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Project code: **ROMD00586**

Financing contract no. **109279/27.05.2025**

Beneficiary: Moldova State University

Project title: **Pilot Project for Environmentally Friendly Algal Biomass Production for Fish Nutrition - Algae4FishRo-Md**

Reports on the determination of the physicochemical parameters of the water in RAS-I (first)

Introduction

Within the project Pilot project for the production of ecological algae biomass for fish nutrition – Algae4FishRo-Md, Code: ROMD00586, financing contract no. 109279/27.05.2025, and as part of the activity "A1.1", work package "Recycling of wastewater from RAS using the algae system and introducing algal biomass into fish feed", physical water samples were collected for initial analysis, necessary for the preparation of the first reports on the determination of analytical parameters. Subsequently, after a certain period, new samples were taken for monitoring analysis. Water samples were collected for the determination of initial parameters. Certain parameters were analyzed by LP1 (pH, dissolved oxygen (DO), temperature, nitrogen and phosphorus compounds, alkalinity, heavy metals and trace elements), others by PP2 (total dissolved substances – TDS, carbon dioxide, dissolved CO₂, turbidity, analysis and occurrence of parameters and organic parameters) functionality of the study needs.

For the cultivation of algae, as well as other aquatic plant organisms, it is imperative to ensure the adequate supply of nutrients. Nutrients constitute the material and vital basis of the existence of algae, being indispensable for the metabolic processes carried out at the cellular level and for the formation of the structural components of the cell. It is known that wastewater from recirculating fish farming systems contains biogenic elements, microelements and other substances that can be exploited by using them as a nutrient medium for algae. However, the direct use of these waters in algae cultivation necessarily involves the preliminary determination of the concentrations of the main water quality parameters. This stage is necessary to establish the ways of optimizing nutrient media, both by reducing the concentration of some nutrients and by supplementing the medium with wastewater in optimal proportions.

Therefore, the first stage of the project consisted in carrying out a detailed analysis of the wastewater from the recirculating system, an evaluation that serves as a basis for planning subsequent algae cultivation experiments and for developing optimal nutritional solutions.

The project implementation team of the State University of Moldova performed the analysis of wastewater from the RAS system by determining the following parameters: pH, TDS, conductivity, dissolved CO₂, organic matter, temperature, and the content of trace elements/heavy metals (Cr, Cu, Pb, Ni) was determined jointly with the team of the lead project partner LP1.

Working method and equipment used

A potentiometer equipped with a pH electrode, model "Consort C933" was used to determine the pH. The TDS content was determined using the "Adwa AD 331" device. The dissolved CO₂ concentration was determined by the titrimetric method, using titration with 0.05 N hydrochloric acid.

The organic matter was determined by the gravimetric method, by burning the samples at a temperature of 550 °C. The water temperature was measured using an electrode with a temperature sensor. The content of trace elements (Cr, Cu, Pb, Ni, Mn) was determined spectrophotometrically, using the "UV-Vis T80+" spectrophotometer and using the high-resolution atomic absorption spectrometry with a graphite furnace electrothermal atomizer and an Argon 5.0 high-purity ion carrier, employing a ContrAA 600 spectrometer.

The mathematical processing of the results was carried out by calculating the arithmetic mean and standard error, using the Microsoft Excel program.

Results obtained

The analyzed wastewater was collected from the sewage system, coming directly from the fish farming ponds, before reaching the wastewater treatment plant. The results of the determinations for the analyzed parameters are presented in Table 1-5.

Tab. 1. Initial analysis of pH, t, TDS and conductivity values of wastewater from the RAS system used as a medium for algae cultivation

Algae species researched							
<i>Spirulina platensis</i>				<i>Chlorella vulgaris</i>			
pH	T, °C	TDS, g/l	Conductiviti, µs/cm	pH	T, °C	TDS, g/l	Conductiviti, µs/cm
7,85±0,01	21,0±0,01	0,48±0,02	960,10±4,50	8,01±0,01	21,0±0,01	0,47±0,01	961,10±2,40

Tab. 2. Initial analysis of dissolved CO₂, turbidity and organic matter values of wastewater from the RAS system used as a medium for algae cultivation

Algae species researched					
<i>Spirulina platensis</i>			<i>Chlorella vulgaris</i>		
Dissolved CO ₂ , mg/l	Turbidity, NTU	Organic matter, mg/l	Dissolved CO ₂ , mg/l	Turbidity, NTU	Organic matter, mg/l
30,00±0,14	20,10±0,01	80,01±0,10	30,15±0,14	21,20±0,02	80,45±0,11

Tab 3. Initial analysis of trace element values of wastewater from the RAS system used as a medium for algae cultivation

Algae species researched							
<i>Spirulina platensis</i>				<i>Chlorella vulgaris</i>			
Cr, μg/l	Cu, μg/l	Pb, μg/l	Ni, μg/l	Cr, μg/l	Cu, μg/l	Pb, μg/l	Ni, μg/l
0,138±0,012	110,71±2,10	3,00±01	29,3±0,01	0,138±0,012	110,71±2,10	0,00	3,28±0,01

The results of the measurements show that the wastewater from the RAS is characterized by weakly basic pH values, which is favorable for the cultivation of the *Chlorella vulgaris* species and less favorable for *Spirulina platensis*. The TDS content indicates a moderate amount of dissolved salts, which confirms that the water is not highly mineralized. The conductivity values correspond to an average mineralization, a fact also supported by the TDS results.

The recorded turbidity reflects a significant amount of suspended particles, specific to fish wastewater. As for organic matter, the values are relatively high, mainly due to food residues from fish food and their excretions. The content of trace elements has very low values, which indicates the absence of heavy metal pollution.

Correlating these results with the quality parameters determined by the project partner allows us to conclude that these waters can be used for the cultivation of *Chlorella vulgaris* and *Spirulina platensis* algae, provided that a method of optimizing nutrient media is applied, based on the partial substitution of the components of the nutrient medium with waste water. However, these waste waters cannot fully provide the necessary macro- and microelements for the development of algae, and it is necessary to supplement them with mineral salts added to the culture medium.

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