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Mainstream partial nitrification-anammox process in domestic and municipal wastewater treatment in Russia

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Mainstream Partial Nitrification-Anammox (PN/A) process is at the peak of interest for providing sustainable nitrogen removal from domestic and municipal wastewater. The interactions among key microbial groups: Ammonium-oxidizing, nitrite-oxidizing, anammox, and heterotrophic bacteria are critically overviewed in a recent publication. Reactor design, flow pattern, carriers, oxic-anoxic conditions, pH, temperature are essential for an effective cooperation of key microbial groups. The principles of new PN/A technology and the design of full-scale prefabricated 100-1000 m³/day "BCH-ECOS" Wastewater Treatment Plants (WWTPS) were based on the results of microbiological studies and semi-pilot trials. The new technology involves chemically enhanced pretreatment of the mainstream for a significant part of carbon and phosphorus removal. The brush-shaped carrier is applied at all steps of biological treatment for microorganism's immobilization and biofilm formation. Wastewater with high ammonia concentration comes into the denitrification (first step), which also receives water that is high in nitrate and nitrite by means of recirculation from the aeration tank (second step). N₂ is produced by anammox and heterotrophic denitrifying bacteria in denitrificator. Three genera and new species of anammox-bacteria were detected in denitrificator biofilms. The quality of the treated water exceeds the requirements for discharging into water bodies. More than 20 "BCH-ECOS" plants are in operation in different regions of Russia since 2009. WWTP "Megapolis" (5000-100000 m³/day) is developed based on the new technology for municipal wastewater treatment. All WWTPS are isolated from the environment and keep a constant temperature.

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