



## Grafted cellulose for PAHs removal present in industrial discharge waters

Elise Euvrard (1), Coline Druart (1), Amandine Poupenev (1), Nadia Crini (1), Elena Vismara (2), Tommaso Lanza (2), Giangiacomo Torri (3), Sophie Gavaille (4), and Gregorio Crini (1)

(1) Laboratoire Chrono-Environnement, UMR 6249 usc INRA, Université de Franche-Comté, Place Leclerc, 25000 Besançon, France, (2) Dipartimento di Chimica, Ingegneria Chimica e Materiali G. Natta del Politecnico di Milano, 7 Via Mancinelli, 20131 Milano, Italy, (3) Istituto di Ricerche Chimiche e Biomediche G. Ronzoni, 81 Via G. Colombo, 20133 Milano, Italy, (4) Agence de l'eau Rhône Méditerranée Corse, 34 rue de la Corvée, 25000 Besançon, France

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Polycyclic aromatic hydrocarbons (PAHs), chemicals essentially formed during incomplete combustion of organic materials from anthropogenic activities, were present in all compartments of the ecosystem, air, water and soil. Notably, a part of PAHs found in aquatic system was introduced through industrial discharge waters. Since the Water Framework Directive has classified certain PAHs as priority hazardous substances, industrials are called to take account this kind of organic pollutants in their global environmental concern. Conventional materials such as activated carbons definitively proved their worth as finishing treatment systems but remained costly. In this study, we proposed to use cellulose grafted with glycidyl methacrylate [1] for the removal of PAHs present in discharge waters of surface treatment industries. Firstly, to develop the device, we worked with synthetic solutions containing 16 PAHs at 500 ng/L. Two types of grafted cellulose were tested over a closed-loop column with a concentration of 4g cellulose/L: cellulose C2 with a hydroxide group and cellulose C4 with an amine group. No PAH was retained by the raw cellulose whereas abatement percentages of PAHs were similar between C2 and C4 (94% and 98%, respectively, for the sum of the 16 PAHs) with an experiment duration of 400 min (corresponding to about 20 cycles through grafted cellulose). Secondly, to determine the shorter time to abate the amount maximum of PAHs through the system, a kinetic was realized from 20 min (one cycle) to 400 min with C4. The steady state (corresponding to about 95% of abatement of the total PAHs) was reached at 160 min. Finally, the system was then tested with real industrial discharge waters containing both mineral and organic compounds. The results indicated that the abatement percentage of PAHs was similar between C2 and C4, corroborating the tests with synthetic solution. In return, the grafted cellulose showed lower adsorption capacities of PAHs (about 40% for the total PAH content) when they were in real effluents than they were in synthetic solutions. However, it was observed that PAH composition in discharge waters was different than in synthetic solutions, qualitatively and quantitatively. Despite the presence of numerous other substances in industrial effluents at high concentrations (for instance metals equal to mg/L and salts to g/L), the grafted cellulose was demonstrated as suitable to remove organic substances at trace levels like PAHs (equal to ng/L).

### Reference:

[1] Vismara E., Melone L., Gastaldi G., Cosentino C., Torri G. J. Hazardous Mat. 170 (2009) 798-808.

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