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Sampling method effects of wastewater treatment system on removing rate calculation: influence of sample type

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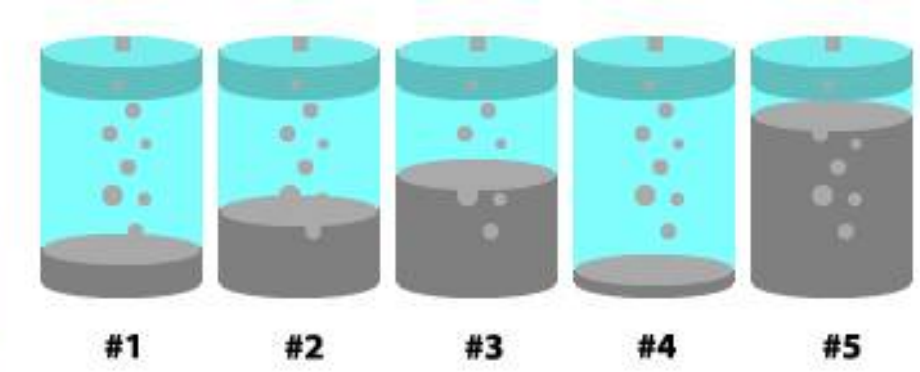
AN OLD AXION SAYS:

THE RESULT OF ANY ANALYTICAL DETERMINATION CAN NOT BE BETTER THAN THE SAMPLE ON WHICH IT IS MADE…

… BUT THE SAMPLE TAKEN COULD BE THE PROBLEM



CONCERNING THE SAMPLING IN SCIENTIFIC PAPERS

2.2. Water quality monitoring

The system treatment behaviour was examined through monthly monitoring of the influent and effluent quality between May and November 2005. Samples were analyzed for water quality parameters including temperature (T), dissolved oxygen (DO), pH and electrical conductivity (EC), which were all measured in situ, and 5-day biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), total suspended solids (TSS), total Kjeldahl nitrogen (TKN), total phosphorus (TP) and bacteriological parameters, mainly faecal coliforms (FC) and faecal streptococci (FS). Analyses were conducted in accordance with French standard methods for the examination of water and wastewater [16].

2.2. Samples and analyses

In order to evaluate the removal efficiency of the experimental plant samples of the influent (storage tank), primary treatments (settlers and HR-B reactor) and effluent (big wetlands) were taken (always at [illegible] and [illegible] am) 3–4 times per month from April 2007 to July 2008. Samples were analysed for pH, redox potential, turbidity, COD, TSS, ammonium and sulphates. In addition, from October 2007, BOD_5, dissolved COD, nitrites, nitrates, TKN and total phosphorus were also analysed approximately once a month. Redox potential values were corrected for the potential of the hydrogen electrode. Analyses were carried out following the methods described in APHA-AWWA-WPCF (2001). The results will be presented in concentration and mass per area unit, though removal efficiencies were only calculated in terms of areal mass removal. Differences between lines were statistically evaluated through the two-way (time and treatment) ANOVA (without replication) test using the software package SPSS 17.0.

? **Spot sample**
? **Time-integrated sample**
? **Flow-integrated sample**

STUDY OBJETIVES

Objetives:

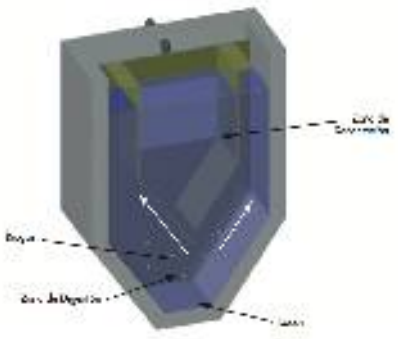
1.Evaluate the time of sampling influence on removal efficiencies calculation.

2.Study the differences between time-integrated and flow-integrated samples. Which one choose?.

3.Evaluate the right period of sampling for integrated samples.

