

strategy could reduce energy consumption and did not affect the efficiency of biological wastewater treatment, even could increase the N removal process effectiveness.

Nowadays, the most important objective of the cost-effective WWTPs is to invent efficient and sufficient AOB-NOB control strategies. The results identified the following issues: removing the NOB bacteria from the system, growing and keeping the AOB bacteria in the system. Theoretically, the numerical ratio of AOB to NOB in a balanced nitrifying system should be 2:1 according to thermodynamics and electron-acceptor transfer which means that AOB should be the dominant bacteria in a nitrifying community. However, a disproportion in the ratios of AOB/NOB existed, from time to time, in floc and/or granular sludge as well as lab/pilot/full-scale experiments. In the lab/pilot tests of Mari et al. (2012), an elevated NOB/AOB ratio (3.0–4.0) was observed in an aerobic granular sludge. Ramdhani et al. (2013) investigated the nitrifying bacteria communities at two full-scale domestic WWTPs in South Africa: lower AOB/NOB ratios were detected, 1.0–1.5 in Kingsburgh WWTP and 0.8–1.0 in Darville WWTP. It suggests, that more investigation are needed in order to find the best growth rate balance between AOB/NOB using specific oxygen strategy enhance with mathematical model and computer simulations, which will be the task of this study.

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CONTAMINATION OF SURFACE WATERS BY HEALTH AFFECTING ENDOCRINE ACTIVE COMPOUNDS

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Currently, trace pollution, associated with the development of civilization and human activity, becomes increasingly prevalent in the natural environment. These are impurities such as: active pharmaceutical compounds – PhACs, residues of products used for personal hygiene (PCPs), artificial sweeteners – ASs, or endocrine active compounds, which can affect the functioning of endocrined chemicals in the body (EDCs). These compounds are biologically active and persistent as well as accumulated in the environment. As a result, the undesirable ecological phenomena caused by the said pollution, but also their strong impact on human health are being increasingly discussed.

In their daily lives, every person is exposed to phytoestrogens (isoflavones, lignans, kumestans), i.e. the substances of plant origin, the action of which on cells can be beneficial or harmful. Their presence has been indicated in numerous food products, among others in wheat, rice, soybean, cabbage, apples, coffee, carrots, garlic, potatoes, etc. Undoubtedly, however, a significant threat involves the pharmaceuticals introduced into the natural environment. The estrogens derived even from hormonal therapies are transported together with domestic and industrial wastewater, surface runoff as well as leachate from landfills to surface waters and then migrate to groundwater. This is because in wastewater treatment plants, only partial removal and accumulation in sewage sludge occurs, and the remaining quantity is fed into the receivers. There, they affect the hormonal changes of organisms, and then the human health, contributing to a variety of unwanted changes, including premature puberty of girls, developmental problems in boys, as well as disorders in deliberately used hormonal treatments. Another group of the described, dangerous compounds are the so-called xenoestrogens, i.e. compounds with activity similar to female hormones, which infiltrate into the environment in the form of numerous impurities released, among others, from plastics, food or cosmetics.

Endocrine-active compounds (ECDs) as well as their metabolites migrate in the environment and undergo changes. The first mention of the presence of pharmaceuticals in the environment appeared in 1976 in the United States, where the presence of clofibric acid at the level of 0.8-2.0 $\mu\text{g} / \text{l}$ in treated wastewater was reported. The presence of cardiac drugs and contraceptives was also shown in this medium. In 1998, the results of the monitoring of the state of rivers, streams and wastewater in Germany were published, showing the presence of numerous pharmaceuticals. However, for the Polish conditions, the first forecast literature reports on the occurrence of pharmaceuticals in the environment appeared in 2001, and they were published on the basis of the data on drug consumption.

The problem of the compounds entering the environment is enormous, as evidenced by world literature and the cited test results regarding the amount of determined substances in the treated wastewater discharged from wastewater treatment plants and in surface waters. This process has been described for years, and due to, among others the emergence of new synthetic substances on the market is being observed on the continuous development of the pharmaceutical, chemical and food industries. Thus, both now and in the coming years, new compounds and their derivatives, as well as metabolites of the afore-mentioned hormones and substances with similar effects on living organisms will be determined at once. However, importantly, there is still a lack of legal regulations regarding the levels of specific compounds both in the treated wastewater discharged to the receiver and in the treated water directed to the water supply network. Unfortunately, in the determination of trace amounts of EDCs (ppb or ppt) in environmental matrices, the preparation, extraction and purification of samples, as well as the selection of an appropriate analytical method for detecting low concentrations of analyte turn out to be problematic.

The study will also consider the effects of estrogens entering the environment, as well as their effects on the human health, and in particular the proper development of the male sex characteristics. For years, the representatives of medical sciences, health sciences and biologists held a discussion on this topic, during which it was noted that if the substances suspected of having estrogenic effects enter the body of the future mother (through the skin, tongue, digestive processes), they can disrupt the sexual development of the fetus. For a male child to develop, the male sex hormone must be activated at a certain point. Staying under the influence of high concentration of estrogens, which actively influence the change in the direction of further development of the embryo, the confused organism implements its basic program and the girl develops. Moreover, at the conference of the American Society for the Development of Science in San Francisco, it was emphasized that environmental pollution exerts a negative impact on human and animal organisms by derived products of female sex hormones decay, as well as a variety of chemical substances similar to estrogen. This probably leads, among others, to infertility and causes malignant tumors of male and female genital organs, genital malformations, obesity, endocrine dyshormonosis as well as behavioral changes.