In particular, the content of zinc in 2016 year have exceeded indicators with a maximum allowable concentration by 2,75 times, mangan - by 6,1 times, ferrum - by 3,7 times, nickel - by 3,1 times. This specifies about growing, in comparison with previous (1999-2015) for years, pollution of this hydroecosystem and loss of the river to self-cleaning ability, that finally can lead to pollution of the Dniester water ecosystem of regional value.

For improvement of an ecological situation, which has developed, we offered to use coastal- and water makrofits as the biological filters capable to adsorb heavy metals. The conducted studies (determined by the content of heavy metals in the plant, mg / kg of dry mass) showed that the highest absorption capacity for plants belongs in the root, with the exception of *Ranunculus circinatus Sibth*., whose absorption capacity is greatest in the leaf (in the absorption of zinc, cobalt and plumbum). So, *Nuphar lutea (L.)* most accumulate ferrum and zinc, *Sagittaria sagittifolia L*. - cobalt, nickel, *Ceratophyllum demersum L.* - manganese, *Ranunculus circinatus Sibth*. - plumbum. Therefore, we have proposed the additional distribution of aquatic plants, as biological filters, along rivers and in the coastal areas with their further disposal.

Prevention and implementation of all the above-mentioned methods of preventing pollution of the rivers will serve to preserve and restore aquatic ecosystems, and thus to realize the goals of sustainable development.

BIBLIOGRAPHY

1. *Вергун, А. М.* Концепція сталого розвитку в умовах глобалізації / А. М. Вергун, І. О. Тарасенко // Вісник КНУТД, 2014. – № 2. – С. 207-218.

2. Report of the Secretary-General, Special edition: progress towards the Sustainable Development Goals, 2019 session // Economic and social council 2019 / 68. – 39 p.

USE OF SPECTRAL REFLECTANCE METHOD FOR MONITORING OF PLANT TRAITS AND DROUGHT STRESS EFFECTS IN WHEAT

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The drought stress represents one of the main environmental factors affecting growth and yield of crops in a global and regional scale. The non-invasive methods enable fast and efficient way to monitor the drought stress effects. The aim of the study was to test the application of spectral reflectance method and select the proper parameters to evaluate the main leaf traits in various wheat genotypes in genebank. The results enabled to indicate the parameters showing a good link to observed traits and an appropriate sensitivity to drought stress effects. The study represents the initial step of the program aimed at stress tolerance screening and monitoring of wheat germplasm.

Keywords: stress monitoring, wheat, spectral reflectance, genotypes, hyperspectral analysis.

Spectral reflectance analyses represent a promising technology for field environmental monitoring of stress effects in plants. Drought stress is another key environmental factor responsible for the reduction of growth and yield of plants. Drought stress adversely affect plants, including the reduction in leaf water contents, photosynthesis [1], nutrient uptake, growth, and yield of plants [2]. There are numerous methods and protocols for non-invasive assessment of stress effects with a different level of labor costs [3]. One of the most promising is hyperspectral monitoring using the broadband spectral reflectance records, which was successfully used in different crops and various stresses [4]. Previous studies over the past decades have successfully used hyperspectral data to quantify the canopy characteristics of crops. It was found that leaf spectral reflectance increases in portions of the visible and very-near infrared range as a plant experiences physiological stress [5]. These methods are well established in the remote sensing, including the satellite or plane applications. It is well documented that the wheat germplasm is characterized by an enormous phenotypic diversity, including the morphological traits of aboveground biomass determining the optical properties of the crop canopy. The open question is the reliability of the methods for monitoring the physiological status of the diverse accessions of wheat differing in various leaf traits. To answer this, the hyperspectral field records as well as the subsequent leaf analyses were made in 100 wheat genotypes from the collection of Slovak Genebank. Moreover, the automated phenotyping of 25 wheat genotypes grown in pots were performed at a PlantScreen phenotyping facility of SUA. The traits of the fully developed flag leaves (chlorophyll content, leaf area, leaf thickness, etc.) were correlated with >100 hyperspectral indices developed to estimate different properties of crop aboveground biomass. The genotypes provided high diversity in all observed traits, providing good background for correlation analyses. We identified a group of parameters with a high correlation (MCARI, red edge parameters), which can be useful for the automated field phenotyping of wheat genetic resources. The RGB analyses enabled to collect the phenotyping data related to the plant height, leaf area, but also the color characteristics of plants and leaves. The study represents the initial step of the program aimed at stress tolerance screening and monitoring of wheat germplasm, including local landraces, towards developing the methodological approaches to assess the genotype. This effort may contribute to efficient utilization of crop genetic resources, their protection and increase of genetic and biological diversity of cultivated cultural plants. The study was supported by the grants VEGA 1-0589-19, APVV-18-465, and APVV-15-0562.

BIBLIOGRAPHY

1. *Zivcak, M.* Photosynthetic electron transport and specific photoprotective responses in wheat leaves under drought stress / M. Zivcak, M, Brestic, Z. Balatova et al. // Photosynth. Res. – 2013. – Vol. 117, № 1–3. – P. 539–546.

2. *Bodner, G.* Management of crop water under drought: a review. / G. Bodner, A. Nakhforoosh, H. P. Kaul Agron // Sustain. Develop. – 2015. – Vol. 35, № 2. – P. 401–442.