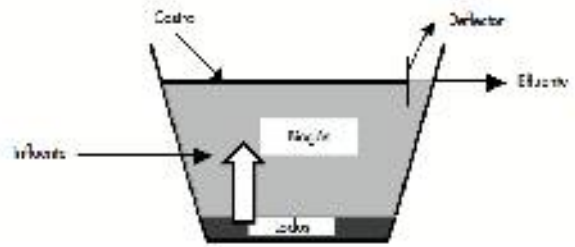
SYSTEM STUDIED

Afluent:
Carrión de los Céspedes (Spain) urban wastewater. (2500 PE)



Fuete: E. Ortega et al. *Manual para la implantación de sistemas de depuración en pequeñas poblaciones*. MARM.

IMHOFF TANK
4,00 x 2,02 x 3,72 m (43 m^3/day)



Fuete: E. Ortega et al. *Manual para la implantación de sistemas de depuración en pequeñas poblaciones*. MARM.

ANAEROBIC POND
7,00 x 7,00 x 4,50 m (50 m^3/day)

COD REMOVAL EFFICIENCY

10:00

Afluent:	Efluent Imhoff Tank:	Efluent Anaerobic Pond:
444 mg O_2/L	327 mg O_2/L	290 mg O_2/L
	26% removal efficiency	35% removal efficiency

