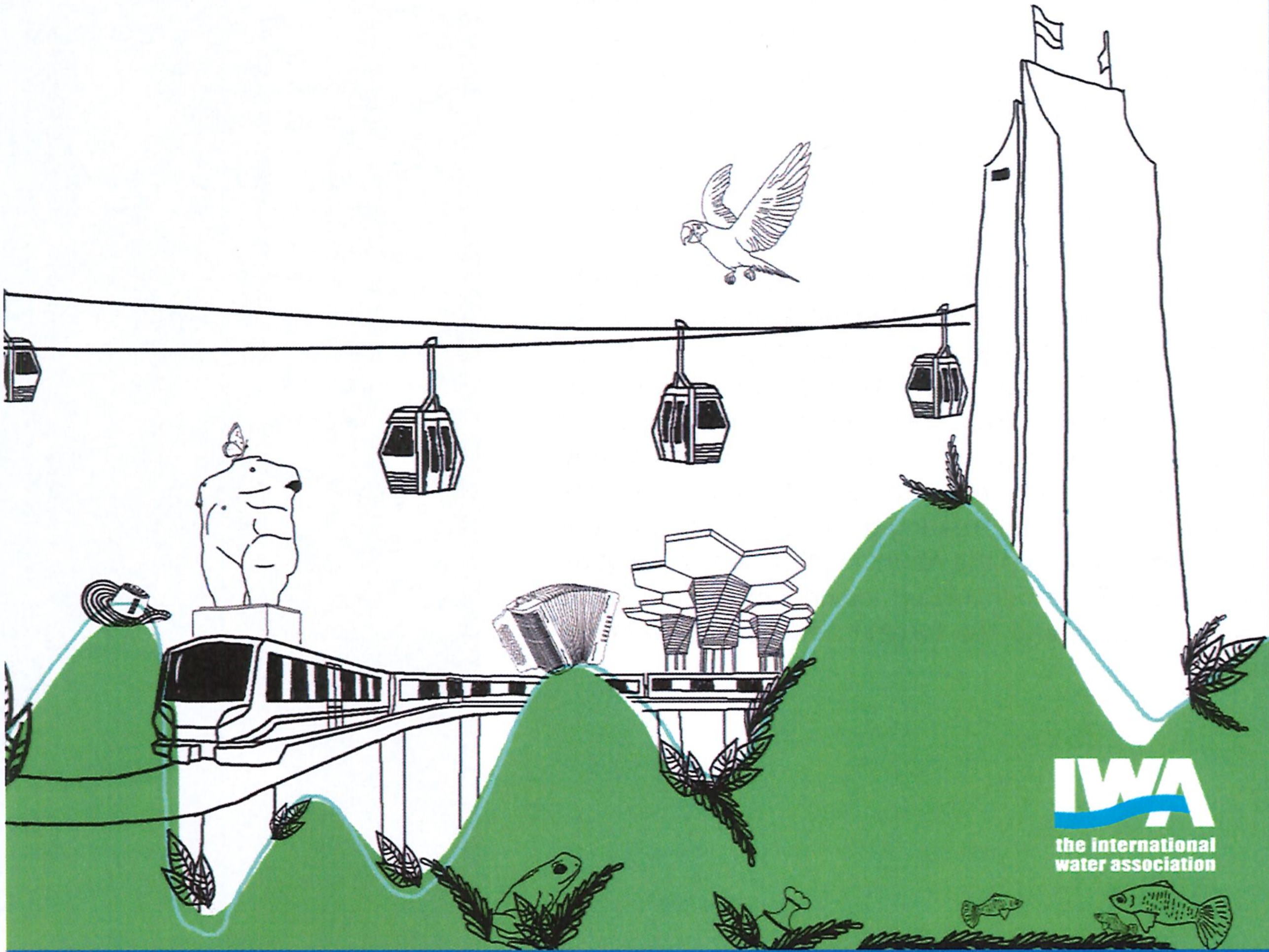
XIII Latin American Workshop and Symposium on Anaerobic Digestion

"An environmental, social, and energetic innovation alternative"

October 21 to 24, 2018
Medellín, Colombia



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INVITATION

On behalf of the Organizing Committee, we welcome you to the XIII Latin American Workshop and Symposium on Anaerobic Digestion (DAAL XIII) to be held in Medellin, Colombia, from October 21st to 24th, 2018. This event is the thirteenth version of the series of Latin American symposium on anaerobic digestion that has historically taken place in different countries and which is supported by the International Water Association - IWA and its group of Anaerobic Digestion Specialists.

