DETERMINATION OF THE INHIBITION OF THE BIOLOGICAL TREATMENT PROCESS BY FUNGICIDES

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Abstract

As a result of current worry, from urban WWTTP exploitation that receive or are liable of receiving wastewater proceeding of post-harvest phytosanitary treatments, that take place in the hortofruticultural centrals, is considered the need of carrying out a study to determine the effects of the biocides have on biological treatment processes that take into in WWTP.

Key words

Fungicides, inhibition, toxicity, IMAZALIL, THIABENDAZOLE, ORTOPHENILPHENOL

Introduction

For the most part of horticultural centers, in header processing or previous to the installation entrances, is common aply determined fungicides to protect the citrus of the fungi colonization, principal organisms alters of citrus. The used products in these treatments have a marked toxic effect, on the biological reactor of the WWTP, reducing the treatment capacity and therefore affecting the quality of the discharged treated water by the WWTP. During the citrus harvest season, the characterization of these spillages shows the presence of three fungicides: IMAZALIL, THIABENDAZOLE AND ORTHOPHENILPHENOL. The objective of this study is to quantify the inhibitory effect of these three fungicides on the microbiological activity of a WWTP.

Methods

For carrying out the quantification of the fungide inhibition effect was used a technical respirometry starting from the activated sludge of the WWTP in endogenous phase. The activated sludge is subjected to an easily biodegradable synthetic substrate in the presence of certain concentrations of biocide to the test, taking as a reference sample substrate without biocide.

After an initial characterization of the status of the activated sludge (reference sample), several aliquots of this sludge was submit to different concentrations (1, 5, 10, 25 and 50 ppm) of each one of the fungicides (IMAZALIL, THIABENDAZOLE AND ORTHOPHENILPHENOL).

Sample volume (Vs) and mixed liquor volume (Vr) were determined to reproduce the operation conditions of the receiving WWTP, according to the equation 1 of the figure 1:

(1) $Qo / (Qo + Qr) = Vs / Vr$

(2) $I(\%) = (1 - Rs/Rsmax) * 100$

Figure 1. – Volume calculation equations (1) inhibition degree (2)

Where:

Qo: Influent flow to the WWTP biological reactor.
Qr: Recirculation flow of mixed liquor (activated sludge) to the WWTP biological reactor.
Vs: Sample volume
Vr: Volume of the recirculation sludge (mixed liquor)
I: Inhibition
Rs: Respiration rate
Rsmax: Maximum respiration rate

The inhibitory effect of the fungicides was quantified obtaining respiration rate valour (Rs) at the time that Rsmax, in the reference test, was obtained.

Results and discussion

ACTIVATED SLUDGE CHARACTERIZATION

The status of activated sludge sample from WWTP was evaluated by the determination of oxygen consumption rate of the mixed liquor (OUR) in(mg O_2/l.h) and the oxygen consumption specific rate of the mixed liquor (SOUR) in (mg O_2/VSS.h). The obtained results are shown in the table 1:

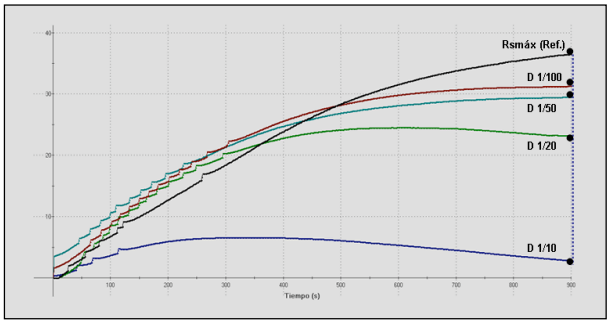
Temperature	20 °C	Sludge volume	1 liter	VSS	3,8 g/l

OUR (consumption rate of the mixed liquor	11,142 mgO_2/l·h
SOUR (consumption specific rate of the mixed liquor)	2,718 mg O_2/g SSV·h

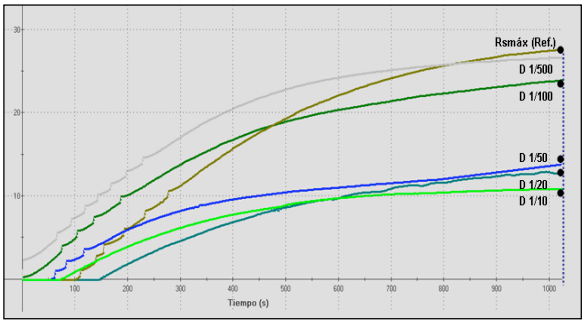
Table 1. – OUR and SOUR in unhibited activated sludge sample (UNFED test)

INHIBITION TESTS

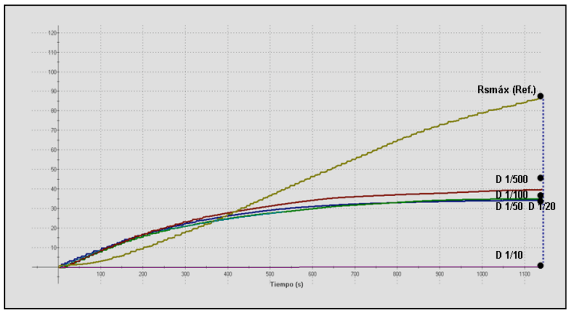
The overlapping of spirometrys (figure 2) of the realized tests is possible to understand the toxic effect of the pesticide addition about the maximum respiration rate (RsMax).



Imazalil toxic tests



Thiabendazol toxic test



Ortophenilphenol toxic test

Figure 2. – Fungicide toxicity tests at different concentrations. Overlapping spirometrys.

Conclusions

The obtained results in the different tests show that the fungicide concentration and the toxicity degree have a direct correlation in all of the cases, obtaining a higher percentage of inhibition when higher concentration of the compound is employed.

References

Horticultura nº145 de junio de 2000, Belen Fouz, Marina Serra, Milagros Mateos, Medioambiente y poscosecha, Instituto Tecnológico Agroalimentario (AINIA).

Ripollés Pascual, F. y Santateresa Forcada, E. La Problemática Asociada a las Sustancias Prioritarias en las Redes de Saneamiento. Actas de las XXVI Jornadas Técnicas AEAS (2.006).

Ripollés Pascual, F., Marín Galvín, R., Santateresa Forcada, E., Lahora Cano, A. y González Canal, Í. Presencia de Contaminantes Emergentes y Aplicación del E-PRTR en Saneamientos Públicos. Actas de las XXIX Jornadas Técnicas AEAS (2.009).

Directiva 2006/11/CE del Parlamento Europeo y del Consejo de 15 de febrero de 2006 relativa a la contaminación causada por determinadas sustancias peligrosas vertidas en el medio acuático de la Comunidad.