WASTE WATER TREATMENT IN COASTAL TOURISTIC AREAS USING STANDARIZED MODULAR BIOLOGICAL FILTRATION SMBF

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ABSTRACT

The selection of appropriate wastewater treatment technology for coastal tourist areas is an important engineering challenge. The local situation in coastal tourist cities and villages is characterized by important daily and seasonal fluctuations in hydraulic flow and pollution, high annual temperature variations, scarcity of building area and high housing density. In the same time coastal zones have to meet stringent effluent limits all over the year and need simple and easy technologies to operate.
This paper presents the innovative technology of standardized modular biofiltration SMBF as adapted solution for waste water treatment in sensitive coastal areas and demonstrates practical results of existing plants.
Keywords: waste water treatment, touristic areas, biofiltration

1. INTRODUCTION

Europe is surrounded by four marine spaces: the Mediterranean See, the Black Sea, the Baltic Sea and the Northeast Atlantic, which includes the North Sea. The length of the coast around the EU is about 68.0000 km. About 50% of the population of the EU lives less than 50 km far from the Seaside and 70 Mio people are living less than 500 m from the coast [1]. In the same time coastal areas are popular locations for holidays with the result that the population of coastal areas can multiply itself by many times depending on the season. This special situation in coastal tourist cities and villages leads to important daily and seasonal fluctuations in hydraulic flow and pollution connected with annual waste water temperature variations. In the same time coastal zones have to meet stringent effluent limits all over the year and need simple and easy technologies to operate. Scarcities of building area and high housing density also have to be taken into account when planning a waste water treatment station. Based on these specific situations the selection of appropriate wastewater treatment technology for coastal tourist areas is a major engineering challenge.
The applied waste water treatment technologies need to be adapted in terms of investment and operation costs. In the same time the treatment plants should be easy to operate, mostly automatic, modular and flexible for different hydraulic and organic loads.

2. STANDARDIZED MODULAR BIOFILTRATION SMBF

3.1 General aspects

The application of biofiltration in waste water treatment goes back to the beginning of the 1980s. Since that time, filtration technology has already been used successfully as the principal unit in the treatment of potable water in order to eliminate suspended solids.

The long term positive experience regarding the application of filtration in the treatment of potable water was transferred to waste water treatment. The aim was to achieve mechanical filtration and elimination of dissolved organic and inorganic pollutants, such as BOD and nitrogen in the same reactor.

In this respect, different technologies regarding the biological filtration of wastewater were developed, such as upflow and downflow filters including or excluding aeration, as well as different filtering media like floating or non-floating media. Long term practical experiences with numerous biofiltration plants in waste water treatment has shown that biofiltration with granular non floating media is currently considered to be the best and most reliable technology for waste water treatment [2].

Presently, more than 1.000 biofiltration plants are in operation worldwide in order to treat municipal and industrial waste water. In France about 50 municipal biofiltration plants are in operation since more than 20 years (see figure 1).

Figure 1: Examples of municipal biofiltration plants in France

The classical biofiltration technology has been developed in about 1980-85 mainly for medium to huge treatment plants like Colombes 900.000 PE (Person Equivalents), Marseille 1.500.000 PE or Toulouse 550.000 PE.

Based on the positive long term experiences with operated biofiltration plants a new innovative technology of SMBF as full indoor solution has been developed for small to medium waste water treatment plants with about 2.000 to 10.000 connected persons.

3.2 Presentation of SMBF technology

The principal function scheme of SMBF is portrayed in Figure 2. The waste water is pre-treated by coarse and fine screen followed by primary settlement. In order to equalize hydraulic and concentration variations the water is lead into an equalization tank. After equalization the water is lead to several independent units of aerated biofiltration tanks. Waste water cleaning is affected through biological activity and mechanical filtration. The clean water with low concentration of suspended solids of about 10 mg SS/L leaves the reactor at the top. A secondary clarifier is not necessary.

