**Summary of the activity and results obtained in the project in 2025**

*Project code* 25.80012.7007.17TC

*Project name* Valorization of local waste by obtaining activated carbon for water treatment

In the Republic of Moldova, the nut sector represents an important agricultural field due to the high quality of cultivated varieties and the expansion of Juglans regia (Chandler variety) plantations. Walnut shells, an agricultural by-product generated in large quantities, are typically left unused, despite their suitability for producing activated carbon. Biomass-derived activated carbon is valued for its effectiveness in removing heavy metals, dyes, and volatile organic compounds from water, owing to its porosity and the diversity of functional groups on its surface. Previous studies have shown that agricultural biomass, including walnut shells, can be an effective precursor for producing adsorbent materials.

This study analyzes the process of transforming Chandler walnut shells into activated carbon using chemical activation with citric acid. Citric acid is a biocompatible activation agent capable of creating functional groups that enhance the adsorption performance of the raw material. The walnut shells were collected from the village of Tîrșiței, Telenești district, and crushed to obtain granulometric fractions of 0.8–2.0 mm. The shells were impregnated with citric acid solutions at concentrations of 30%, 50%, and 70 %, followed by carbonization at temperatures of 350 °C and 450 °C for 2 hours, with a heating rate of 10°C/min. Thermogravimetric (TG, DTA, DTG) and X-ray diffraction analyses were used to evaluate the thermal behavior and chemical structure of the materials.

The results showed that impregnation with citric acid significantly altered the chemical structure of the walnut shells. After carbonization, it was observed that the samples treated at 350°C had a higher yield (ranging from 18% to 45%) compared to those treated at 450°C (ranging from 9 % to 29 %). This result suggests that temperature plays an important role in obtaining activated carbon with optimal characteristics. X-ray diffraction analyses confirmed the presence of citric acid in the impregnated samples, particularly in the CN-6 sample, which displayed distinct peaks in the diffraction range of 15–40°, indicating efficient impregnation of the shells with citric acid.

In conclusion, it was demonstrated that walnut shells impregnated with citric acid could represent a valuable and environmentally friendly source for producing activated carbon, with significant potential for use in water purification processes and other ecological applications. Further testing will be conducted to assess the adsorption capacity of the obtained material, and the most efficient samples will be used to reproduce larger quantities and carry out additional experiments. The results of this study will contribute to the valorization of an agricultural by-product.

Project manager / Ceban Irina

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