DISTRIBUTION OF ORGANIC CONTAMINANTS BETWEEN THE AQUEOUS PHASE AND THE SUSPENDED PARTICULATE MATTER COMPOSING WASTEWATER

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INTRODUCTION

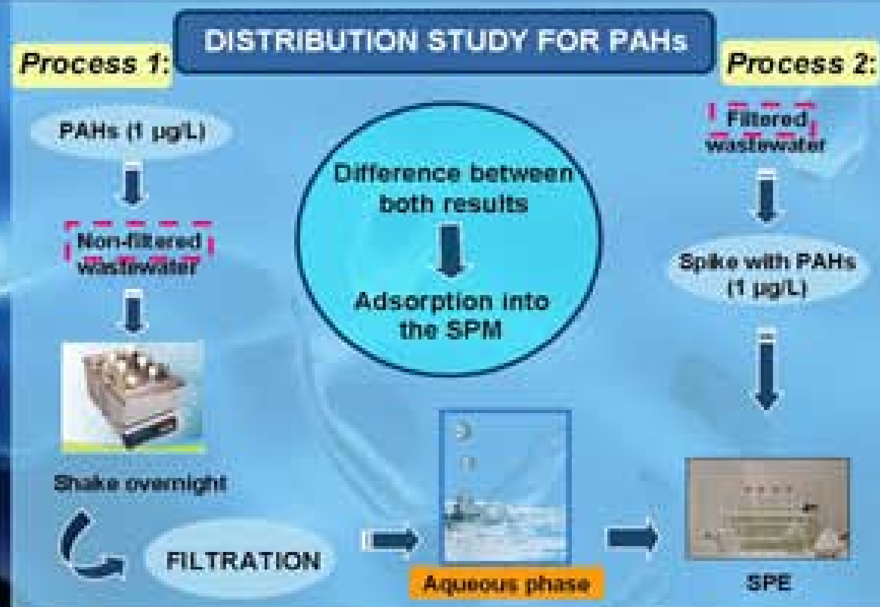
Nowadays, there is an increasing interest in reusing wastewater (WW) in water-deficient regions. Treated WWs can be utilized in agricultural irrigation (Petrović *et al*, 2003), for municipal and industrial purposes, for environmental aims, such as the recharging of aquiferous, or they can be directly discharged into rivers or the sea. Certain groups of contaminants (e.g. pesticides, polycyclic aromatic hydrocarbons (PAHs) and phenolic compounds) are listed as priority pollutants by the European Union (EU, Decision No 2455/2001/EC) and the United States Environmental Protection Agency (US-EPA) (CFR 40 Chapter I Part 423) and they have been identified in WW. Consequently, these compounds need to be determined and controlled in WW effluents to assure their quality. An important issue, which is not usually considered, is that WW is a complex multiphase matrix characterized by the presence of suspended particulate matter (SPM) in different amounts, depending on the treatment received. In fact, most of the analytical methods found in literature for the analysis of organic contaminants in WW are only based on the analysis of the aqueous phase obtained after sample filtration, without regarding to the SPM that is retained in the filters (Pitarch *et al*, 2007). However, due to the fact that the organic contaminants can be associated with SPM depending on their hydrophobicity and the nature and concentration of the particles, it is necessary to evaluate the possible distribution of the contaminants between both phases in order to avoid underestimations in the total concentration in the samples.

In this study, an evaluation of the distribution of pesticides (including polar and non-polar compounds), PAHs and phenolic compounds between the aqueous phase and the SPM in different WW effluents (anaerobic pond, maturation pond, extended aeration and membrane bioreactor) has been performed, which is, up to our knowledge, the first approach described in this topic. Furthermore, a general approach to evaluate this effect is proposed.

METHODS

DISTRIBUTION STUDY FOR PESTICIDES AND PHENOLIC COMPOUNDS

DISTRIBUTION STUDY FOR PAHs

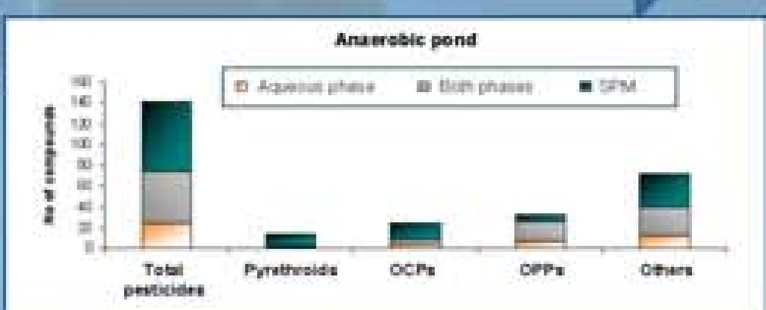


RESULTS AND DISCUSSION

Non-polar pesticides

- Depending on the hydrophobicity (established as the log K_{ow}) the compounds are mainly distributed in the aqueous phase or SPM
- Most of the compounds were distributed in both the aqueous and the SPM, except for pyrethroids and organochlorine pesticides, which were more prone to remain in the SPM

Necessary to analyze both phases



Distribution of the non-polar pesticides found in each phase with a rate higher than 75 %, as well as those distributed between both phases with rates between 25 and 75 %, in the anaerobic pond effluent. Abbreviations: OCPs: organochlorine pesticides; OPPs: organophosphorus pesticides.

Polar pesticides and phenolic compounds

- The fraction of analytes bound to SPM was insubstantial, and they were mainly found in the aqueous phase

The analysis of SPM is not necessary

Distribution of the polar pesticides, phenolic compounds and PAHs found in each phase with a rate higher than 75 %, as well as those distributed between both phases with rates between 25 and 75 %, in the anaerobic pond effluent

PAHs

- Most of the PAHs are mainly adsorbed into the SPM

Necessary to analyze both phases

CONCLUSIONS

A distribution study of organic contaminants between the two phases composing WW samples, aqueous phase and SPM, has been carried out. Although the SPM is not usually analyzed, this distribution between the aqueous phase and the SPM has revealed that it is necessary to analyze both phases to consider the total concentration in the sample. Thus, for the analysis of non-polar pesticides and PAHs, both phases should be submitted to analysis due to some of these compounds are more prone to remain in the SPM. However, for polar pesticides and phenolic compounds, the analysis of the SPM does not provide significant information due to these types of compounds are mainly found in the aqueous phase. A similar trend was observed for all the compounds despite of the type of treatment that wastewater had undergone.

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Acknowledgments

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