

## TRICKLING FILTER EFFICIENCY IN BOD REMOVAL. CASE STUDY.

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### Abstract

The Nacimiento WWTP has been studied during a 12 month period. Efficiency in BOD removal has been analyzed, in conditions of very low organic load. Results are compared with predictions of literature.

### Introduction

Nacimiento is a small town in the region of Andalusia, with waste water typically domestic. It had an ancient WWTP based on an anaerobic lagoon as primary treatment followed by peat filters which had become overflowed. In 2.008 DTD constructed an upgraded plant, to improve its efficiency.

The anaerobic pond was maintained as primary treatment and as secondary step was built a trickling filter and a clarifier. The biological sludge is recycled to the anaerobic step, for a long term stabilization. The peat filters were reutilized as drying beds, pumping to them the digested sludge from the bottom of the pond. This flow scheme has been suited very often in Andalusia, because of its energy low consumption and simplicity in management.

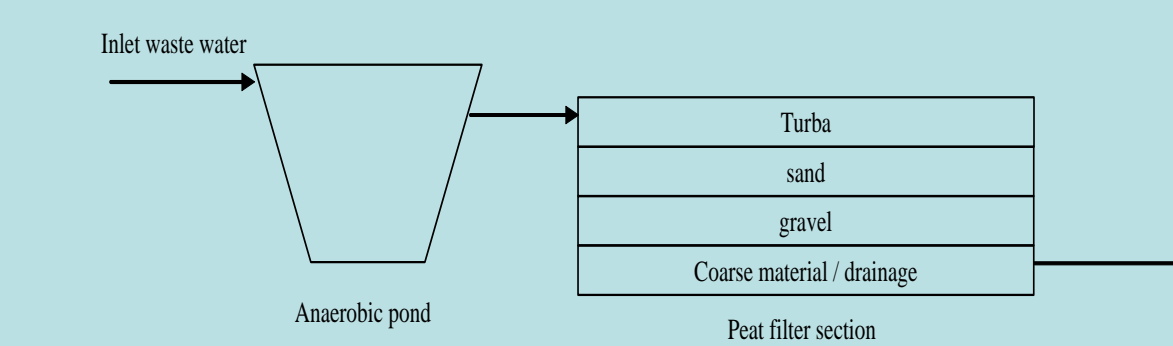


Figure 1.a Nacimiento previous flow scheme

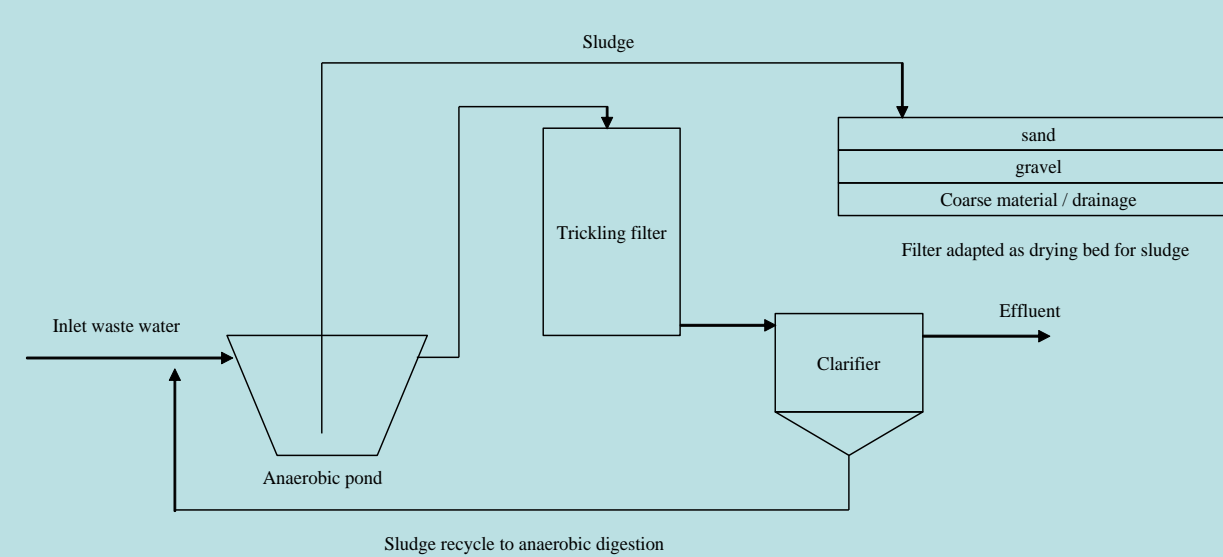


Figure 1.b Nacimiento modified flow scheme

After starting up the plant, DTD also managed it during two years. A lot of analytical data have been collected during this period, trying to know the real efficiency of the system and its capability to reach with guarantees the standards of the spanish regulation (TSS < 35 mg/L; BOD<sub>5</sub> < 25 mg/L)

### Methods

One sample was obtained monthly, during a year, in order to determine Total BOD<sub>5</sub>, Soluble BOD<sub>5</sub>, TSS, Total COD and Soluble COD along the process:

- Influent to anaerobic pond
- Effluent of anaerobic pond
- Effluent of trickling filter
- Effluent of clarifier

Samples were taken every three hours and composed in order to obtain a representative one.