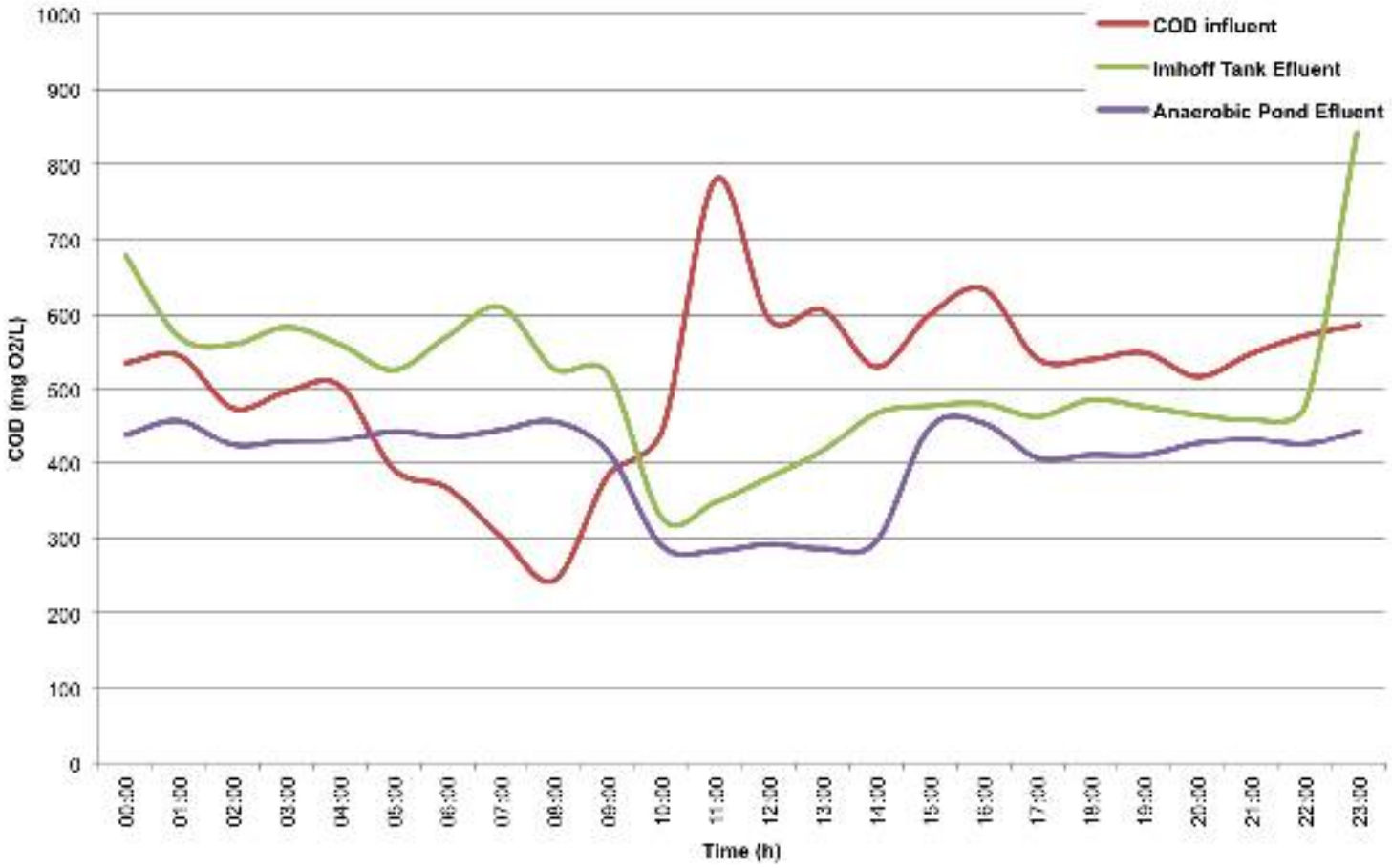
20:00

Afluent COD:	Efluent Imhoff Tank:	Efluent Anaerobic Pond:
517 mg O_2/L	466 mg O_2/L	427 mg O_2/L
	10% removal efficiency	17% removal efficiency