On this occasion, the event is organized by a large group of Colombian institutions: Universidad de Antioquia, Universidad Industrial de Santander, Universidad Nacional de Colombia, Universidad Javeriana, Universidad de Ibague, Universidad del Valle, Universidad Pontificia Bolivariana, Universidad de la Guajira, Universidad de Cartagena and Colombian Biomass Energy Network.

Anaerobic digestion has been conceived worldwide as a sustainable and widely developed technology, which has allowed the treatment, recovery and recovery of waste and wastewater, including from the transformation of recalcitrant pollutants to the use of energy. In Colombia, anaerobic digestion has been fundamental to the development of the country as it has laid the foundations for basic sanitation in rural areas and has set the guidelines for the treatment of domestic and industrial wastewater and the proper management and disposal of sludge.

The city of Medellín has been an example of progress and equity in Colombia. In 2013, it was chosen as the most innovative city in the world in the City of the Year competition organized by The Wall Street Journal and Citigroup. Our city also won the Lee Kuan Yew World City Prize in 2016. Medellín is a leader in Colombia in the field of water management through the Aburrá Valley watershed sanitation program, which includes the infrastructure for collecting, transporting, and treating the wastewater from the ten municipalities that make up the Aburrá Valley, with the Aguas Claras Water Waste Treatment Plant being one of the most modern in Latin America and the largest secondary treatment plant in Colombia.

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Welcome to the city of everlasting spring

Medellín, 2018

Preventing sulfide – related drawbacks in biodigestion through phase separation: energetic aspects

C.Gil-Garcia*, L.T. Fuess*,**, L.A.G. Godoi* and M.H.R.Z. Damianovic*
* Biological Processes Laboratory, São Carlos School of Engineering, University of São Paulo, 1100 João Dagnone Avenue, São Carlos, SP, Brazil. (E-mail: *carolgilg@sc.usp.br, leandro.augusto.godoi@usp.br, mdamianovic@sc.usp.br*)
** Department of Chemical Engineering, Polytechnic School, University of São Paulo, 580 Prof. Lineu Prestes Avenue, São Paulo, SP, Brazil. (E-mail: *ltfuess@alumni.usp.br)*

Abstract
The application of two-phase anaerobic systems is a suitable alternative to provide favorable conditions for distinct groups of microorganisms, optimize the overall process efficiency and minimize the occurrence of adverse conditions. In this context, the application of the effluent from a first-stage acidogenic/sulfidogenic reactor in a second-stage methanogenic reactor was compared with a single-phase system treating sulfate-rich wastewater.. Higher methane production rates and the generation of a sulfide-free biogas were observed in the two-phase reactor, whilst the single-phase system required longer start-up time and presented lower methane yield, in addition to the undesirable presence of sulfide in biogas.

Keywords
Phases separation; biogas; sulfide; metane production.

INTRODUCTION

The strategy of phase separation allows greater flexibility in the anaerobic process, allowing the system to withstand higher loads than single-phase systems, considering an enhanced substrate biodegradability by minimizing adverse effects from toxic compounds by producing volatile organic acids separately from methanogens (Dinopoulou, Rudd, et al., 1988). During this process, sulfate is reduced into sulfide whereas organic matter is converted in bicarbonate by the complete pathway, or in acetic acid via incomplete pathway (Muyzer and Stams, 2008), the latter product being readily consumed by methanogenic archaea. Another advantage of phase separation is the establishment of specific operating conditions for distinct groups of microorganisms, with higher organic load and low pH in the first-stage and lower organic load, pH above neutrality and eventual addition of buffering agent to the second stage.

