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Research Article

Typology of Municipal Wastewater Treatment Technologies in Latin America

This paper presents an analysis of the wastewater treatment plants in six Latin American and Caribbean countries. Based on a sample of 2734 municipal treatment facilities, the applied processes are classified by sizes (influent flow) and type of technologies. The distribution of the technologies is also presented for each of the six countries. In addition, a representative municipal wastewater characterization, based on influent data from 174 treatment plants, is proposed. Results show that stabilization ponds, activated sludge, and the upflow anaerobic sludge blanket reactors represent 80% of the treatment facilities of the sample, providing treatment to 81% of the total flow considered. Moreover, 67% of the plants in the sample are small (flow <25 L/s) and the very small facilities (influent flow <5 L/s) are extensively applied in the region (34% of the sample), especially in Mexico and Brazil. The use of very small treatment plants may result in low energy efficiency systems and on possible incompliance of the discharge standards. This common practice in several countries in Latin America should be revised in order to improve the environmental performance of such facilities.

Keywords: Energy consumption; Operational costs; Small wastewater treatment plants; Wastewater characterization; Wastewater infrastructure

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1 Introduction

Population growth in Latin America and the Caribbean (LAC) has surpassed the capacity of national and local governments in order to meet the demand for water supply and sewerage. With the historical economic resources allocated to the sector in the last decade, many LAC countries have been able to provide water and sanitation services to millions but not enough to achieve universal access to this highly important determinant of public health [1]. Moreover, unplanned urban growth has given priority to water services and sewerage, resulting in an imbalance between available water resources and water quality protection, so treatment of wastewater and solid waste disposal has lagged [2]. This is confirmed with data from the Water and Sanitation Program that established that LAC countries reached 91 and 79% coverage of water supply and sewerage, respectively, but provided treatment to just 15% of municipal wastewater (www.wsp.org/wsp/sites/wsp.org/files/11142007111614_Latinosan_Final.pdf).

Based on the foregoing context, it is imperative for LAC region to develop and implement new solutions in order to fill the gap of existing infrastructure for wastewater management, with new administrative and technological systems that should consider the limitations and conditions of the region, offering innovating, and adaptative options to existing conventional solutions [1].

Water systems were initially designed for hygiene and sanitation reasons; however, given the need to achieve long-term sustainability, the objectives of urban water systems need to go beyond the protection of public health and environmental quality. It is necessary to reduce the impacts to natural resources, to optimize the use of energy and water, to reduce waste generation and to allow nutrients recycling for crops [3]. Selection of a particular wastewater treatment technology (WWTT) should not be based primarily on technical or economical issues but should also be the result of the integration of technological, economic, social, and environmental activities that surround it, seeking wastewater reuse opportunities as far as possible [4].

It is necessary to emphasize that the wastewater treatment sector has a responsibility to contribute to reduction of greenhouse gas (GHG) emissions and overall energy consumption. To achieve this goal, accurate diagnosis and new analysis tools are necessary so that government agencies, water utilities, and regulatory agencies can better meet the challenge of reducing the carbon footprint of the sector while improving its environmental and economic sustainability [5].

In this paper, the most adopted WWTT for LAC region are identified and classified according to their treatment capacity, together with a representative wastewater characterization. Also, significant differences of national regulations for water discharge are pointed out based on a comparative analysis. Finally, a comparison of operational cost and energy consumption of the three more representative WWTT is presented.

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Abbreviations: BOD, biochemical oxygen demand; **GHG**, greenhouse gas; **UASB**, upflow anaerobic sludge blanket