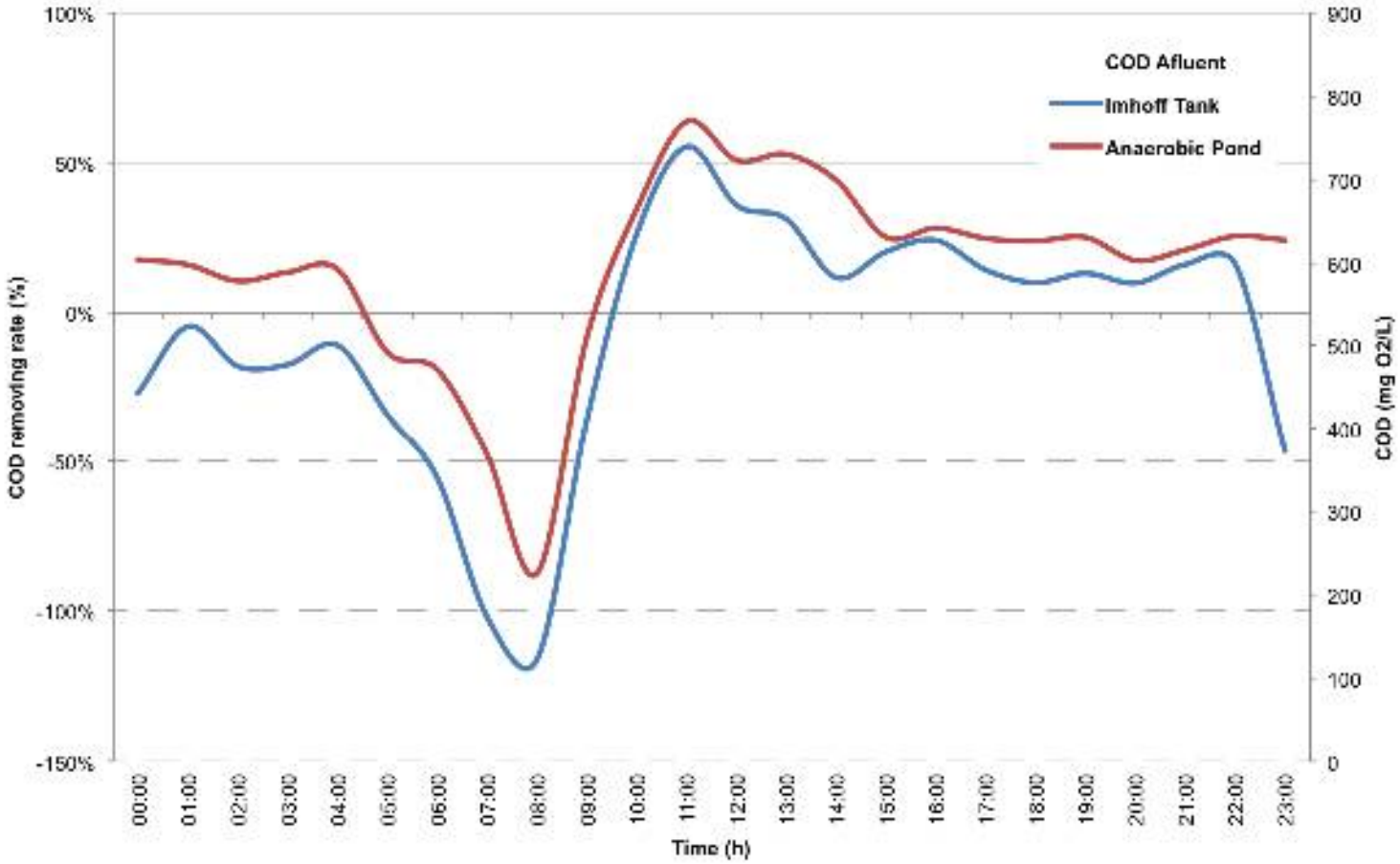
08:00

Afluent COD:	Efluent Imhoff Tank:	Efluent Anaerobic Pond:
244 mg O_2/L	527 mg O_2/L	457 mg O_2/L
	-116% removal efficiency	-87% removal efficiency