MATERIALS AND METHODS

Two anaerobic structured-bed reactors (ASTBR) filled with polyurethane foam cubes as the support material were operated under thermophilic conditions (55°C). The single-phase reactor was fed with synthetic wastewater containing COD_{TOTAL} (ethanol) of 1250 and SO_4^{2-} concentration of 400 mg L^{-1}. The second-phase reactor was fed with the effluent from an acidogenic/sulfidogenic first-phase reactor (Gil-Garcia, de Godoi, et al., 2018) with residual concentrations of ethanol and acetic acid as following: COD_{TOTAL} = 1050 mg L-1 ($COD_{ETHANOL}$ = 874 + $COD_{ACETATE}$ = 177) and SO_4^{2-} = 24 mg L^{-1}, with a mean sulfate residual of 6.7%. The start-up of the reactors was performed with organic load (OL) of 2.5 g d^{-1} and dosage of sodium bicarbonate in the proportion of 1.2 g for each g of COD, with a progressive increase up of OL to the final load of 5 g d^{-1}.

RESULTS AND DISCUSSION

At the initial operational step (OL - 2.5 g d^{-1}), the single-phase reactor presented organic matter removal lower than 40%, so that the organic load was reduced to 0.625 g d^{-1}. After this, the system required a longer period (119 days) with gradual increase in OL prior to reaching the target OL, i.e., 5 g d^{-1}. For the same starting condition, the second-phase reactor reached COD removal > 85%, allowing a load increase to 3.5 g d^{-1} (average removal of 97%). After 75 days of operation, 5 g d^{-1} of OL was applied, with sulfide concentration in the effluent as low as 5 mg L^{-1}.

The single-phase reactor was impaired by the higher sulfate concentration, which implied in toxic effects caused by sulfide (96 mg L -1) on the methanogenic process (Figure 1-a). In addition, the diversion of electrons to the sulfate-reduction pathway led to the reduction of the methane production as well as the presence of sulfide in the biogas. The average methane production for the second-phase system was 1.95 L-CH_4 d^{-1}, while the single phase-system presented 1.76 L-CH_4 d^{-1}, with approximately 1.6% sulfide in biogas composition (Figure 1-b), requiring additional post-treatment steps for sulfide removal, which highlighted the advantages of the two-phase system

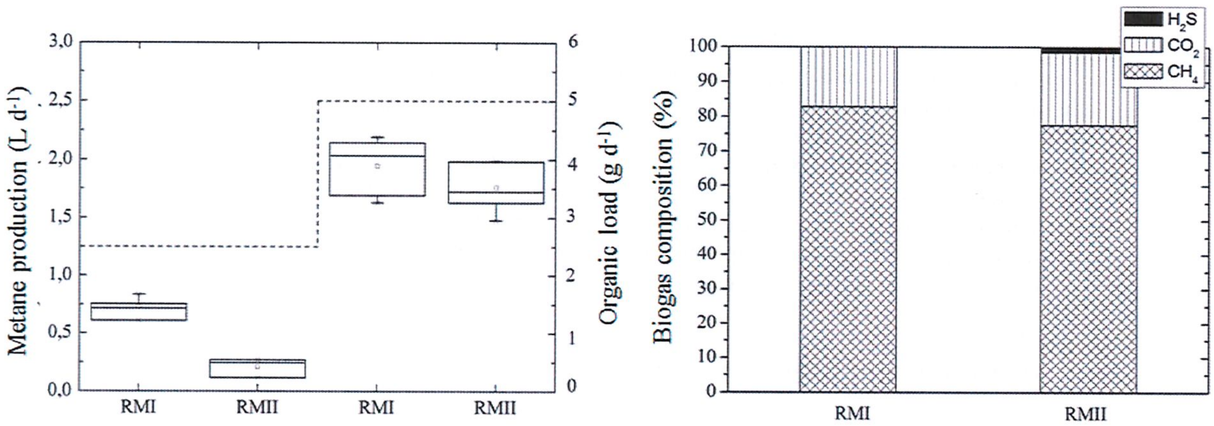

Figure 1.Perfomance of second-phase (RMI) and single-phase (RMII) reactors: (a) Comparison between the daily methane production (boxplot) of the second –phase (RMI) and single-phase (RMII) reactors related to the organic load (- - -); (b) Biogas composition.

CONCLUSIONS

Phase separation promoted greater methane production, besides minimizing potential problems caused by the presence of sulfide in biogas. The single-phase system required a longer starting period, most likely caused by the toxic effects of sulfide over the methanogenic biomass.

ACKNOWLEDGEMENTS

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