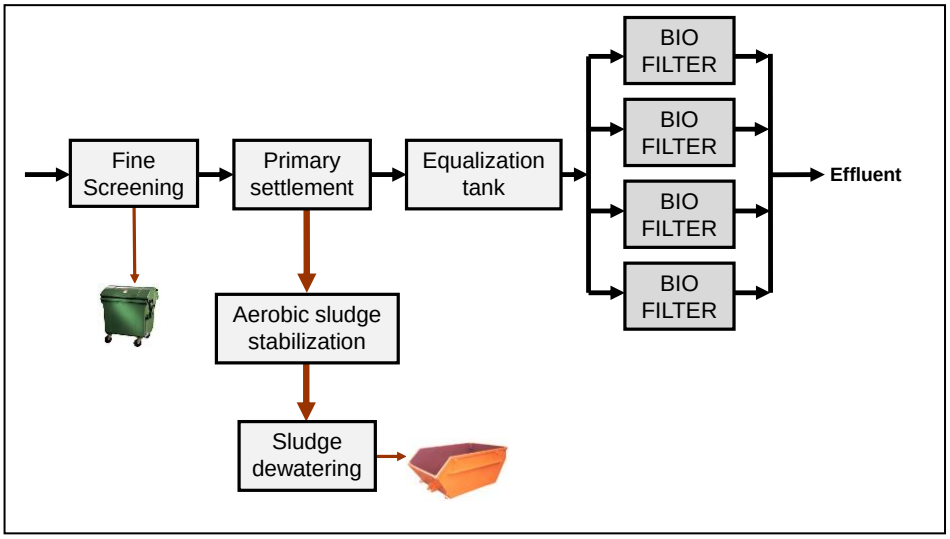

Figure 2: Scheme of Aerated Biological upflow Filtration SMBF

Each biofilter is operated as independent unit and can be stopped or operated at any time and according to actual needs. Like this an adapted operation of biofilter units during day and over the year is possible (see figure 3). In this manner low energy consumption and full results are achieved at any time.

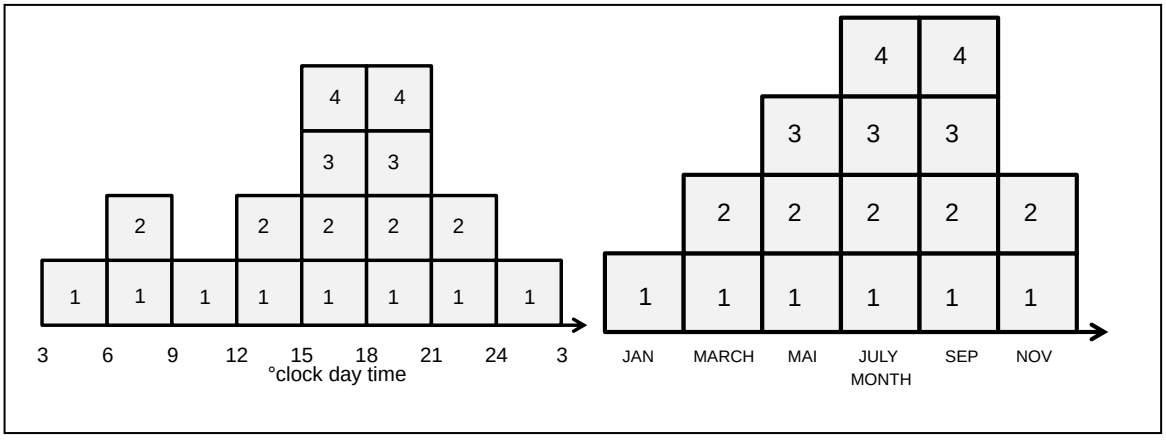

Figure 3: Adapted operation of biofilter units during day and year

3.3 Examples of SMBF treatment plants

The SMBF has considerable savings in volume and space. For example, the space required for a municipal sewage plant can be cut down to 25% compared to required space for activated sludge or SBR plants. The low space requirement for SMBF plants makes a fully covered in-house treatment plant economically possible. In this case the WWTP can also be constructed close or even inside villages and towns or inside tourist areas.

Figure 4: Example of SMBF plant in touristic site (5.000 PE)

3.4 Results

The treatment results of a municipal touristic SMBF plant during one year of operation are demonstrated in Figures 5 and 6. The results show that even with high concentrations and high variations in the inlet stable outlet concentrations in terms of total N and BOD are achieved. The outlet concentration for BOD is usually in the range between 10 and 15 mg BOD/L. The Tot-N concentration at the outlet is usually < 20 mg N/l.

