

# Optimizing separation of antioxidants from polyethylene used in landfill geomembranes

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## Introduction

Along with incineration, storage is the most common method to dispose of non-hazardous waste in France. In order to prevent environmental pollution due to leachate (water that has been exposed to waste) escaping into the soil, the bottom and the sides of the landfill are lined with a geomembrane. This geomembrane is usually composed of high density polyethylene, and to reduce its aging, stabilizers or antioxidants, are added. The aim of this study was to characterize the antioxidants previously extracted from the geomembrane by chromatography.

## Equipment

Extracted antioxidants were analyzed by HPLC using a system composed of a WATERS 2707 autosampler chromatograph, a WATERS 486 UV detector and a WATERS 600 pump. Detection was made using a UV detector and fixed at a wavelength of 270 nm. The stationary phase was a C18 column 5  $\mu\text{m}$ , 150 x 4.6 mm. The mobile phase consisted of acetonitrile (ACN) and tetrahydrofuran (THF) at 1  $\text{mL}\cdot\text{min}^{-1}$  flow rate.

## Experimental procedure and results

Firstly, analysis was performed with ACN isocratic eluant (fig 1). On the chromatogram, there was a major peak at 17.14 minutes. There were also low intensity peaks between 10 and 47 minutes. Subsequently in order to reduce time analysis as well as to increase the resolution, more strength eluant was needed. Because of its lower polarity, THF is more eluant than ACN. Once the choice of eluents was made, the antioxidants were separated with an ACN / THF gradient elution. The following gradient was used: linear gradient at 10% THF and 90% ACN to 35% THF and 65% ACN over 10 minutes; washing column with 90% THF and 10% ACN for 2 minutes, and re-equilibrating column for 20 minutes at 10% THF and 90% ACN. Chromatograms obtained were performed under optimal conditions (fig 2). The analysis time was shorter and the chromatographic peaks were better resolved than before. For example, the major peak was at 8.6 minutes

## Conclusion

To conclude, the antioxidant separation was optimized with an ACN/THF gradient eluant and the analysis time was reduced to 14min. When the nature of antioxidants will be identified, the composition of mixture of the antioxidants will allow understanding the geomembrane degradation used in landfills.

Figure 1 : Chromatogram of the extracted solution with a ACN solvent elution

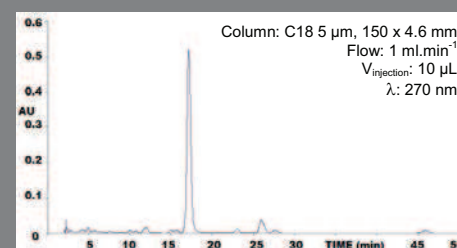
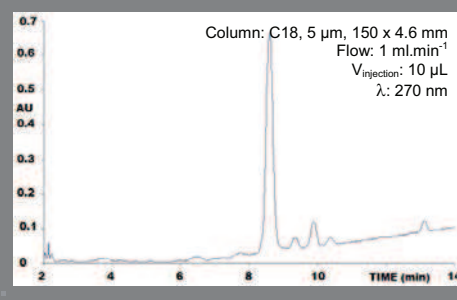


Figure 2 : Chromatogram of the extracted solution with ACN/THF solvents elution gradient



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