

Wastewater Treatment Plant "CONTUS"[®]

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Abstract

Description of pre-fabricated waste water treatment unit of modular system "CONTUS"[®], which is in operation at the industrial enterprise since 2009. Sea transport container of ICC standard is used as a module for the treatment plant. MS "CONTUS"[®] WWTP depending on composition allows to achieve different required quality of effluent up to the level corresponding to the limited allowed concentrations of water bodies suited for fishery. Treatment process includes biological treatment methods by suspended and immobilized microflora, as well as "dry" biological filter for a tertiary treatment. Elements of different sizes, made from synthetic floating materials used as a carrier for immobilized microflora. Technological processes and constructive elements are patented. Operation of MS "CONTUS"[®] confirms the high efficiency and reliability of its performance.

Keywords: Module system "CONTUS"[®], package treatment plant, waste water, biological treatment, immobilized microflora, nitrogen compounds removal, synthetic foamed material, biological tertiary treatment, «dry» filter, nutrients, treatment standards.

Introduction

Growing amount of small towns and its' degree of improvement are leading to an inevitable increase of wastewater quantity. Lack of modern sewage and waste water treatment facilities may cause a serious threat of pollution to water bodies especially if small rivers, ponds and other small flow water bodies meant. The real situation is even worse as small towns may not usually have a full-size waste water treatment plant due to lack of relevant specialists and construction opportunities. It is widely recognized that the use of pre-manufactured waste water treatment plants with its' further adjustment in-situ may be a versatile solution to protect water bodies from pollution of discharges.

Approaches

Stricter legislation in the sense of values of discharge parameters create new challenges for manufacturers of waste water treatment plants as they have to make a significant improve of efficiency of facilities they produce. This article contains authors' experience of elaboration and operation of wastewater treatment plant at the basis of module

system (MS) "CONTUS". The elaboration of MS "CONTUS"[®] went through all necessary stages:

- scientific research of waste water treatment processes,
- testing of a pilot plant on real waste water;
- industrial testing with urban waste water.

Wastewater treatment plant MS "CONTUS"[®] (capacity of 35 m³/d) was originally installed at the industrial site of "Mosstroy-31" company in 2009. It was used for treatment of domestic wastewater from industrial buildings and small factory's dormitory. The treated wastewater is discharged into a nearby little brook.

All process tanks of MS "CONTUS"[®] are located in two sea containers ICC type. One container is used for biological wastewater treatment and consists of the following technological zones: anaerobic, aerobic, secondary clarifier, 2nd stage aerobic and additional settling tank, the second container includes two "dry" filters for after treatment. The aerobic zone is equipped with cords 15 mm in diameter, made of synthetic foamed material with closed cellular structure, which provide a large area for immobilization of microflora. In the 2nd stage aerobic zone there are media made of foamed polystyrene in pieces with a size of 30-50 mm. "Dry" filters are loaded with foamed polystyrene grains 3-5 mm in diameter.

Biological treatment is performed in the main block (1st container) to allow the reduction of the BOD to 9.5-11 mg/l (efficiency is 90%); COD to 61-74 mg/l; suspended solids to 4-16 mg/l; ammonium to 0.5-2.6 mg/l, i.e. effluent concentration does not exceed the level of indicators of recreational water use. Nitrate and nitrite concentration in effluent is 2.5-3.6 mg/l and 0.012 mg/l respectively, that is significantly below the requirements for recreational water use for both indicators. Calculation shows the reduction of total nitrogen for 60-65.4% after the plant, witnessing the implementation of processes of nitrification and denitrification.

During the biological treatment concentrations of other pollutants are also considerably reduced: detergents from 0.8 to 0.1 mg/l, oil products from 0.9 - 5.5 mg/l to 0.05 mg/l and fat - practically until the full withdrawal.

All pollutants in the effluent are additionally reduced by means of "dry" filter, e.g. BOD – to 1.4 mg/l (efficiency is about 70%), ammonium – to 0.1 mg/l, nitrite – to 0.07 mg/l, nitrate – to 0.8 mg/l (i. e. all inorganic forms of nitrogen). As

a result of the purification of nitrogen compounds on the filters are removed by 79.4%. Reduction of different forms of nitrogen indicates that nitrification and denitrification are carried out during filtration, although they both run in very diluted solutions. Evaluation of performance of the entire treatment process shows that removal of inorganic forms of nitrogen in the effluent reaches 93%, which is significantly higher than that of traditional biological treatment processes. Operation and maintenance of the treatment plant MS "CONTUS"® are conducted by technical personnel of the factory in accordance with accompanying technical documentation. There is still a possibility to contact the developers if needed. Service staff only visit a plant once a day for the inspection of equipment operation (pumps and blowers). Backwashing of "dry" filter is needed once a month, while the plant washing is performed once a year. Despite the lack of a special skills the personnel successfully performs the operation of the MS "CONTUS"® facility.

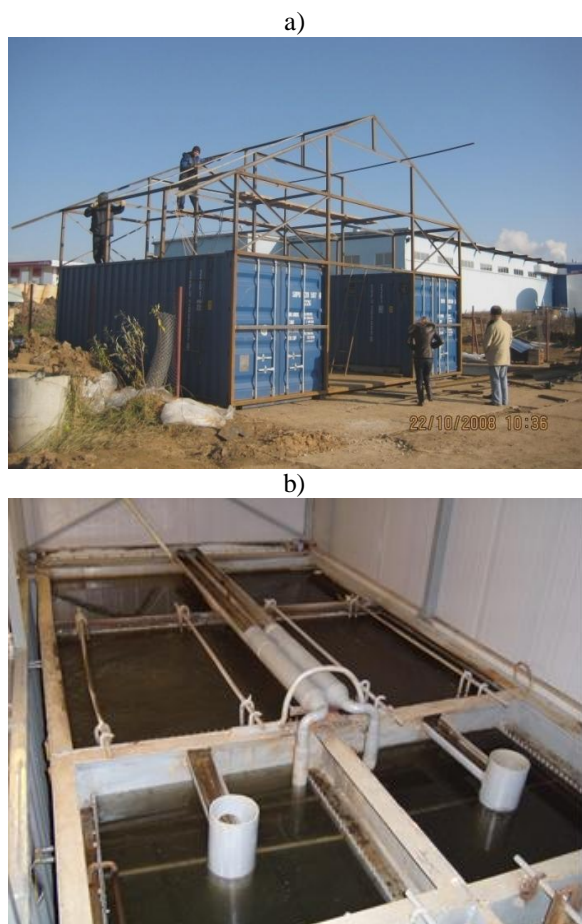


Fig. 1.a) In-situ installation; b) Biological treatment unit

Conclusions

1. Experience of development and implementation of MS "CONTUS"® facility shows that technological and technical solutions applied are flexible and efficient to ensure required quality of the effluent.

2. Six years' experience of operation of MS "CONTUS"® plant has shown that applied process provide the quality of treated water according to the requirements for discharge to water bodies of cultural and community purpose, and together with "dry" filters – to water bodies of fishery purposes.
3. Selection of synthetic media for immobilized microflora helped to avoid special regeneration and to minimize the required labor costs for operation and maintenance of the entire plant.
4. Technological processes and technological solutions applied in the MS "CONTUS"® plants allows to perform operation by staff with no special skills in the field of wastewater treatment. The availability of technical support by developers also helps to enhance the efficiency.

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