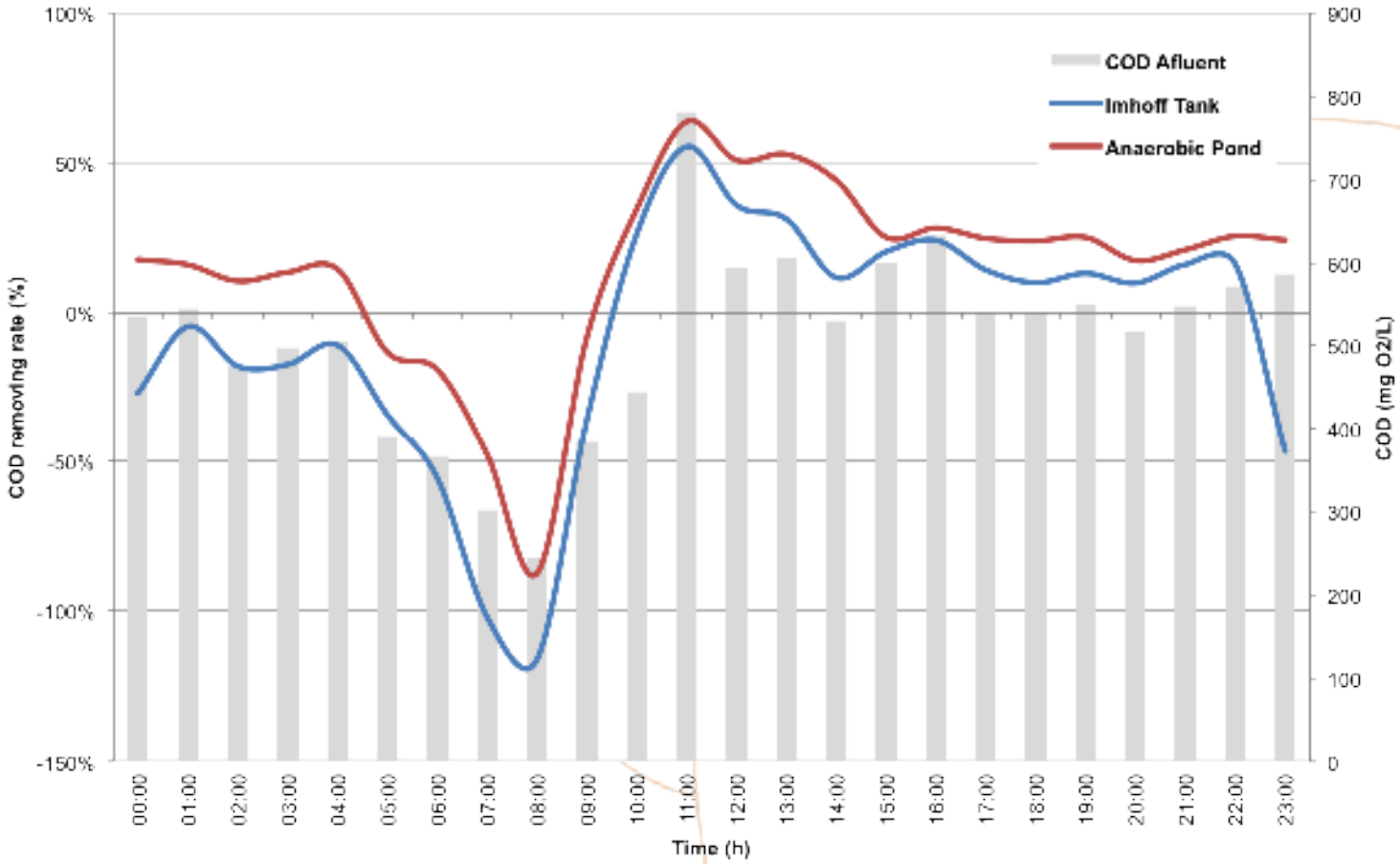
COD REMOVAL EFFICIENCY



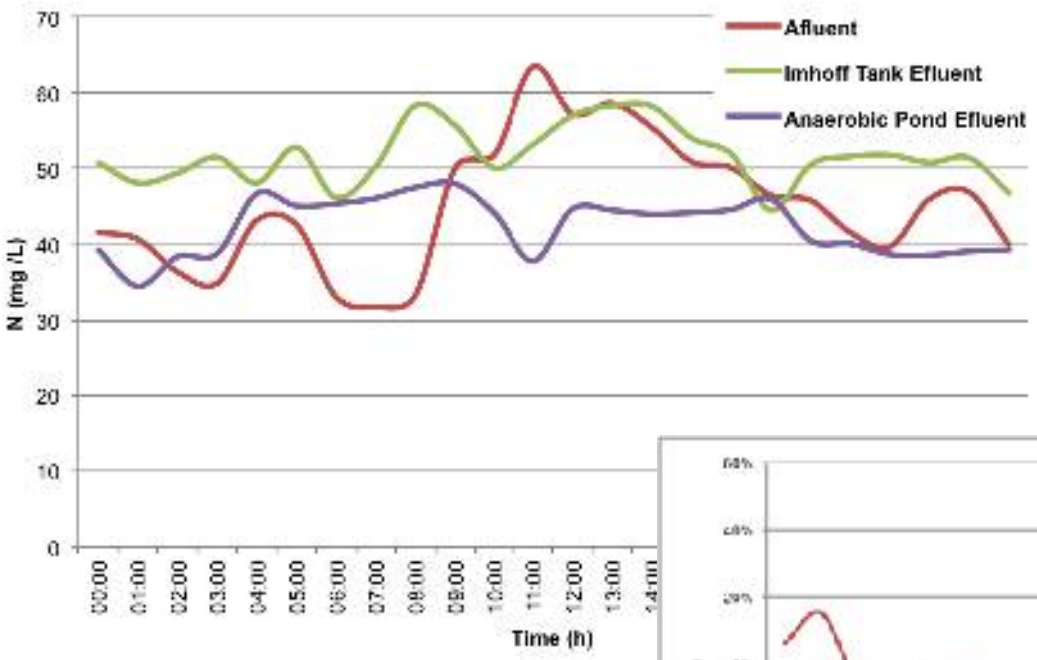
COD REMOVAL EFFICIENCY

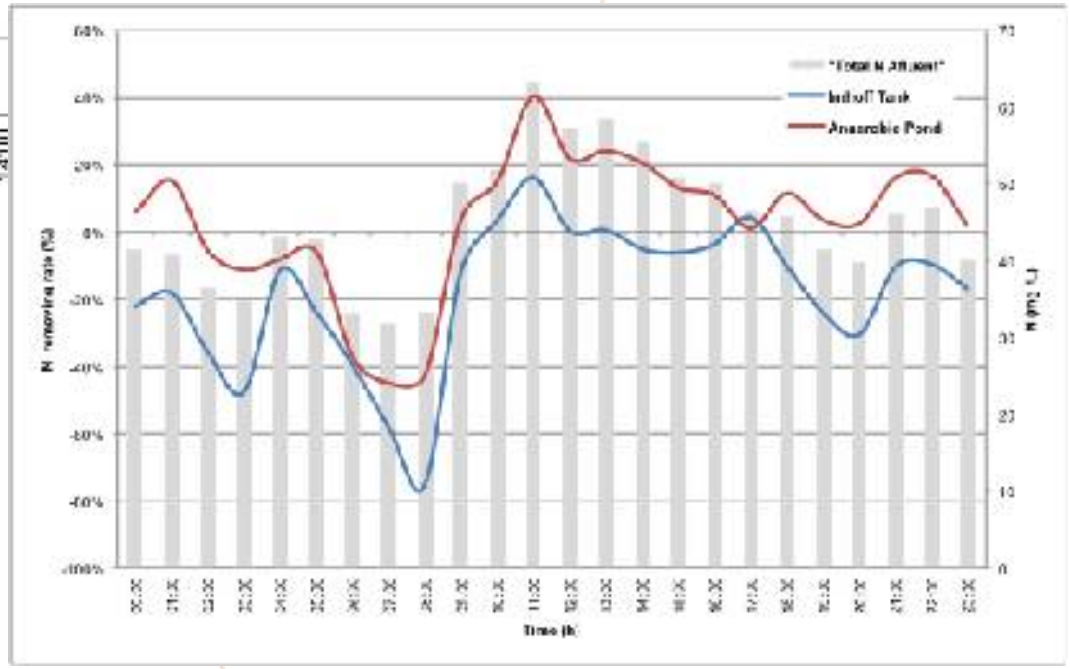


COD REMOVAL EFFICIENCY

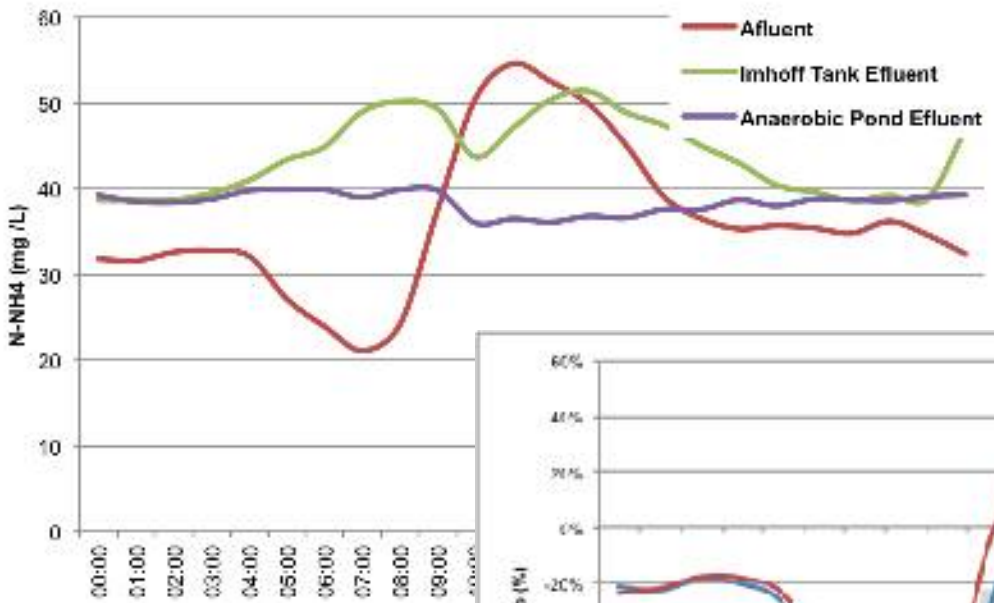


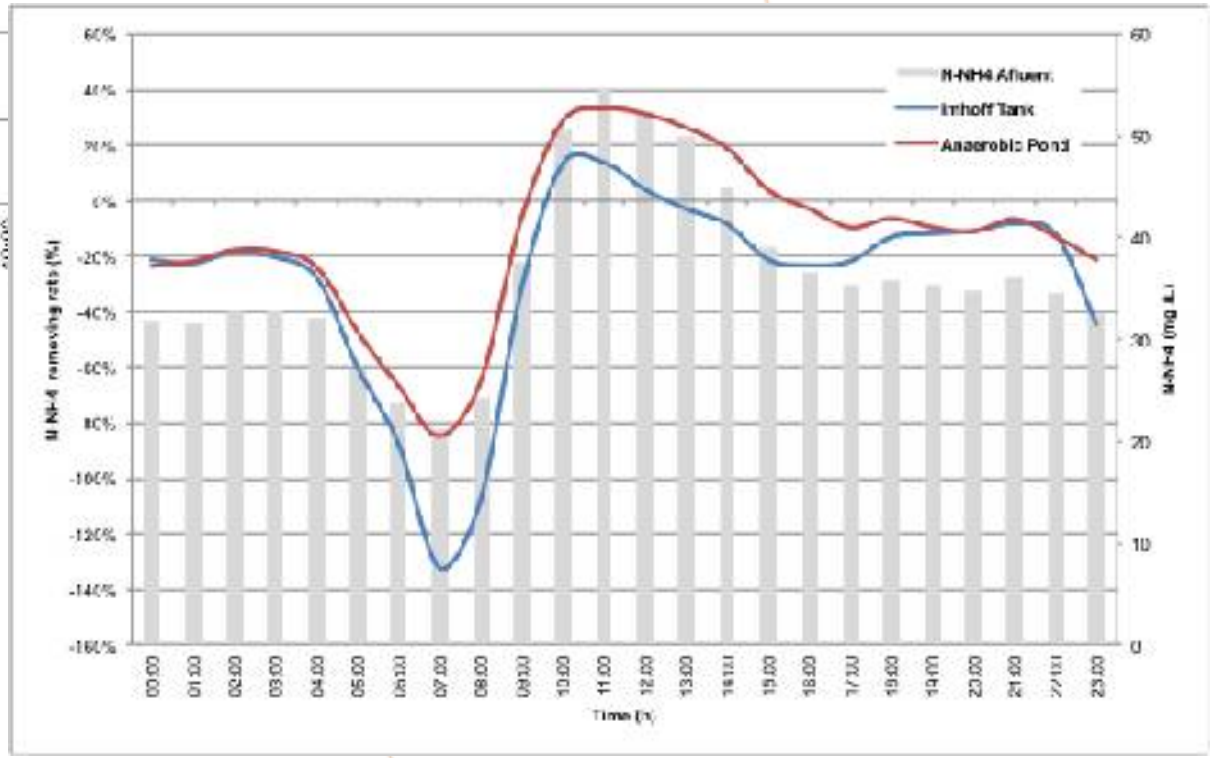
TOTAL NITROGEN REMOVAL EFFICIENCY





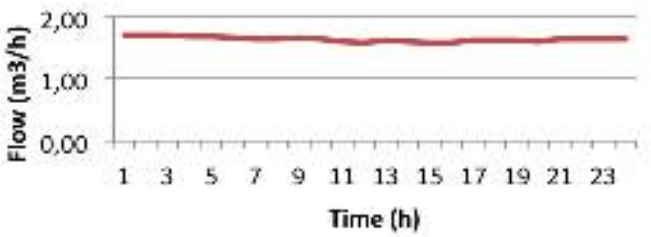
AMMONIUM NITROGEN REMOVAL EFFICIENCY





INTEGRATED SAMPLE

Studied systems has contact flow