### Results and discussion

The trickling filter is designed under the standard ATV [1]. The design organic load is 0,4 kg BOD<sub>5</sub>/m<sup>3</sup>/d. It was filled with plastic random media, with a specific surface of 120 m<sup>-1</sup>. A recirculation ratio of 1:1 was established.

The design hydraulic load in the clarifier was 0,5 m<sup>3</sup>/m<sup>2</sup>/h (average flow).

The efficiency of the anaerobic step has been extremely high, as is shown in figure 2, so the organic load in the filter has been lower than expected.

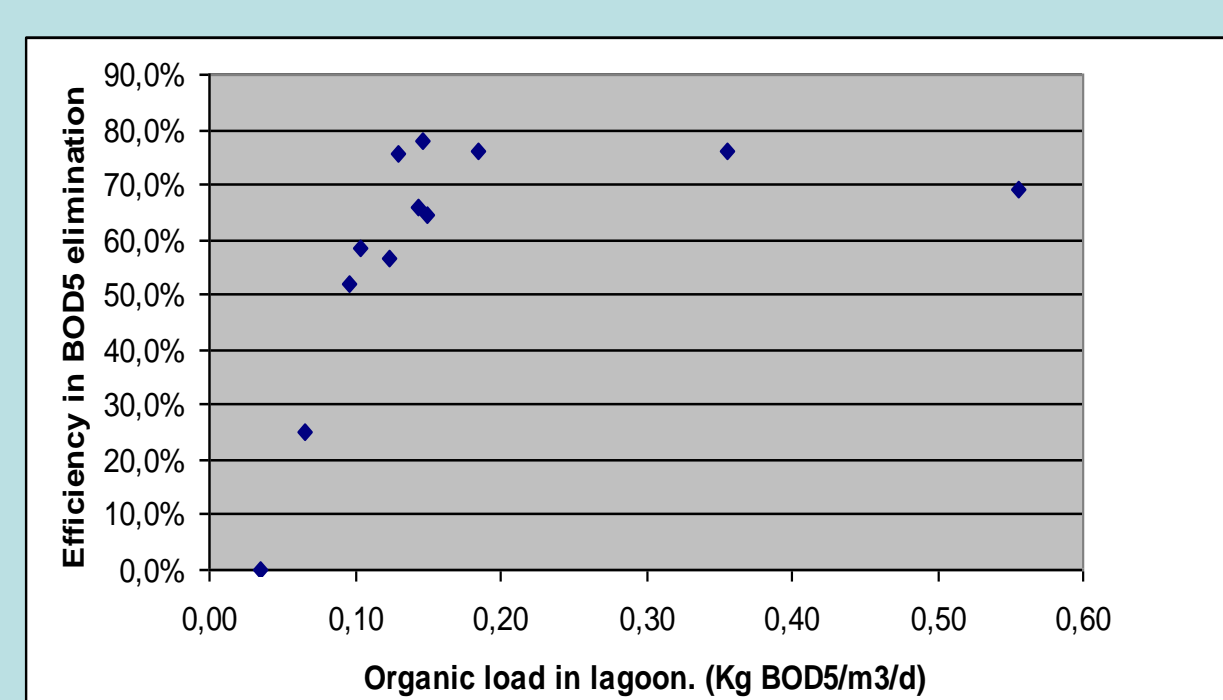


Figure 2

The efficiency in elimination of total BOD<sub>5</sub> in the filter + clarifier system is shown in figure 3.

