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OPTIMIZATION OF TECHNOLOGICAL SCHEME OF A SMALL BIOLOGICAL TREATMENT PLANT

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Introduction

In the Republic of Moldova from 2005 to nowadays, the service providers for the design and construction of small treatment plants for rural areas (classic technology, with cyclic bioreactors, with MBBR (Moving Bed Biofilm Reactor) type reactors) offer just maintenance services and not ones for analysis during the warranty period (maximum 24 months).

The WWTP of the Municipal Enterprise "Apa-Canal" Magdacesti, a small biological treatment plant of type MBBR was designed and built for the treatment of domestic wastewater, coming from the households of the inhabitants of the Magdacesti commune. Under real operating conditions, there are often a number of factors that seriously affect the technological process, resulting in the discharge into natural reservoir of effluent with a low degree of purification, including: reduction of the effective surface of biofilms due to uncontrolled filling losses, wear and clogging, reduction of aeration intensity, decrease of aerated layer height, increase of water velocity through interlamellar spaces, oscillations of base index values, change in the composition of organic pollutants, etc. The performance of MBBR depends on the percent of media provided in the reactor, surface area of the biocarrier, dissolved oxygen and the organic loading. All these factors, but also other complementary, led to a decreased efficiency of the process.

This paper aimed to propose the technological solutions for a more efficient operation of the Magdacesti biological treatment plant in order to increase its treatment potential. The recommendations for the intensification of biological treatment by introducing the anaerobic pre-treatment process and the integration in the aerobic process of the "Integrated Fixed-Film Activated Sludge" technology have been carried out.

Results and conclusions

As a result of the investigations and inspection, some causes of the reduction of wastewater treatment degree were found, among which: the deregulation of the technological process of biological treatment as a result of changes in the nature of wastewater and water discharges of the piston type with high load of specific industrial pollutants, the source being the LLC Blue Shark Fish Processing Company "Fish Ocean". The discharge into the communal sewerage network of industrial waters without a proper prior treatment destabilizes the technological process of biological treatment.

As the biological treatment by the aerobic method does not support shocks of high pollutant amounts, it is necessary to include in the stream at the entrance to the WWTP a buffer tank with an anaerobic regime. The process will become much more stable even at increased concentrations of pollutants, with a CODCr of over 2000 mgO/L and thus will reduce the load on the aerated area. At the same time, the quantity of biological film carriers (biofilms), which are the main agent in the oxidation of biodegradable substances, must be brought in accordance with the quantities of pollutants. The capacity of the aerobic reactor in WWTP Magdacesti, being measured by the author, is about 36 m^3, while the volume of the biological film carriers could be completed up to 80% of the reactor volume, i.e. at 29 m^3. Thus, the oxidation capacity will increase at this plant, ensuring the intensity of the process in accordance with to the method of calculation.

The technological process at WWTP Magdacesti must be hybridized as well by recycling the activated sludge from the sedimentation area of the secondary decanter in the aerobic reactor, a process typical for the IFAS (Integrated Fixed Activated Sludge) technology. As a final goal, a technological treatment scheme should be developed by consecutively combining anaerobic and aerobic processes, intensifying the sedimentation and oxidation of organic substances. During the inspection, the intoxication of the activated sludge recycled with Fe^{3+} ions, used in order to intensify the secondary sedimentation process, was also detected. The biomass flasks of activated sludge and biological film, possessing a developed surface, show the capacity of absorption and accumulation of heavy metals.

Technological solutions for a more efficient operation of the biological treatment plant of the municipal enterprise „Apa-Canal" Magdacesti are: (a) the temporary shutdown of the discharge of industrial wastewater from the economic operator for a period of at least one month, in order to monitor the development of the technological process of treatment only of wastewater, for which the station was provided; (b) construction of a buffer tank at the entrance to the treatment plant with an anaerobic technological pretreatment regime is required; (c) it is compulsory to fill the aerobic pool with biological film supports (biofilms) or other type up to 80% by volume; (d) concomitantly, the implementation of IFAS technology is essential; (e) it is also necessary to temporarily exclude the $FeCl_3$ solution from the activated sludge recycling process, the overdose of which is toxic to the sludge. After restoring the viability of the activated sludge, the optimal dose of $FeCl_3$, used to intensify the secondary sedimentation process, will be established; (f) in order to intensify the secondary sedimentation process in case of the volume deficit of the secondary decanter and the insufficient sedimentation time it is necessary to form the fluid jet in laminar regime, to reduce the sedimentation path of the activated sludge particles by completing the secondary decanter with cutting edge and the gaps between them of 50-100 mm.