Ammonia release during the Anaerobic Digestion of Thermo-Alkali pre-treated WAS. Preliminary assessment of the increase of electrical energy and GHG emissions in the water line of Castiglione Torinese WWTP.

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Greenhouse gases (GHGs), that is methane (GWP_{20y} 84), carbon dioxide (GWP_{20y} 1) and nitrous oxide (GWP_{20y} 264), are normally present into the atmosphere. GHGs have long mean lifetimes and are an important factor to regulate the temperature on the Earth.
However, the large and uncontrolled GHG emissions due to human activities produce the well-known global climate change. Biological treatments for the removal of organic matter and macronutrients in Wastewater Treatment Plants (WWTPs) are considered one of the anthropogenic sources of GHGs. Specifically, the production of nitrous oxide (N2O) is linked with the biological nitrogen removal processes. Methane production from the AD of waste activated sludge (WAS) is limited by poor and slow biodegradability. Campo and coauthors (2019) assessed the feasibility of a thermo-alkali pre-treatment (4 kg NaOH/100 kg TS, 90 °C and 90 min.), to increase the WAS methane production, by using a semi-continuous AD test. The test revealed that the pretreatment allowed to increase the methane production of WAS by 167%, thus obtain an overall methane increase of 34% from the digestion of a mixed (primary – secondary) sludge. On the grounds of those very promising results, the authors proposed to introduce the thermo-alkali pretreatment in the sludge line of Castiglione Torinese WWTP. However, it was demonstrated that the thermo-alkali pretreatment also increased the ammonia release during the WAS digestion; this over production is an issue that must be considered from an energy and environmental point of view. In this study, a mechanistic first order ammonia release model is proposed. The used data to be introduced into the model were obtained during two semi-continuous anaerobic digestion tests carried out on raw and treated WAS respectively. Later, the results of the model were used to estimate the increase of electric energy required to treat the increased amount of NH_3. Finally, an assessment of the increase of N_2O emission was done by using the same data. The N_2O emission assessment was performed by referring to some of the models reported in the scientific literature (G. Mannina et al, 2016).

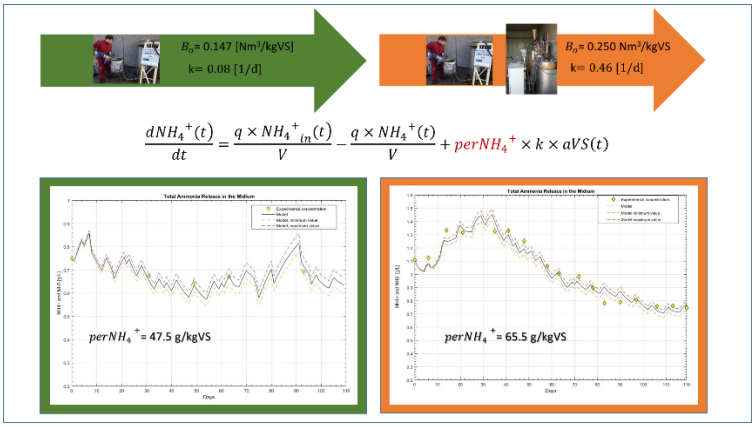

Figura 1. Ammonia release

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