LANDFILLS WASTE WATER TREATMENT PLANTS PERMEATES AND EUROPEAN UNION DIRECTIVE 2000/60/EC: A CASE STUDY OF PAHs

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Introduction

The directive 2000/60/EC of the European parliament and of council of 23 October 2000 establishes a framework for Community action in the field of water policy. This directive is modified by Decision n°2455/2001/EC of the European Parliament and the Council which benches a first list of 33 priority substances or group of substances among which are ten hazardous priority substances comprising PAHs, fifteen priority substances subjected to a review for identification as possible "priority hazardous substances" comprising anthracene and naphthalene, and 8 priority substances comprising fluoranthene. The directive requires the Member States to ensure establishment and/or implementation of relevant emission limit values for those of the 33 substances which are matter of concern. In the Walloon Region, the transposition of the 2000/60/EC gives limit values for the 6-Borneff, for naphthalene and for anthracene PAHs.

Research objective and method

The study objective is to assert in the view of these PAHs, if the application of the Directive 2000/60/EC and Decision n°2455/2001/EC is in accordance with the actual leachates treatment plants management.

To achieve this objective, considerations on PAHs reduction in the leachates treatment plants have been taken into account. The aim of reducing PAHs is assessed by comparison of total PAHs content in initial leachate and leachate treatment plants permeate released to environment. Total PAHs content consist of 15 PAHs of the 16 of EPA list (excepted acenaphtylene). We also took into account, to respect to the Directive, considerations on permeate content in 6-Borneff PAHs, in naphtalene and in anthracene. The analysis was carried out in accordance with standard NBN EN ISO 17993.

The study is held in a four collecting campaign analysis in 8 MSW leachate treatment plants of Wallonia. The eigth plants can be gathered into four sequence process :

- the first sequence of processes (MBR/ACA) is: membrane bioreactor (MBR) and activated carbon absorption (ACA), 3 sites (Belderbusch (BDB), Cour-au-Bois (CAB) and Froidchapelle (FRO)) are thus equipped
- the second (AS/Clar-Floc/ACA) combines activated sludge (AS) as biological process with clarification-flocculation process (Clar-Floc), Biological Aerated Filtration System (BAFS) and ACA for completion. The sites of Tenneville (TNV) and Habay-la-Neuve (HLN) are equipped with this process
- the third sequence of processes (MBR/O_3) is composed of MBR and ozone oxidation process for completion. Only one site, Happe-Chapois (HCP) is equipped with this process
- the fourth is composed of a single reverse osmosis process (Rev. Osmosis) and installed in Hallembaye 1 and 2

Results and discussion

The results of the study are presented in three stages. The first stage assess PAHs content in leachate. The second deals with PAHs reduction in leachate treatment plants and the third with assessment of residual PAHs in the leachate treatment plant permeates.

In the first stage, the PAHs content in leachate is low and variable. In fact, values of the various PAHs components are generally lower than the range described by Andréotola (1997).

In the second stage, the study shows that the PAHs reduction in the leachate studied is high in general for the four standard sequences of process plants in particular;

- the first sequence of processes gives the best results of PAHs elimination, as well as for the sum of 15 PAHs, as for the sum of 6-Borneff, as for naphthalene and as for anthracene. The rate of reduction is higher than 98 %.
- the second sequence of processes plants gives also good results of PAHs reduction (96%), in spite of a light weakness in naphthalene reduction.

- the third sequence of processes plant gives intermediate results. Indeed, if the results of PAHs reduction for 15 PAHs and 6-Borneff are not bad (87% and 94%), the reduction of naphthalene (the most important PAH in quantity) is a problem.
- the fourth group of plants composed of a single reverse osmosis process (Hallembaye 1 and 2 are the sites equipped with this plant) give the worse results in PAHs elimination. This is worth as well for 15 PAHs as for the 6-Borneff and for the naphthalene which is the most responsible of this weak elimination rate.

In the third stage, we observed the fulfilment of leachate treatment plants permeate with the quality requirements of the European directive 2000/60/EC. The quality requirement for Wallonia implies to be below the emission limit value of 100 ng/l for 6-Borneff and for anthracene and 1000 ng/l for naphtalene. The results, except one case, show that all the plants release permeates in respect to the quality requirements of the 2000/60/EC Directive in the field of PAHs. The exception relates to the installations of reverse osmosis process. Indeed, in this group, naphthalene poses a huge problem because it is the only substance which exceeds the limiting value, of almost three times in one cases and remains alarming in the other one.

Conclusions

The leachate content in PAHs is variable. The reduction of PAHs in treatment plants is a reality, but this reduction is variable according to leachate treatment sequence process and according to PAHs substances considered. Indeed, the reduction ratios of naphthalene are lowest. The residual content of PAHs in the permeates shows that, as much for PAHs 6-Borneff as for the anthracene and the naphthalene, their concentration is really below the emission limit values applied for three of leachate treatment plant types. For the fourth, provided with reverse osmosis unit process, it has values beyond the emission limit value for naphthalene. This can be due to a high threshold of cut of the membrane.
Finally, we can conclude in this study that the Directive implies no heavy changes for leachate treatment plants managements in Wallonia.