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THE APPLICATION OF PERMANENT MAGNETIC FIELD TO INTENSIFY TECHNOLOGICAL PROCESSES OF SLUDGE TREATMENT.

The sewage treatment plant in Braniewo was built on the site of an old one, remembering pre-WWII times. The new facility, with a designed capacity of 12 000 m3 / d, was opened in 1996.

The resulting sediments are directed to processing. The sludge treatment in our plant consists of aerobic sludge digestion, sludge conditioning by polyelectrolyte, press dehydration and removal to the municipal landfill. That division of the plant generates considerable costs in relation to the mechanical-biological treatment. Energy intensive sediment transformation, purchase of flocculant, transportation and storage charges lead to the constant search of the methods that may optimize (lower) these expenditures. One of such methods is to assist the technological process with the use of a permanent magnetic field.

I have used for the conducted research the mono-polar energizers by MGI MUNDIMEX Poland. The simple design of this device, work with no need to supply energy from outside, lack of moving parts encourages its use. Assembly on existing installation, without any interference in it, is simple and fast. It gives a chance to find such a location of the Magnetizer, so that one can utilize to maximum its impact on the flowing medium. Its construction, based on permanent magnets, gives a possibility to use only two types of the Magnetizers: with positive or negative working magnetic field. The impact these fields exert on live organisms and chemical compounds, as it happens with the opposites, is diametrically different. These magnetic activators differ with the quantity of magnets used and the amount of induction. These sizes are selected regarding the cross-section (outside diameter, OD) of the existing installation and the flow speed.

After running a series of laboratory tests, confirming changes occurring in the magnetized water, I have selected and installed the Magnetizer on the installation of the bathing press. This has resulted in systematic removal of deposits that were lowering the diameter of holes in the press's belt. There have appeared brighter bands testifying of the de-calibrating or defective setting of the bathing jets. A set of bands scheduled for replacement due to systematic increase in hydration of the pressed residue has been already working six months, reaching the parameters of the new bands.

The application of the Magnetizer in the aerobic sludge digestion has confirmed the occurrence of desired effects. It turned out that applying a positive magnetic field for sediment conditioning causes inhibition in the decomposition of the organic matter, reduction of general phosphorus content in water above the sediment. There has been improvement in sedimentation of precipitate (sludge settling), the value of the chemical oxygen dependability (COD) has been reduced. In this case, the tank of aerobic sludge digestion behaves like the activated sludge chamber. Exposure of sediment to the negative magnetic field has brought about the opposite effects. There has been decrease of content of the organic matter. COD and general phosphorus have increased. The time of capillary suction (CST) has worsened. In our plant, the tank volume for crude sediment does not allow to carry stabilization process for longer than three days. For this reason, I have used for the carried tests a one-day aerobic sludge digestion. Using in this process the atmospheric oxygen submitted to magnetic activation deepens the described effects.

The conducted experiments with the use of MF (magnetic field) in the conditioning of sludge have been based on samples taken from the aerobic sludge digestion carried out earlier on. I have made CST measurements for all combinations, beginning with magnetic activation of sediment after stabilization, finishing with its conditioning with polyelectrolyte. I used the magnetized flocculant. From the obtained results a path has arisen showing the method of the Magnetizer application, which would guarantee the best results after the dehydration process. On the basis of the carried experiments, I have selected and installed Magnetizers in the process of sludge conditioning. The obtained hydration is placed in the range of 76 to 84% and depends on the proportion of the preliminary sediment to the excessive one. The usage of flocculant has decreased from 3.4 to 2.2 kg / t of dry matter.

By using the magnetization of pipes one can avoid depositing of struvite in them. This will cause a slight deterioration in the floc structure of the drained sediment. The proper Magnetizer selection in the station of polyelectrolyte mixing will cause significant improvement in the parameters of the hydrated sediment.

The carried study has confirmed the purpose of using the MF in the technology of sludge treatment. The used pipe cross-sections (OD) allow to use the Magnetizers, whose prices are located between one and several thousand Polish zlotys. Preliminary calculations have shown that one Polish zloty invested gave a six Polish zloty profit per year. Profit can grow in direct proportion to the size of a treatment plant. Technical advantages of the used Magnetizers and the obtained results, both economic and technological, fully compensate the carried out outlays.

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