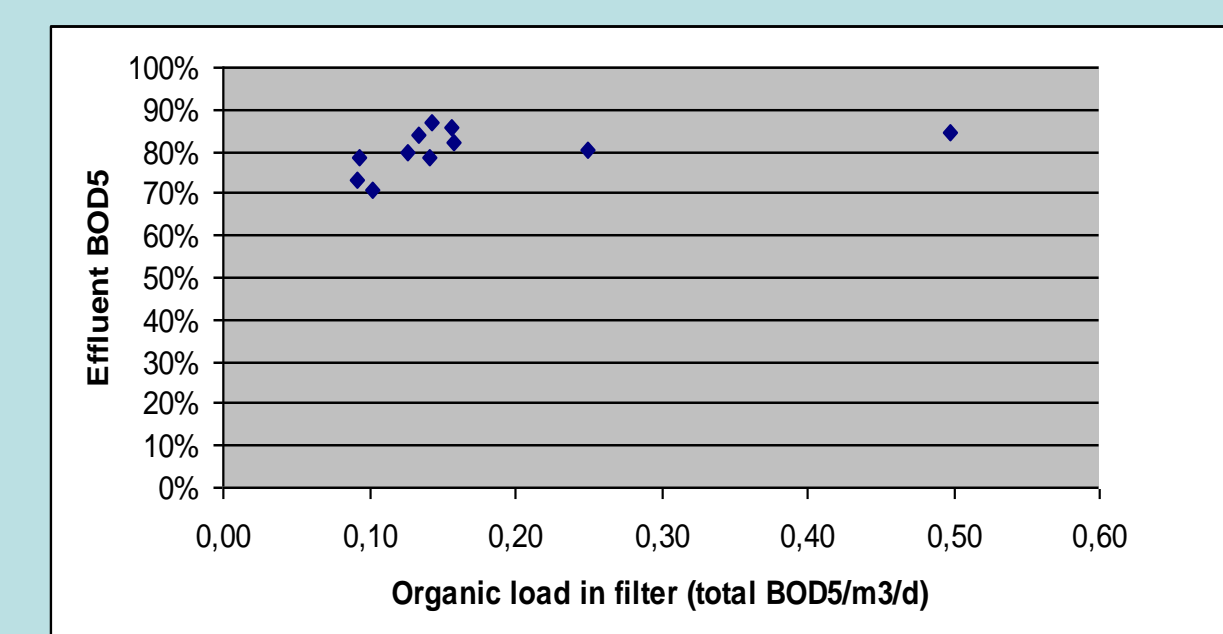


Figure 3

Total BOD<sub>5</sub> can be considered as addition of two terms:

- Soluble BOD<sub>5</sub>, which has not been degraded in the filter.
- BOD<sub>5</sub> associated to the effluent suspended solids. BOD associated to SS = K SS effluent

In figure 4, are plotted the values of soluble BOD<sub>5</sub> effluent. Only in two cases, values less than 10 mg/L are obtained.

