Resumen de Tesis Doctoral

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Título de la tesis	Sewage sludge anaerobic digestion. Study of synergies and operacional strategies of co-digestion
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(Mínimo 1 y màxim 4, podéis verlos en http://doctorat.upc.edu/gestion-academica/carpeta-impresos/tesis-matricula-y-deposito/codigos-unesco)

Resumen de la tesis de 4000 caracteres máximo (si se superan los 4000 se cortará automáticamente)

Wastewater treatment plants (WWTPs) are characterized by their high organic matter and nutrient removal efficiency, but also by their high energy consumption. In the current context where resources are increasingly scarce, all feasible strategies to save energy emerge as an important issue for the sustainable management of WWTPs.

In this thesis, sewage sludge (SS) anaerobic co-digestion with available organic wastes, coming from different sources and having different compositions, was proposed as an interesting strategy to approach an energy self-sufficient scenario for wastewater treatment by means of an improved biogas production. The studied co-digestion strategies were focused on the effect of the co-substrates composition ~~li~~pids, by adding grease waste (GW) from the dissolved air unit of the WWTP; alcohols, by adding crude glycerol (CGY) from a biodiesel facility; and of mixed composition, when adding the organic fraction of municipal solid waste (OFMSW) ~~-~~and the effect of operational temperatures ~~m~~esophilic and thermophilic ~~o~~n the general performance of the SS anaerobic digesters.

This approach was evaluated in terms of methane yield and the stability of the process. Methane productivity increased 2.3 and 2.2 times in comparison with sewage sludge mono-digestion when the GW added amounted to 26% and 27% of the COD inlet under mesophilic and thermophilic temperature conditions, respectively. The addition of GGY showed a 2.5 increase in methane productivity under mesophilic temperature, while in thermophilic range the co-digestion showed great instability mainly due to volatile fatty acids accumulation. Addition of the OFMSW showed a 3 to 5 times increase in methane productivity compared to SS mono-digestion, when the OFMSW added amounted respectively to 51% and 33% of the COD inlet under mesophilic and thermophilic conditions respectively..

The biomass acclimatization brought about by a slow increase of the influent dose of GW, could be a good strategy to increase fat degradation and reduce the inhibitory effect of LCFAs. Thermophilic co-digestion showed a lesser tolerance to LCFAs than mesophilic, and therefore, the adaptation time to grease waste was longer.

Thermophilic anaerobic co-digestion of SS with CGY proved to be very unstable due to the extreme pH of CGY and its fast decomposition into volatile fatty acids. On the other hand, mesophilic co-digestion showed a good performance, concluding that doses above 2% v/v of CGY did not bring about an improvement on the methane yield. In this case, it can be concluded that the optimization strategy based on the C/N ratio must be modulated by other factors such as the characteristics of crude glycerol (particularly its pH and total alkalinity) and the operational temperature.

The OFMSW was proved to be a suitable co-substrate both under mesophilic and thermophilic temperature conditions. Results suggest that the addition of the OFMSW could be an adequate strategy to promote the activity of thermophilic saturated fatty acid oxidizers and acetoclastics methanogenic bacteria. In addition, the evolution of specific activities was assessed and used as a feasible tool to explain and manage the response of the system, especially when conventional control parameters were not enough to explain the performance of the reactor.

Within the obtained results, it has been demonstrated that co-digestion is a suitable approach to optimize the energy balance of a WWTP. But, depending on the composition of the organic waste and the temperature range of operation, different operational strategies should be put into practice to find the most stable process, and avoid inhibitory episodes.

Based on the results obtained with the strategies studied in this PhD thesis, sewage sludge co-digestion with different organic wastes could be expected to represent an attractive alternative to attain energy self-sufficient wastewater treatment operations, and perhaps even net energy producing WWTPs

Lugar _____ Fecha _____

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