Comparison Performance of Side By Side IFAS and Activated Sludge in a Municipal WWTP

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Introduction

During the last decade, increasing stringent effluent requirements, concerning effluent nutrients concentrations, have been imposed by authorities. In order to meet these standards, the utilities are required to modify their treatment processes.

Settecamini is a municipal wastewater treatment plant (WWTP) treating wastewater in Rome, Italy. The WWTP, operated by ACEA, was based on the Conventional Activated Sludge (CAS) technology treating 2,500 m3/d.

Due to population growth the WWTP was required to almost double its treatment capacity up to 4,500 m3/d. It was also required to improve its effluent quality in order to meet nutrient limits of the EU directive for effluent discharging to sensitive area, local Italian regulations and specific regulation in the regional area of Lazio. The main challenge of this project was to maximize the capacity of the existing facility with minimal civil works under limited available area conditions.

The utility first conducted an extensive analysis of upgrade alternatives. The **integrated fixed-film activated sludge (IFAS)** process was determined to be the most cost-effective approach. It was then decided to upgrade one of two existing treatment trains into a 5-stage IFAS process.

Design Basis

The design criteria for Settecamini WWTP was to upgrade one train from 1,250 to 2,500m3/d using the exiting reactor with a volume of 744m3.
The wastewater temperature ranges between 12 to 25°C.

Table 1. Influent characteristics and new effluent requirements after secondary treatment

Parameter	Influent (mg/l)	Effluent (mg/l)
COD	550	125
BOD5	220	25
TSS	330	35
Total Nitrogen	71	15
Ammonia as N	51	2

The IFAS train upgrade was completed and commissioned in October 2015.

Acclimated Aqwise Biomass Carriers (650m2/m3)

Results

After a quick start-up of less than a week, the IFAS and CAS trains treated 2,000m3/d each. Only the IFAS train achieved all effluent quality requirements.

The improvement in effluent TN at the IFAS train is significant. The average effluent quality was 11 and 27 mg/l in the IFAS and CAS trains, respectively. The IFAS achieved 86% removal compared to 64% by the CAS.

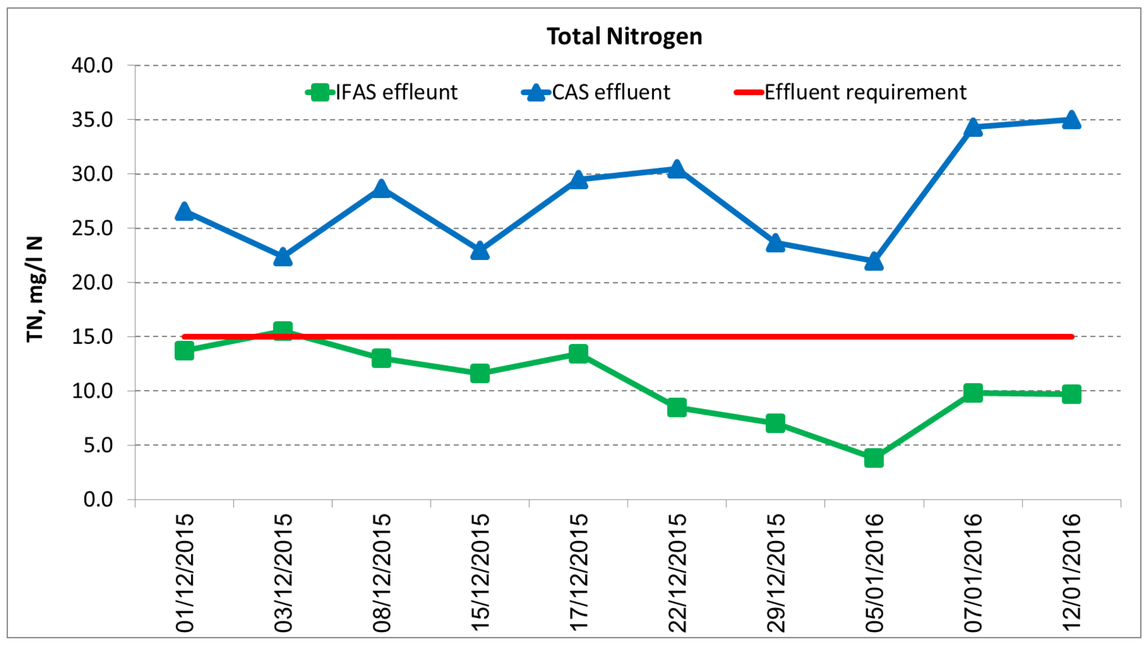


Figure 1. Effluent Total Nitrogen concentrations in the IFAS and in the CAS trains

Before the IFAS upgrade, between 2012-2013, several significant deviations in Ammonia levels were observed (up to 300% from the required level), while after the IFAS was operated, effluent concentrations were 7% below the discharge requirements.

