SURFACE MODIFICATION OF POLYETHERSULFONE MEMBRANES BY CATECHOL AND POLYETHYLEIMINE TO REMOVAL REACTIVE DYES FROM TEXTILE WASTEWATER

Maria Teresa Pessoa de Amorim, University of Minho, Portugal
mtamorim@det.uminho.pt

The application of ionic adsorbent to the microfiltration membrane to remove reactive dyes from industrial wastewaters from cotton dyeing process is an environmentally friendly technique which allows significant reductions in energy consumption as compared with the conventional process required for the removal of these dyes the nanofiltration membranes This work studies the co-deposition of catechol and polyethyleneimine on porous polyethersulfone microfiltration membranes (PMM), and their application to removal of color from textile effluents. The PMM was a commercial product from Sartorious Stedim Biotech, with an average pore size of 0.2 µm, hydrophobic. Catechol (Cc) and Polyethyleneimine (PEI) were dissolved in Tris buffer solution and the concentration of catechol was fixed at 1 mg mL^{-1}. PMM samples were pre-wetted and then immersed into the freshly prepared reaction solutions (1 : 0.2 and 1 : 0.5 ratio of Cc-PEI). This method is adapted already described in literature, and the textile industry wastewater dyeing result from a trichromy of Novacron® reactive dyes. Until now, the characterization/monitoring of the membranes was realized by FT-IR/ATR (wavenumber 600 – 4000 cm^{-1}), hydraulic permeability, hydraulic flux, membrane resistance, UV-VIS. absorption (436, 525 and 620 nm), pH and conductivity. The experiments were carried in a stirred cell (Sterlitech®, model HP 4750). Filtrates were collected until 25 minutes, for each experiment, the filtration was repeated 3 times with the same membrane and during all experiments. The driving force is the height of the water/wastewater column in stirred cell (7 cm) and the pH of industrial wastewater is not adjusted (pH 9,7).

The results of the FT-IR/ATR indicate that the deposition on the membrane superficies in ratio 1:0.2 is higher than 1:0.5 Cc – PEI (wavenumbers: 1500 – 1700 cm^{-1} and 3500 – 3700 cm^{-1}) (more amines or imines groups and carboxyl groups). The decolorization of dye wastewater is greater with the deposition 1:0.2, the resulted main is summarized in Figure 1.

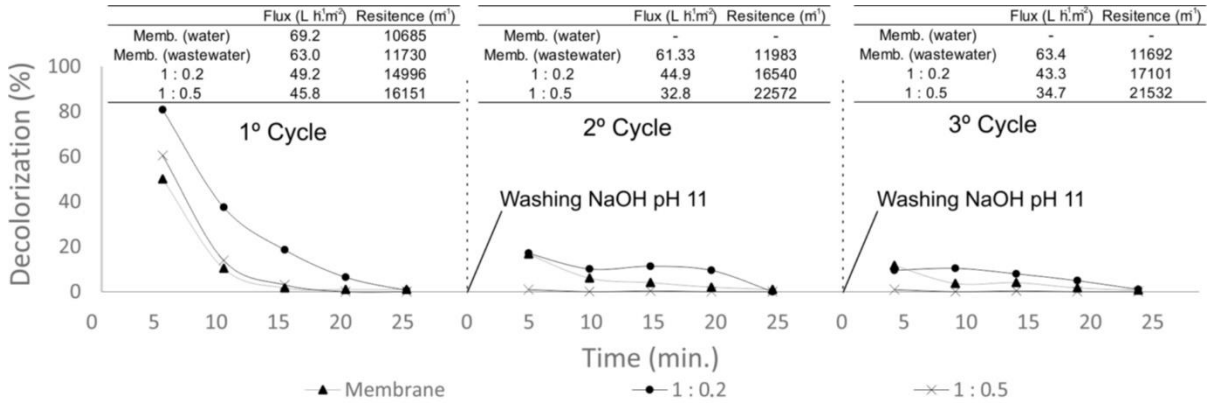

Figure 1 – Decolorization of wastewater at 436 nm (%), permeate flux (L $h^{-1}.m^{-2}$) (medium), and membrane resistance (m^{-1}) (medium) over three cycles of operation.

The preliminary results of this research indicate that ratio of 1:0.2 of Cc-PEI are promissory, with possibility of the improving the performance of the membranes. This is justified by PEI accelerate the cross-linking of Cc–PEI to form aggregates, which continuously deposit on the membrane surfaces. However, an excessive amount of PEI is likely to suppress the covalent binding among aryl rings and stacking of catechol via oxidation, and thus to disintegrate the aggregate formation for deposition. The separation of dye wastewater, likely, based on the principle of adsorption, but to better explain will be need more experiments, others ratios of the Cc-PEI, different pH and study of adsorption. Therefore, further work is in progress in order to study this method as an environmentally friendly technique to treat the dye textile wastewater and allow the water reuse.