Nanopurimon

Newsletter, Issue 2

JOINT OPERATIONAL PROGRAMME
ROMANIA-MOLDOVA 2014-2020

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of the implementation team of the project 2SOFT/1.2/139 „Advanced nanotechnology-based approaches to waste-water purification from organic pollutants and their monitoring in water bodies" and can in no way be taken to reflect the views of the European Union or of the Joint Operational Programme Romania-Moldova 2014-2020 management structures."

Gold medal for the invention created within the project

Participation at the INVENTICA-2022 international exhibitions

The Institute of Electronic Engineering and Nanotechnologies participated at two international exhibitions: European Exhibition of Creativity and Innovation "EURO INVENT" held in Iasi, Romania on May 28 and the XXVI-th International Exhibition of Inventics "INVENTICA 2022", held in Iasi, Romania, on 22-24 June, 2022.

During these events, the implementation team of the project "Advanced approaches based on nanotechnology for the purification of wastewater from organic pollutants and their monitoring in water bodies" with the code 2SOFT/1.2.139 financed by the European Union within the Joint Operational Program Romania - Republic of Moldova 2014-2020 presented the innovative results obtained so far, namely demonstrated the high efficiency of the elaborated thermal photovoltaic installation that is capable of simultaneously producing electricity, heat and cold. The project is implemented in partnership with "Dunărea de Jos" University from Galaţi and National Environmental Center, Chisinau.

The invention relates to the field of renewable alternative solar energy, photocatalytic purification of water and air from organic and inorganic pollutants using a photocatalyst based on nanosized titanium dioxide grafted on the surface of a porous carrier and can be used for purification of aqueous media from organic pollutants and degradable toxic inorganics, in devices that convert radiant energy, including solar energy, to produce hydrogen from water into electrochemical cells, or heterogeneous photocatalytic conversion of carbon dioxide to produce new compounds.

The expert commissions highly appreciated the results gained by the implementation team, the invention being awarded twice with Golden Medal.

More about the project read **here**.

The previous edition of the Newsletter can be accessed **here**.

Determining the physico-chemical parameters of the aquatic ecosystems from the study area (Lower Danube and adjacent rivers Siret and Prut) for establishing the degree of pollution according to the Water Framework Directive

For determining and assessment of water quality in the study area 15 physico-chemical parameters were determined such as: pH, turbidity, dissolved oxygen, nitrogen compounds (nitrites, nitrates and ammonia), phosphorus compounds, sulphates, chlorides, iron, phenols.

Monitoring and sampling of water samples was carried out through different techniques specific to each river section. The water sampling from the three rivers (Danube, Siret, Prut) is an important step ahead of the physico-chemical analysis and will be done according to specific protocols from the upstream to downstream and at each river confluence.

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Some of the parameters were analysed in situ: pH, conductivity, turbidity, dissolved oxygen, using a portable multipara meter equipped with a multisensory electrode and the rest of 11 parameters were measured in the laboratory using a Spectrophotometer UV-2550 SHIMADZU. Following the determinations, the data obtained will be processed to calculate a pollution index for establishment of water quality status on the studied sections. The University "Dunărea de Jos" from Galati (UGAL) will use Water Quality Index (WQI), a very useful and efficient method for assessing the suitability of water quality, a dimensionless number that combines multiple water-quality factors (all chemical indicators) into a single number, through which the river section studied falls in quality classes.

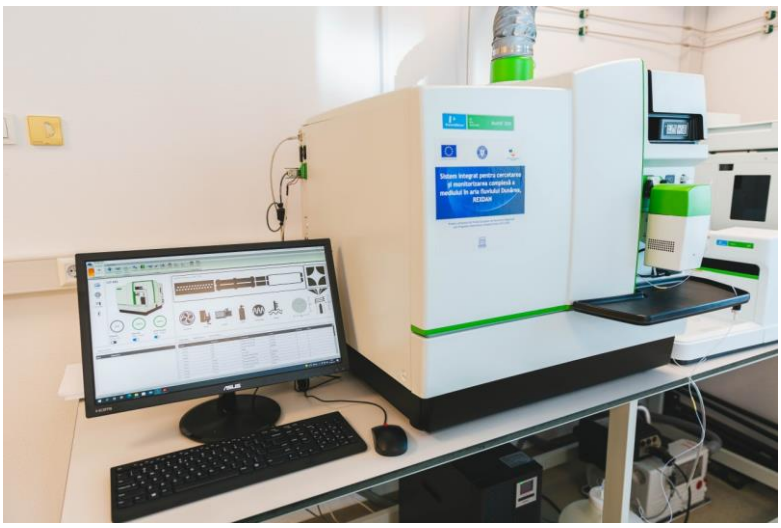
Determination of certain organic pollutants and determination of certain substances, respectively six parameters from the IARC LIST, with oncogenic risk for the human population

The International Agency for Research on Cancer (IARC) have devised a system of categories to evaluate the carcinogenicity of an agent to humans. An agent is classified based on scientific evidence derived from human and experimental animal studies and from mechanistic and other relevant data. The list of categories and their definition are shown **here**.