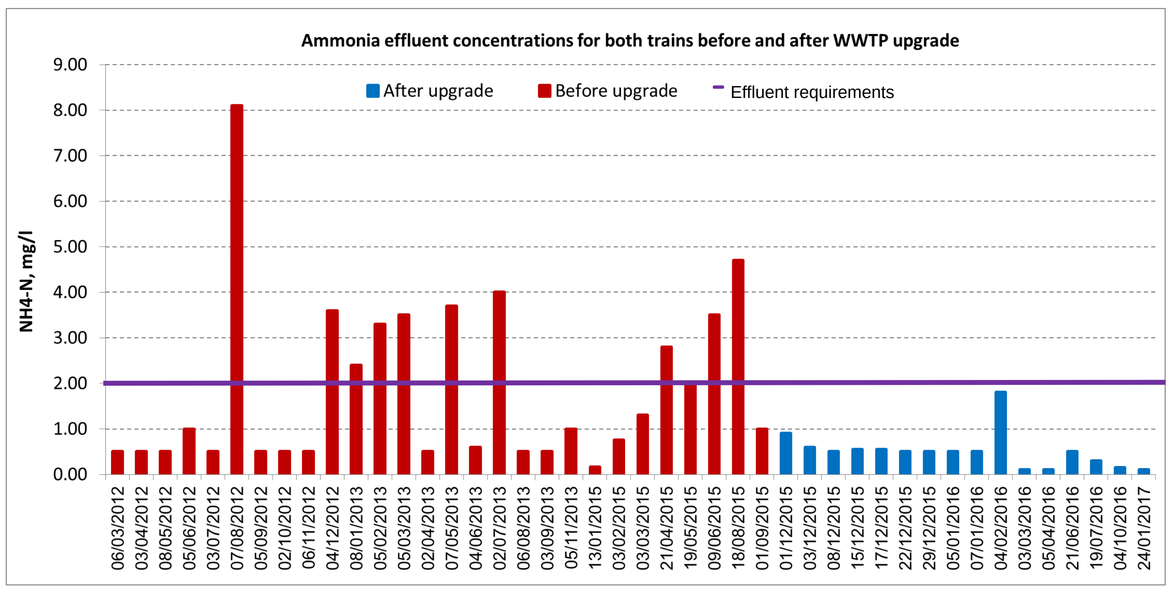
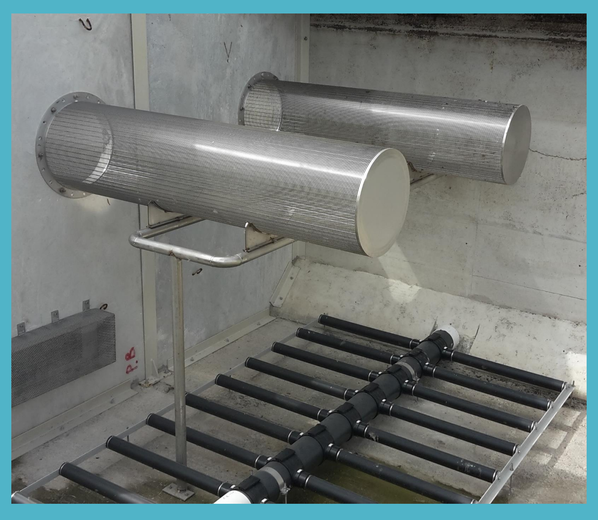


Figure 2. Ammonia effluent concentration before and after biological reactors upgrade



Summary

The IFAS upgrade of the municipal WWTP allowed new effluent requirements to be successfully achieved in the same existing biological reactor volume. The IFAS has a high and stable removal efficiency of organic loads and nitrogen compounds. In addition, the operation team indicated that the IFAS train is more stable and easy to operate.

The AGAR®IFAS Technology

The AGAR®IFAS (Attached Growth Airlift Reactor) process combines CAS technology and biofilm systems into a single reactor.
The biomass carriers are utilized in all or part of the aerated stages. This creates a synergy between two distinct biological processes: while the MLSS degrades most of the organic load (BOD), and the biofilm creates a strong nitrifying population for oxidation of the nitrogenous load.

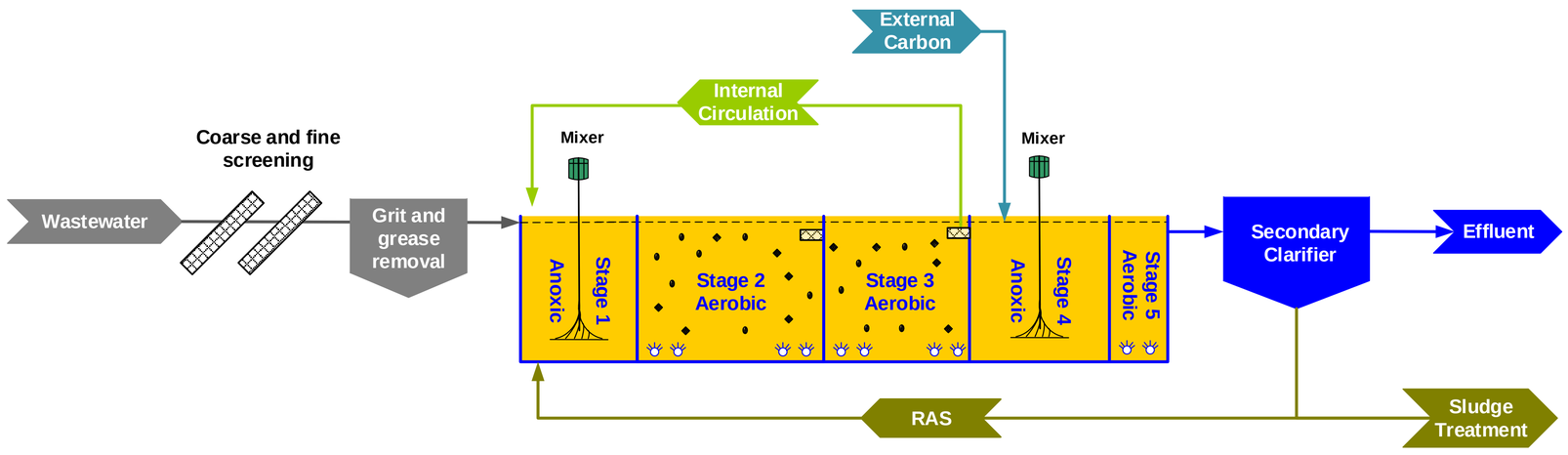


Figure 3. 5-stage IFAS upgraded configuration of one treatment train in Settecamini WWTP