

# REMOVAL OF CAFFEINE IN WASTEWATER RECLAMATION PLANT WITH MEMBRANE BIO REACTOR SYSTEM

Edilaine de Freitas Lima<sup>1</sup> (IC), Cassiana Carolina Montagner Raimundo<sup>1\*</sup> (PQ), Romeu Cantusio Neto<sup>2\*</sup> (PQ)

<sup>1</sup> Universidade Estadual de Campinas, <sup>2</sup> Sociedade de Abastecimento de Água e Saneamento S/A

\* [montagner@iqm.unicamp.br](mailto:montagner@iqm.unicamp.br), \* [microbiologia@sanasa.com.br](mailto:microbiologia@sanasa.com.br)

Laboratório de Química Ambiental, Instituto de Química, UNICAMP. Cidade Universitária Zeferino Vaz - Campinas - SP 13083-970

Laboratório Central, Sociedade de Abastecimento de Água e Saneamento S/A, SANASA. Swift - Campinas- SP 13045-750

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## Abstract

This study determined the removal efficiency of caffeine (99.99 %) in Wastewater Reclamation Plant Capivari II that employs Membrane Bio Reactor with ultrafiltration membranes after a biological treatment. The result can be indicated the removal of other emerging contaminants with physical-chemical properties similar to the caffeine, which may be very important considering the type of reuse to be performed with the final effluent

## Introduction

The wastewater reclamation plant (WWRP) Capivari II is located in the Midwestern region of the city of Campinas-SP and receives domestic sewage from about 175,000 inhabitants. The WWRP employs a biological treatment followed by Membrane Bio Reactor (MBR) system with ultrafiltration membranes. The WWRP produces 70 L s<sup>-1</sup> of reclaimed water quality to meet urban purposes, non-potable. The membranes are fibers that promote physical separation of the influent unwanted matter. In WWRP Capivari II, ultrafiltration membranes have a nominal pore 0.04 μm that promote retention of suspended solids and colloids, including bacteria<sup>2</sup> and the treated effluent not consumed is released in Capivari River. The aims of this study was to determine the concentration of caffeine in raw sewage, pre-MBR system effluent and the final effluent for obtained the removal efficiency of this compound in WWRP by monthly sampling held between March 2015 and February 2016 in order to complete a seasonal period. The removal efficiency in WWRP was compared with other conventional wastewater treatment plants (WWTP) located in the same city. The determination of caffeine was performed using Solid Phase Extraction (SPE) with OASIS HLB (Waters) cartridges and Liquid Chromatography tandem Mass Spectrometry (LC-MS/MS) with an electrospray ionization source from Agilent Technologies according to Montagner et al., 2014 (Figure 1).<sup>1</sup>

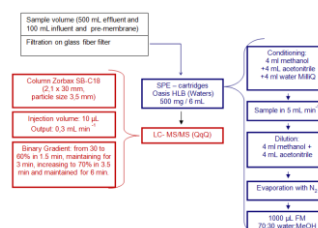


Figure 1. Summary scheme of the experimental part.

## Results and Discussion

The limit of detection (LOD) of this method was 8 ng L<sup>-1</sup> which shows that is very sensible method for this analysis. In general, the mean concentration of caffeine in raw sewage was about 2 mg L<sup>-1</sup>, after biological treatment the caffeine mean concentration was 2 μg L<sup>-1</sup> and after MBR system, the final effluent present caffeine in concentration about 35 ng L<sup>-1</sup>, which represents a removal of 99.99 % after ultrafiltration membranes treatment. This percentage of efficiency is higher than those obtained by conventional WWTP according to literature<sup>3,4</sup>. In addition, for completed this study, were collected samples of raw and treated effluent from four conventional WWTP from Campinas-SP to compared with WWRP efficiency and the data are being finalized.

## Conclusion

The study has indicated that caffeine removal efficiency in the treatment employed in WWRP Capivari II is above 99.99 %. Considering that, the presence of caffeine in natural waters was related with the presence of other emerging compounds, including endocrine disruptors compounds,<sup>1</sup> their removal may mean a decrease of estrogenic activity of the treated effluent.

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