Flow-integrated sample = Time-integrated sample

Afluent COD:
512 mg O_2/L

Efluent Imhoff Tank:
512 mg O_2/L

0% removal efficiency

Efluent Anaerobic Pond:
403 mg O_2/L

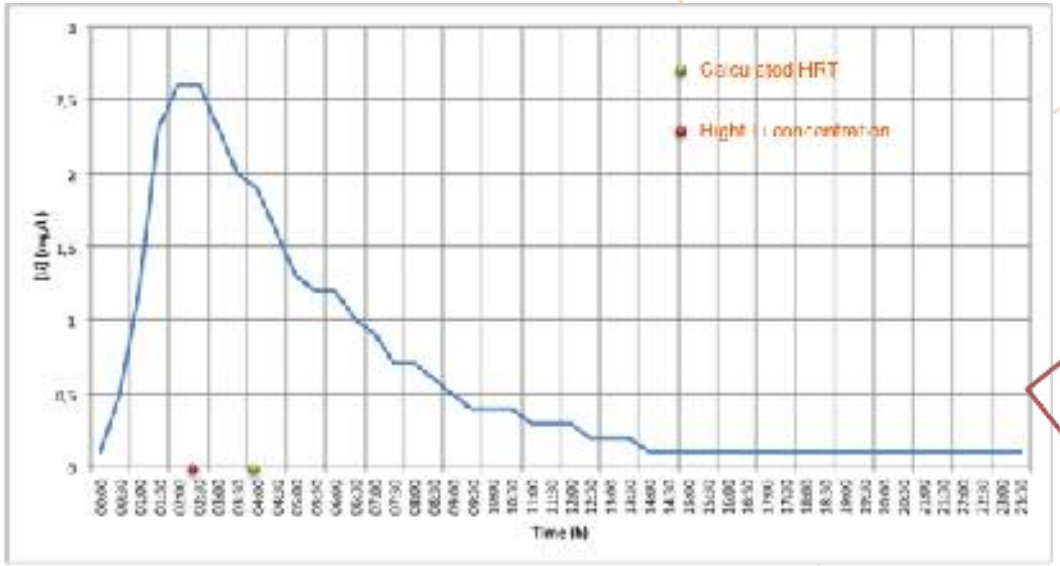
24% removal efficiency

IT IS CORRECT THIS PERIOD OF TIME?

INTEGRATED SAMPLE

May be necesary to take in account the hydraulic retention time (HRT) in order to set the integration period of the sample?

The **Hydraulic Retention Time** (HRT) or t (tau) is a measure of the average length of time that a soluble compound remains in a constructed bioreactor.
(Metcalf y Eddy (1995). Ingeniería de Aguas Residuales. Tratamiento, Vertido y Reutilización. Mc Graw-Hill. Singapore, 1334 pp.)



Practical estimation of hydraulic retention time in the Imhoff Tank using Li as a tracer.

- If HRT << SIP: Very good situation
- If HRT < SIP: Good situation
- If HRT = SIP: Representative?
- If HRT > SIP: Pour representativity
- If HRT >> SIP: No representativity

IN STUDY

SIP: Sample Integration Period

CONCLUSIONS

1. Removal efficiencies are highly influenced by time of sampling in case of spot samples.

2. Spot samples just give us information on the system status at this moment.

3. Integrated sample of 24 hours is not necesary a good sample to evaluate the removal efficiencies of wastewater treatments.

4. Could be necesary to know the HRT to set a correct sampling period for sample integration.

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