Considering that the main beneficiary of the ecosystem services in the riparian areas of the 3 rivers (Danube, Siret, Prut) is the local population, within this activity will identify and quantify a series of 6 contaminants (Aluminium, Arsenic, Beryllium, Cadmium, Chromium and Phosphate) with oncogenic risk and transfer capacity to the upper links of the trophic chain, respectively to humans, endangering their health.

Selected contaminants are part of Group 1 of the International Agency for Cancer Research (IARC) list and are considered carcinogens for humans and beyond. Starting from the assumption that the transfer of the contaminants to be monitored would lead to a gradual propagation of the toxic effect, the sampling will be carried out periodically from surface water, sediment and aquatic vegetation from representative points located on the three mentioned rivers. At the same time, sampling of fishery material from commercially exploited fish species from the studied area, which will be taken from fishing areas or from local markets, will also be made. Both, the sampling phase and the laboratory analyses will be performed using standardized methods using high performance equipment.

ICP-MS Nexion 2000C, PerkinElmer, used for the Aluminium, Arsenic, Beryllium, Cadmium, Chromium and Phosphate determinations ⟶



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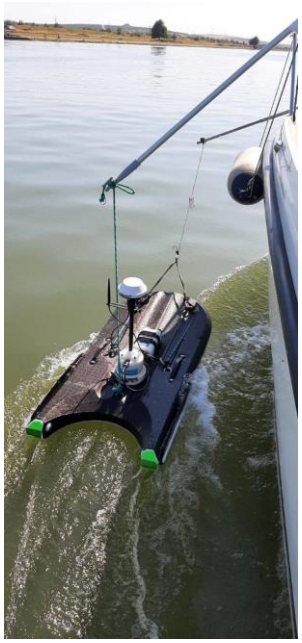
Use of GIS technologies in mapping of polluted sites studied within the project

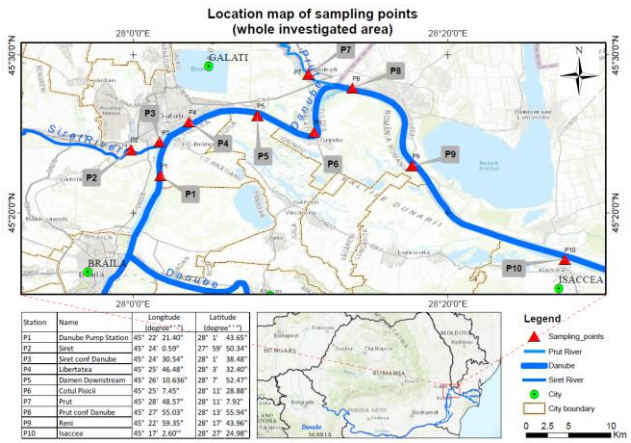
The main purpose of this activity is the need to identify and define the limits as accurately as possible of the vulnerable and potentially vulnerable areas. To determine areas of pollution or areas affected by pollutants, a series of digital databases are used, consisting of existing maps and plans, orthophoto maps in study areas, satellite images or other available digital sources. Their use will serve as a basis for the development of pollution maps. These will also be used in the office preparation step by establishing the geospatial position of water samples. Collecting raw data in the field is a complex process, that needs to consider a range of factors, ex. information availability or accepted error.

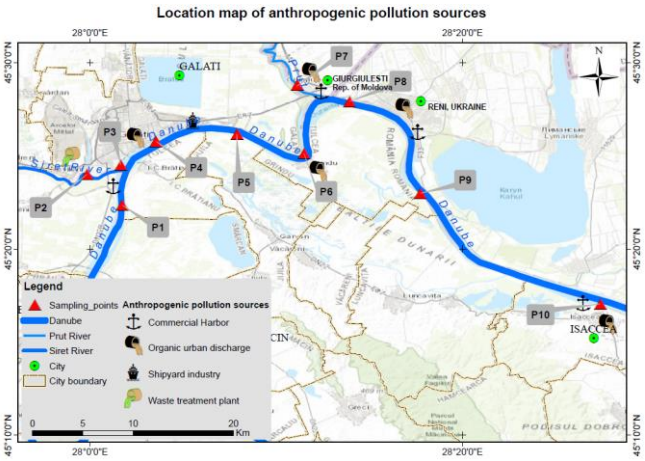
Topo-bathymetric surveying was done by GPS measurements combined with single beam echo sounder for depth determination. All equipment required for water sampling is available at the "European Center of Excellence for the Environment" laboratory, from our UGAL university.



Following, the collected geospatial points of water sampling will be exported and processed in a CAD or GIS software, depending on surveying results. These will be transformed into GIS databases with a permanent update throughout the duration of the project.

For a better understanding and visualization of the experimental data obtained from the processing step, several pollution maps have been created. The maps are be designed with the help of specialized GIS software, like ArcGIS developed by ESRI, for a better organization of the results obtained by eliminating deduction in data storage. Thus, using a GIS program will facilitate the permanent update of new experimental data from different stages of the project. In the current implementation period, a sampling points map and a map of anthropogenic pollution sources were created within the project.





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"The European Union is made up of 28 Member States who have decided to gradually link together their knowhow, resources and destinies. Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms. The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders".