THE 9TH INTERNATIONAL SCIENTIFIC-TECHNICAL CONFERENCE

ENVIRONMENTAL ENGINEERING, PHOTOGRAMMETRY, GEOINFORMATICS

Modern Technologies and Development Perspectives

17-20 September 2019

Lublin, Poland

Editors:

Magdalena Gizińska-Górna
Alina Kowalczyk-Juśko
Patrycja Pochwatka
Kamil Nieścioruk
Krzysztof Jóźwiakowski

Edition: 170 copies

ISBN 978-83-930973-7-1

The conference is funded by the Polish National Agency for Academic Exchange under the International Academic Partnerships Programme

Lublin 2019

CAFFEINE REMOVAL EFFICIENCY IN A VERTICAL FLOW CONSTRUCTED WETLAND

Adelaide Almeida[1,2], Carlos Ribeiro[1], Humberto Chaves[1,2]

[1]Department of Technologies and Applied Sciences, Polytechnic Institute of Beja, Apartado 6155, 7800-295 Beja, Portugal
[2]FibEnTech-UBI: Fiber Materials and Environmental Technologies Center of the University of Beira Interior
Corresponding author's e-mail: hc@ipbeja.pt

Keywords: Wastewater, caffeine, emerging compounds, phytoremmenation.

The presence of emerging compounds in water and wastewater has been increasing substantially in recent years. These are synthetic compounds, present in most of today's consumer goods and may pose a potential threat to ecosystems and human health. The vast majority of wastewater treatment plants do not have the required efficiency for their removal. However low concentrations of these compounds in the environment can cause toxic effects and affect the endocrine system, thus becoming a public health problem. Caffeine is a alkaloid, one of the most consumed substances in the world. Therefore, it is present not only in some industrial effluents, but also in urban wastewater. As already mentioned, conventional treatment processes do not allow efficient degradation, so Vertical Flow Constructed Wetland (VFCW) has been presented as a good solution in the removal of pharmaceutical compounds, including caffeine.

This work aims to assess Vetiveriazizanioides's ability to withstand and remove caffeine from. The research was developed in a pilot VFCW (0.4 x 0.6 x 0.70 m) planted with *Vetiveria zizanioides* on an inert matrix of light expanded clay aggregates. The VFCW was continuously fed with synthetic wastewater supply with a mineral medium and caffeine. A synthetic effluent was used to minimize the variations in the concentration of affluent to the VFCW.

The Hydraulic Load (HL) was kept constant at 110±8 L $m^{-2}d^{-1}$. Samples of affluent and effluent from the VFCW were collected daily. They were measured in situ the pH, electrical conductivity (EC), redox potential (Eh) and dissolved oxygen (DO), as well as the air and soil temperature. The caffeine concentration was determined by HPLC-MS and three concentrations were studied of affluent: 3±1 mg L^{-1}, 4.5±1 mg L^{-1} and 9±1 mg L^{-1}. The study of each Caffein concentration lasted 4 weeks. Chlorophyll *a* and *b* (*Chl a* and *Chl b*) and carotenoids were determined at the beginning and end of the tests. Average efficiencies of caffeine removal were obtained up to 66±10%. The caffeine levels in the affluent with which the VFCW

were fed affected the content of *Chl a*, *Chl b* and carotenoids. It was verified that the increase of caffeine in the affluent caused a decrease in the content of chlorophyll *a* and *b* and an increase of the carotenoids throughout the tests, thus interfering in the composition of the foliar biomass. This study points to the possibility of using VFCW as a low-cost technology applicable to the treatment of wastewater contaminated with emerging compounds.