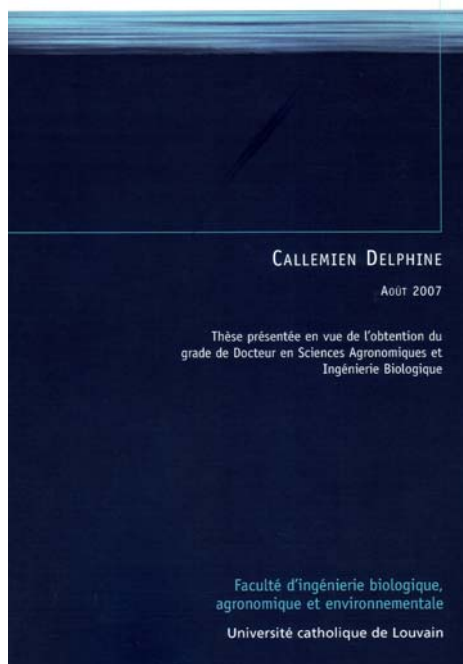


## Use of New Methodologies to Study Phenolic Compounds Implicated in Beer Staling



The goal of our thesis was to better understand the fate of polyphenols through beer storage. First, new methodologies were needed to assess what happens to polyphenols in the bottled beer. They were optimized on fresh beer samples. NP-HPLC-ESI(-)-MS/MS with addition of ammonium salt revealed efficient to quantify monomers to trimers in a Sephadex LH20 acetone/water (70/30, v/v) beer extract: up to 3 ppm P1-P3 were measured in PVPP-treated beers vs. 10 ppm in silica gel-filtered beers. Thiolytic analysis of such extracts indicated that most beer dimers are procyanidins whilst most trimers are prodelfinidins. Detailed structures of each oligomer were determined by reversed phase. As expected according to thioacidolysis data, most beer proanthocyanidins carry a catechin as terminal unit. The analysis of higher oligomers extracted by dialysis and thiolized lead us to conclude that "natural" beer oligomers exhibit a relatively low DP whilst transformed oligomers probably account for most of the "heavy" flavanoid content. The optimized methods were then applied on aged beers. Three lager beers differently stabilized before bottling in glass or PET bottles were monitored over a one-year period of storage at 20°C. In parallel, beer color was measured. Structural rearrangements of polyphenols revealed to be the main source of color changes. The evolution of color was the same in the silica gel-filtered beer as in identically bottled PVPP-treated samples, despite the high flavanoid dimers content of the former. This suggests that only monomers must be considered. Model media were also investigated by the same method. (+)-Catechin emerged as the precursor of less polar products characterized by a yellow-brown color. Similar structures were found in aged beers spiked with (+)-catechin. None of the usual global assays revealed efficient to predict the extent of beer polyphenol degradation.

*Delphine Callemien est née le 10 Juillet 1978 à Etterbeek (Belgique).  
Ingénieur Chimiste et des Bio-Industries spécialisée en chimie organique et biologique  
(Juin 2001), elle a obtenu le Prix InBev-Baillet Latour pour réaliser sa thèse.*