Optimisation of biogas production through a two-stage automated anaerobic digester system developed by the CSIR in South Africa

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Abstract Energy intensive technology, such as activated sludge plants, is fast becoming a high-cost item of municipal budgets amidst the rising electricity tariffs and vulnerable demand-supply dynamics in South Africa. The introduction of anaerobic digestion with the aim of producing biogas as a renewable energy source plays a critical role in addressing the energy demand at a wastewater treatment works depending on the type of technology applied. Efficacy of anaerobic digestion process is highly dependent on the interaction between different microorganisms which encourage the conversion of the substrate through various digestion steps ultimately producing biogas which can be used for energy generation. In order to achieve maximum results the CSIR has developed a two-stage, fully automated anaerobic digester which reduces the operator interference in the digestion process. The two-stage anaerobic digester automatically monitors critical parameters such as pH, temperature, loading rate as well as mixing rate through a computerized control system. Gas sensors were also incorporated with the aim of identifying the amount and specific percentage compositions of CO, Methane, H2S, H2 and CO2 the gas produced. The introduction of the CSIR automated anaerobic digestion system has seen the production of biogas improving both in terms of percentage methane produced and hydraulic retention time (HRT). Methane production improved from between 55 and 60% to 72% using municipal liquid waste (sewage) within 16 days hydraulic retention time compared to the standard 30 to 32 days hydraulic retention time. (Note that the organization of the body of the paper is at the authors' discretion; the only required sections are Introduction, Methods and Procedures, Results, Conclusion, and References. Acknowledgements and Appendices are encouraged but optional.)

Index Terms— two-stage automated anaerobic digester, biogas production, digester parameters.