Extended Abstract

Experimental—Demonstrative Pilot Installation BIOGAS—MICROALGAE [†]

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The installation presented is the main result of complex project 32PCCDI/2018, with the proposal of development and demonstration of innovative technologies to optimize biogas plants by integrating open ponds for microalgae cultivation using the digestate resulting from anaerobic digestion as a culture medium.

The experimental—demonstrative pilot installation biogas—microalgae is comprised of the following elements (material: polystyrene armed with glass fiber): Anaerobic digestion installation: Mobile vessel for substrate homogenization (500 L), Digester (5 m³), Digestate collection vessel (200 L), Liquid digestate collection vessel (200 L); Installation for microalgae cultivation: Nutrient preparation vessel (500 L), Vessel for CO₂ absorption in nutrient medium (500 L), Microalgae growth raceway pond (10 m³); Microalgae harvesting installation: Microalgae suspension harvesting vessel (sedimentation/storage) (500 L), Filtered water collection vessel (500 L).

The digester (Figure 1A) is equipped with a recirculation loop, that ensures a better homogeneity and availability of the substrate for the process bacteria, in order to reduce the process time and maximize methane yield. The retention time in the digester was reduced considerably compared to the conventional process, without recirculation of the substrate, obtaining biogas with over 40% methane (compared to <10% without recirculation) and, after 30 days, 50% methane in the biogas (compared to 15% without recirculation). Microalgae growth reduced the nutrients from the liquid digestate, over 90% N and over 80% P.

Besides the efficient production of biogas with high yield in methane, we also achieved an efficient reduction of the nutrient content of liquid digestate, by growing microalgae on this side flow as an alternative to the specific nutrient rich medium currently used for cultivation.

Figure 1. Main constituents of the Experimental—Demonstrative Pilot Installation BIOGAS—MICROALGAE.

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