Figure 6 shows the COD outlet concentration of several municipal SMBF plants as a function of COD volumetric load. Depending on the COD load, outlet concentrations in terms of COD in the range < 60 mg/l can be achieved.

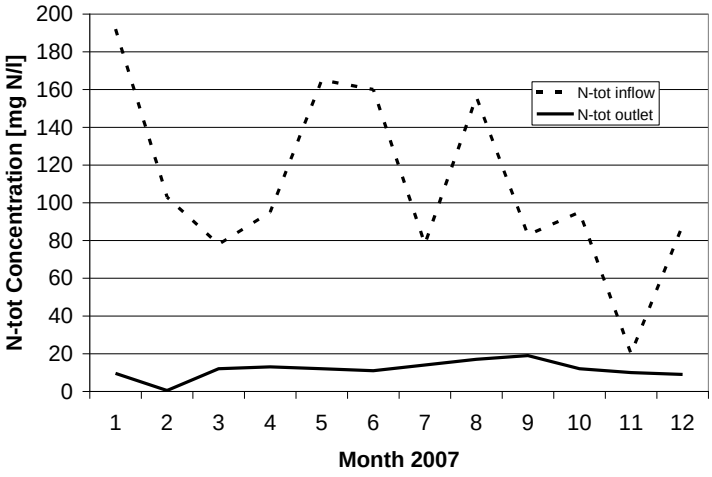

Figure 5: Tot-N in and outlet concentrations

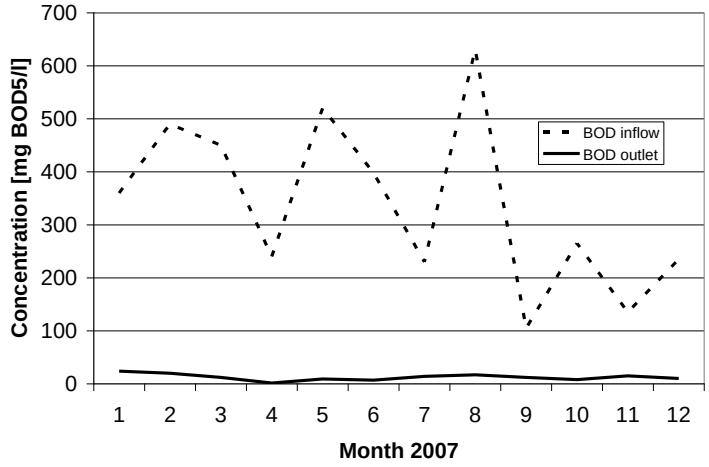

Figure 6: BOD in and outlet concentrations

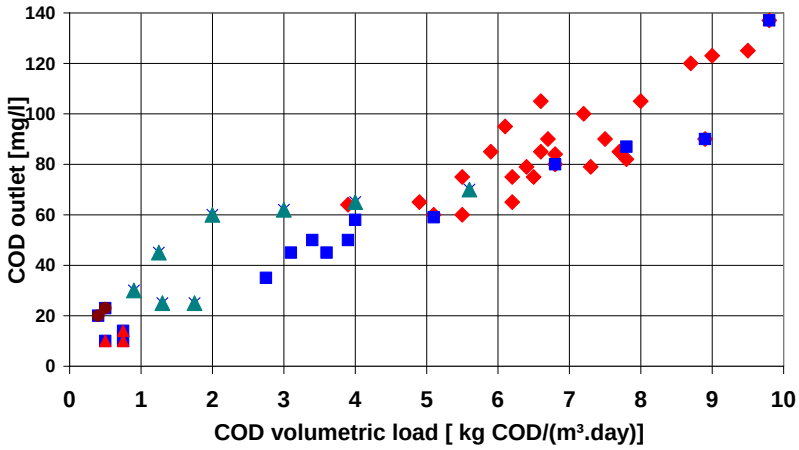

Figure 7: COD outlet as a function of COD volumetric load

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