# Biological Filtration as an alternative to classical activated sludge process in municipal wastewater treatment

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## 1. Introduction

Since the start-up of the first full scale biofiltration plant in the North of Paris in 1982 by DEGREMONT SA, Biological Aerated Filters (BAF) have been successfully implemented in more than 1.000 municipal wastewater treatment plants worldwide, treating the effluents from more than 50 million population equivalents.

Several different technologies are available today, although most of the plants have been built as up flow co-current aerated biological filters. Most stations are in sensitive or space-restricted areas on the coast, in mountains or in city centres. High advantages have also been shown for stations with annual or daily hydraulic or load fluctuations in the inlet waters. The optimisation of the technology over the past decades has led to significant cost savings, so that today BAF often has lower investment costs than conventional activated sludge systems.

Based on existing long term successful results, biofiltration today is officially approved by European and serval national water authorities like German DWA/ATV, French AFNOR and Romanian Ministry of Public Works. Biofiltration is also described and approved by European DIN EN 1085. Biofiltration technology is not patented and is supplied by various well-known manufacturers.

## 2. Biofiltration technology BAF

According to DIN EN 1085 (1997), biological filters are defined as “bio-film reactors with a fixed bed of granular material as filling in which filtration and biological degradation happen in combination”. Thus, the processes of biological wastewater treatment (degradation of carbon compounds, nitrification, and denitrification) and the filtration effects for the removal of suspended solids happen parallel in one and the same reactor.

Fine granular carrier material (maximum ø up to 8 mm) retains both the surplus sludge produced during the biological conversion processes and the suspended solids contained in the wastewater influent. This process technology allows to dispense with secondary clarification. The most important characteristic of biofilter plants is that the volumetric conversion

performances are up to 10 times higher than plants with suspended biomass can reach. This means that the demand for reactor volume and plant space is considerably lower which results in a correspondingly lower demand of reactor volume and plant space. Moreover, another advantage is the avoidance of bulking sludge.

Biofiltration is constructed in several modular cells. Each cell for example can treat the wastewater of 2.500 or 5.000 population equivalent depending on his dimensions and the total size of station. The space demand of biofiltration plants is about 20% compared with classical activated sludge stations (see figure 1). Based on his small footprint with low landscaping, less concrete needed and low energy consumption, BAF is efficient in terms of its use of energy and resources. The $CO_2$ Emissions are about 30% less than conventional technologies.

**Figure 1**: BAF Station with 10.000 PE in coastal area

Despite lower investment costs one of the main advantages are the significant lower energy consumption of BAF (see figure 2). Thanks to its modular design with several individual filters, it is possible to adapt the number of filters in operation to the actual momentary load of the wastewater treatment plant. As a result, the energy consumption of BAF stations is nearly a direct function of load: for example, 30% of load will create only 30% of energy consumption, whereas classical activated sludge plants will create still a very high energy consumption also at low loads.

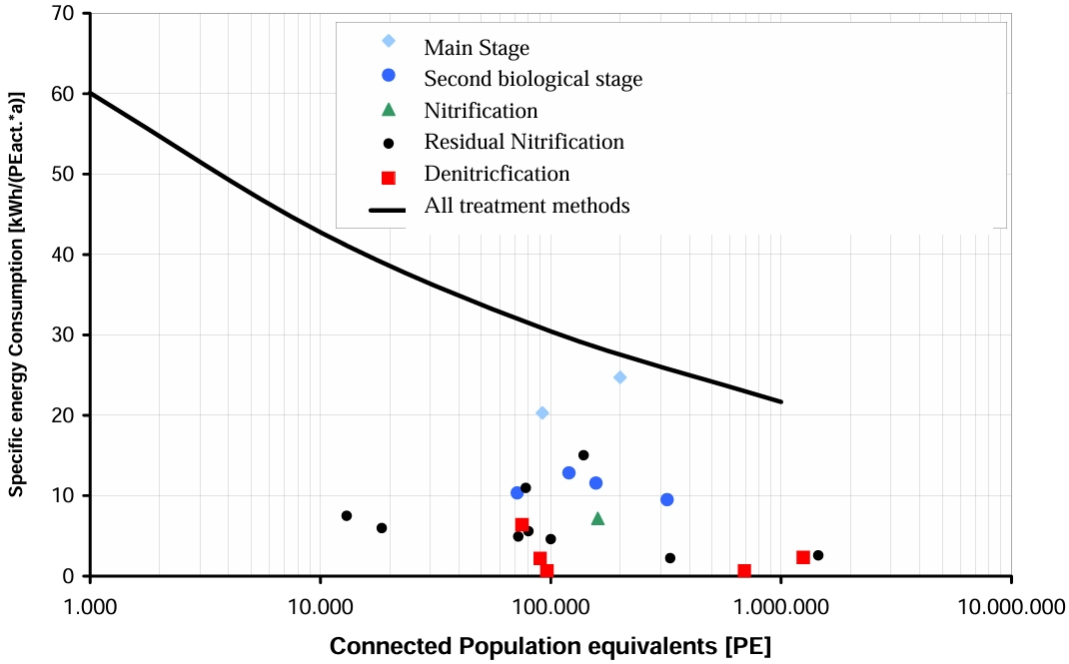


**Figure 2**: Energy consumption of Biofiltration versus Activated sludge [BARJENBRUCH, M.: Benchmarking of BAF Plants, 2007]

## 3. Summary

Biofiltration is implemented today in more than 1.000 municipal wastewater treatment stations with more than 30 years of successful operating experiences. BAF is approved by several national, European and international water authorities as official technology. BAF is not patented and can be realized by different companies.

The main advantages of BAF stations are lower investment costs, lower energy consumption and lower space requirement combined with less concrete consumption. Therefore, BAF technology is a sustainable and modern solution for municipal wastewater treatment and should be considered as an alternative to classical activated sludge processes for any new investment.

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