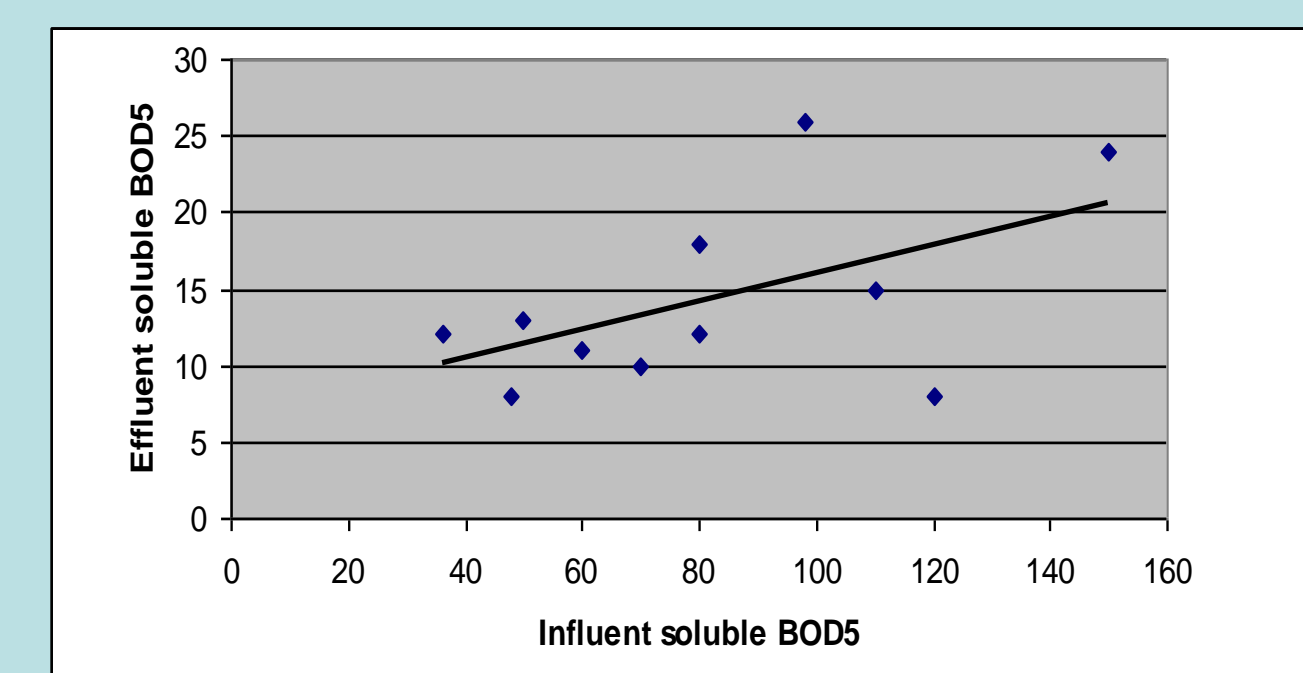


Figure 4

In figure 5, are represented the values of BOD<sub>5</sub> associated to effluent TSS. The line plotted correspond to a K value of 1,2 Kg SS/Kg BOD<sub>5</sub>.

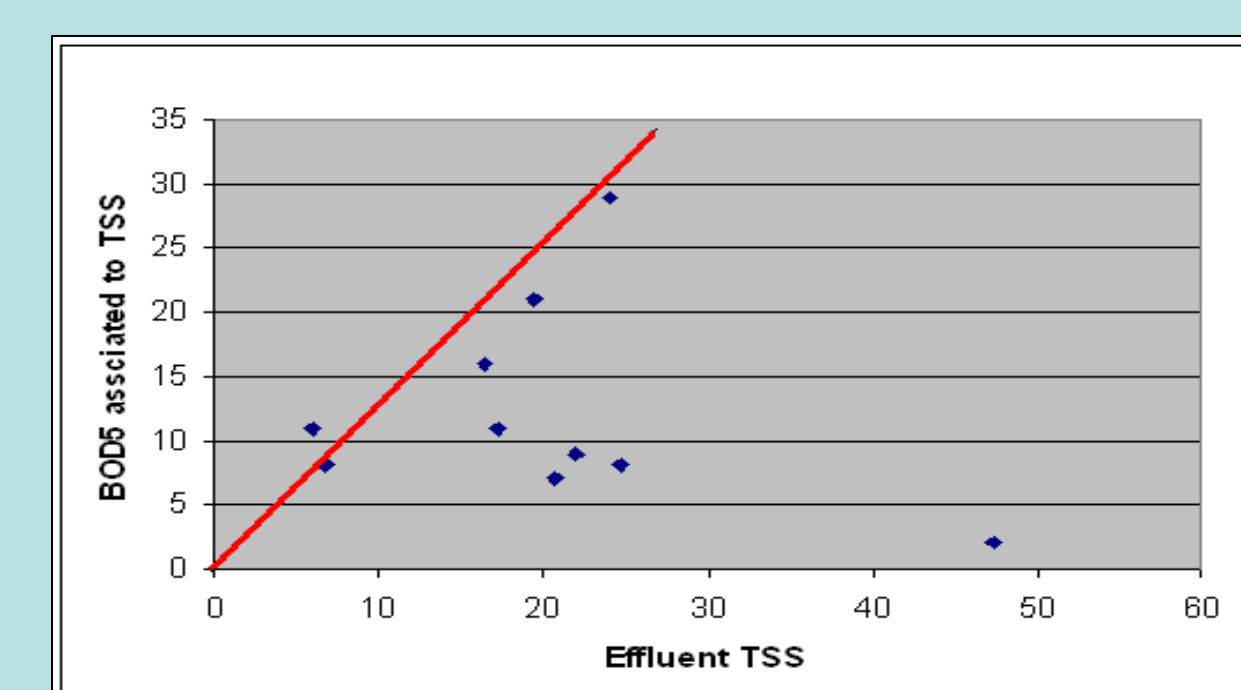


Figure 5

### Conclusions

For organic loads even lower than recommended by ATV standards, the elimination of organic matter in the trickling filter seems to reach a steady value of 75% – 85%. For the range of load studied, there is not inverse relationship between organic load and efficiency, as it was expected.

Even in ultra low load cases, filter effluent soluble BOD<sub>5</sub> is limited to 8 - 10 mg/L. This value can be associated with the non biodegradable organic matter. Other experiences should be necessary to check this limit.

The BOD associated to TSS of the effluent results higher than expected. In MOP 8 [2], values of k ranging from 0,2 to 0,9 are mentioned. According to the Nacimiento results, a value of 1,2 kg BOD<sub>5</sub> / kg TSS should be recommended in further designs. If this value is confirmed in other experiences, the key aspect in the management of these kinds of plants should be the final clarifier.

### References

- [1] ATV-DVWK-A 281 Dimensioning of trickling filters and rotating biological contactors
- [2] Design of municipal wastewater treatment plants. ASCE – WEF. page 12-8 Fourth edition.