Conclusions. The results show that activated carbon produced from sugar sorghum press cake demonstrates the highest sorption activity toward Pb ions. This is explained by their stronger affinity for active surface groups (–OH, –COOH) compared to other metals. Considering that this sorbent is natural, environmentally safe, and simple to produce from agricultural waste, it represents a promising material for water purification from hazardous heavy metals, especially lead.

References

1. Tarnovsky D.V., FedoryshynO.S., VyshnevskyiO.A., RomanovaI.V. Removal of cesium and strontium ions from aqueous solutions using metakaolin based geopolymers. *Chemistry, physics and technology of surface*. 2024. V. 15. № 1. P.102-109
2. Panda L., Lena S.K., Rath S.S., Misra P.K. Heavy metal removal from water by adsorption using a low-cost geopolymer. *Environ. Sci. Pollut. Res.* 2020. № 27(9). P. 24284.
3. Mykhailov M.G. Promising methods for wastewater treatment containing heavy metal ions. Proceedings of the II International Scientific and Technical Internet Conference "Resource Conservation and Energy Efficiency of Engineering Infrastructure of Urbanized Territories and Industrial Enterprises", February 2-27, 2016. Kharkiv (in Ukrainian).
4. Hryhorenko N.O., Roik M.V., KupchykL.O., KupchykM.M., Babjak A.I. Method for obtaining carbon sorption material from sugar sorghum plant waste. Utility model patent 152894. 26.04.2023, Bulletin 1.https://iprop-ua.com/inv/pdf/0jei13zp-pub-description.pdf(in Ukrainian).
5. DSTU EN ISO 11885:2019 “Water quality. Determination of selected elements by inductively coupled plasma optical emission spectrometry” (ICP-OES)(in Ukrainian).

CHANGES IN NITROGEN AND PHOSPHORUS CONTENTS IN THE WATERS OF LAKE PIASECZNO AS INDICATORS OF ANTHROPOPRESSURE ON THE AQUATIC ENVIRONMENT

B. Futa, J. Gmitrowicz-Iwan, M. Myszura-Dymek

Institute of Soil Science, Environmental Engineering and Management, University of Life Sciences in Lublin, Poland, barbara.futa@up.edu.pl

Nutrient pollution, primarily involving nitrate (V) and phosphate (V) ions and resulting from agricultural intensification, has become one of the main drivers of eutrophication in aquatic ecosystems. An imbalance often occurs between the influx of nutrients into aquatic systems and the resulting increase in biomass. This phenomenon is particularly evident in lakes, where limited water exchange and low flow rates promote eutrophic conditions. This leads to anaerobic decomposition processes, which disrupts biological activity in the aquatic environment. The aim of this study was to evaluate the degree of eutrophication in Lake Piaseczno (Łęczyńsko-Włodawskie Lake District, Eastern Poland) based on nitrate and phosphate concentrations in the littoral zone.

Lake Piaseczno, located in the southern part of the Łęczna-Włodawa Lake District in eastern Poland, covers approximately 84 hectares and has a maximum depth of about 39 meters. Its catchment area is relatively small and flat, encompassing around 240 hectares. The majority of the catchment is covered by podzolic soils composed of sand, which are characterized by low fertility and sorption capacity; peat soils have formed in the northern section, originating from fen habitats adjacent to the lake. Based on land use, the lake's basin is conventionally subdivided into three

sectors (sub-catchments): agricultural, forest-recreational, and marsh-peatland. This research focused on the agricultural sector, which was previously primarily used for agriculture but now serves predominantly for tourism and recreation due to the increasing number of holiday plots. The natural tourism carrying capacity of this part of the lake basin has been exceeded more than fourfold. Water samples were collected three times annually (in May, July, and September) across a five-year observation period.

During the observations, the content of nitrates and phosphates in the water of Lake Piaseczno increased significantly over time. This was due to the pressure of recreation and tourism, which increased over time. This is evidenced by seasonal changes in the content of nitrogen and phosphorus compounds in the studied water. The content of these components in the lake water was noticeably higher in summer and autumn than in spring. The change in land use in the Lake Piaseczno catchment area from agricultural to recreational use inhibited the flow of nutrients from agricultural sources and simultaneously increased the flow of nutrients related to tourism and recreation.

FROM FACTORY TO RIVER: TRACKING POLLUTION PATHWAYS IN THE VISTULA VALLEY

J. Gmitrowicz-Iwan, B. Futa, M. Myszura-Dymek

Institute of Soil Science, Environmental Engineering and Management, University of Life Sciences in Lublin, Poland, joanna.gmitrowicz-iwan@up.edu.pl

Despite the growing interest in organic farming, the demand for mineral fertilizers remains high. Fertilizer production is a water-intensive process, and factories are often located near major rivers, increasing the risk of water contamination. This study investigates the influence of a nitrogen fertilizer plant's Chemical Wastewater Treatment Plant (CWTP) on the water quality of nearby river-lake systems in the Vistula River valley, Poland. Six floodplain lakes situated close to the CWTP were selected for analysis – three within the embanked area and three outside. Two additional lakes, located 30 km upstream, served as controls. Monthly water samples were collected from March to November 2022 and analysed for pH, electrical conductivity (EC), Cl^-, total nitrogen (TN), NH_4^+, NO_3^-, total phosphorus (TP), PO_4^{3-}, dissolved organic carbon (DOC), and major cations (Ca^{2+}, K^+, Mg^{2+}, Na^+). Statistical analyses revealed that a canal discharging cooling tower wastewater may significantly affect nearby lakes, increasing their Cl^- and Na^+ concentrations. Elevated NH_4^+ levels were also detected in lakes located downstream of the CWTP, even though they have no direct surface connection with the facility's reservoir and canals. This pattern, together with evidence of NH_4^+-rich water seeping under the dike, suggests possible leakage from the CWTP reservoir. Further investigation of groundwater is required to confirm the integrity of the reservoir, which is of particular importance given its location in the Vistula River valley – a primary source of drinking water for nearly two million people. Any structural failure, especially during flooding, could trigger an ecological disaster affecting not only the Vistula River but also the Baltic Sea.