Мікробіота і біотопи водних екосистем // Microbiota and biotopes of aquatic ecosystems

Microbiological analysis of activated sludge from the Reghin sewage treatment plant, Romania

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Water pollution comes from all sectors of human activity (industrial, agricultural, etc.) and is not only caused by human and natural residues, but also by synthetic substances produced by chemical industries such as dyes, fertilizers, pesticides, radioactive materials, metals, etc. and also various pathogens.

The main purpose of this study is to present and identify microorganisms found in activated sludge, in the stage of biological water treatment, from the treatment plant of the Reghin city, Mureș county; and a secondary aim is to emphasize how important the presence of wastewater treatment techniques is.

The final results for the quality indicator of the activated sludge obtained are approximately around the value of 6 (sample 1=6.181; sample 2=6.384; sample 3=6.465). This aspect indicates the high quality class of the activated sludge used at the Reghin Wastewater Treatment Plant. This sludge belongs to the 2nd quality class, having a stable microbial load and it also exhibits good performance in wastewater treatment processes.

Microbiological component of water – an indicator of its quality and purity

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The microbiological component of water is a critical indicator of water quality and purity. Microorganisms inhabiting natural aquatic habitats can be divided into autochthonous (native) and allochthonous (non-native). For autochthonous species (e.g. Pseudomonas, Flavobacterium, Aeromonas and Alcaligenes in freshwater) water is the primary and natural habitat. They are important in the self-cleaning process of water as their metabolic processes are involved in the cycling of solutes in water. Allochthonous microorganisms, on the other hand, enter water as part of sewage, various wastes (e.g. coliforms, fecal streptococci, Bacillus, Clostridium, Thiothrixa, Thiobacillus), or by leaching from soil (e.g. Azotobacter, Nitrosomonas, Nitrobacter). Many of these allochthonous microorganisms are significant pathogens and thus may ultimately pose a significant risk to humans. The most important pathogens that can occur in drinking water include bacteria, viruses and parasites. Their presence in drinking water can cause a variety of illnesses, ranging from mild gastrointestinal infections to serious diseases such as cholera or hepatitis A.

There are several ways in which the microbiological component of water can be tested. The most common are tests for bacteria, which involve culturing the microorganisms on solid media (also used to determine the number of CFU/ml of the water sample), detection by PCR (polymerase chain reaction), or even immunological tests. Various water quality indicators, such as the presence of coliform bacteria, which are indicators of the presence of faecal contamination, are often used in testing.

The microbiological component of water is an important factor in determining its quality and purity and should therefore be tested regularly. Proper testing and monitoring can prevent the spread of disease and ensure safe drinking water for humans.

Increasing health literacy is crucial for a healthy society therefore education in the field of microbiology is an essential part of the educational standards of the present time. Currently in Slovakia, the time allocation for topics related to the "world of microbes" is limited to a few teaching hours at lower and upper secondary education. From this point of view, it is necessary to gradually introduce activities aimed at the development of knowledge and skills in the field of microbiology so that students have more opportunities to develop key competencies that are closely related to this topic. There is opportunity for teacher´screativity to implement the microbiology in the context of other topics taught in the Biology subject. Of course, the preparation of teachers and the analysis of standards is time-consuming, so it seems necessary to make available methodological materials that would be easy to implement in practice.

Cyanobacteria as potential biofertilizer?

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Cyanobacteria, widespread microorganisms capable of carrying out oxygenic photosynthesis, have played a crucial role in the evolution of life on Earth, being among the oldest living beings. As primary producers in various habitats, their photoxygenic capability is vital for the development and survival of other life forms, even in extreme environmental conditions [4]. To adapt to biotic and abiotic stress, cyanobacteria have evolved diverse features, resulting in different taxa with varying morphologies and biochemical and physiological capabilities. Many species can fix atmospheric nitrogen, while certain strains can produce bioactive compounds, including potent toxins known as cyanotoxins. These characteristics give cyanobacteria both positive and negative impacts on the environment and human activities [2].

The present study aims to investigate the potential utilization of cyanobacteria as a sustainable biofertilizer in agriculture. Through the characterization of selected cyanobacteria and the evaluation of their biological activity, as well as the examination of their impacts on plant growth and development, we aim to demonstrate their ability to enhance soil nutrients and improve soil structure. Moreover, the application of cyanobacteria as biofertilizers has the potential to decrease dependence on chemical fertilizers, thereby promoting a more sustainable agricultural approach. This study provides valuable insights into the prospects of cyanobacteria as an alternative source of fertilizers, thereby unlocking new potentialfor research in the field of biofertilizers [5].

Within the studied region, heightened concentrations of heavy metals have been observed, resulting from either atmospheric migration or deposition from nearby mountain ranges. The primary risk elements identified include chromium (Cr), nickel (Ni), mercury (Hg), and arsenic (As). Intensive agricultural practices in the monitored area have caused a localized increase in the concentrations of specific risk elements beyond their reference values, indicating slight elevations. The elevated concentrations encompass cadmium (Cd) and nickel (Ni), likely attributed to phosphate fertilization, as well as copper (Cu) and zinc (Zn) [2]. These findings underscore the significance of exploring alternative fertilization approaches, such as the utilization of cyanobacteria, which not only offer the potential for sustainable nutrient enrichment but also help mitigate the risks associated with heavy metal accumulation in agricultural soils. By reducing reliance on chemical fertilizers, the application of cyanobacteria as biofertilizers presents a promising source for advancing sustainable agricultural practices. This study emphasizes the necessity for further research in the realm of biofertilizers, aiming to optimize their application techniques and maximize their positive impact on soil quality and crop production [1].