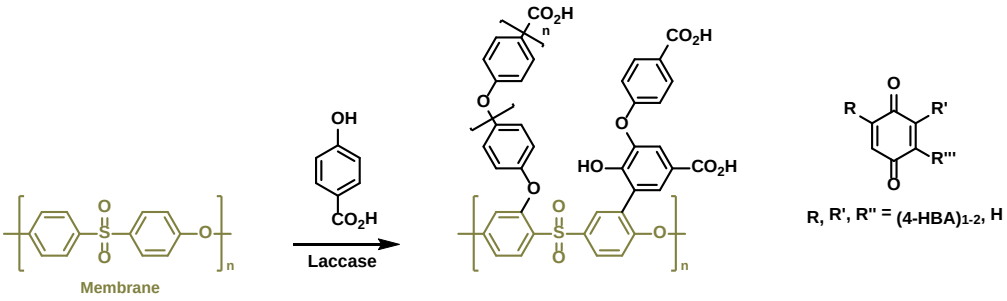
Sjoerd Slagman

Supervisor(s)	Dr. Maurice Franssen, Prof. Dr. Han Zuilhof
Project	Unravelling the Complexity of Laccase Mediated 4-Hydroxybenzoic Acid Oligomerization
Fields of interest	Membranes, organic synthesis, enzyme chemistry & applied analytical chemistry
E-mail	Sjoerd.slagman@wur.nl
Telephone	+31 317 482369

Poly(ethersulfone) membranes are essential in fluid filtration and water purification purposes. These membranes however suffer from severe fouling by (bio-)molecules due to their apolar nature. Previous work within the Laboratory of Organic Chemistry focussed on improving the anti-fouling properties of these membranes by employing an environmentally benign laccase mediated process in which 4-hydroxybenzoic acid was grafted on the surface of the membrane.



In order to further improve the anti-fouling effect one has to look into the mechanistic details of the grafting process. Thus far, however, the molecular structure of the modified membrane has not been elucidated. Direct structural characterization of the membrane is almost impossible; therefore the laccase mediated modification of 4-hydroxybenzoic acid was first studied in solution.

The enzyme laccase generates radicals of phenolic species which undergo further coupling reactions. In this rather uncontrolled process a wide range of products is formed. Separation and characterization by LC-MS revealed the two main products to be dimers of 4-hydroxybenzoic acid which are either coupled through a C-C bond or a C-O bond which was confirmed by chemical synthesis. Further investigation of the LC-MS results lead to the discovery of the probable formation of benzoquinones. Employing preparative HPLC and again synthesis should shine light on the structure of these tentative benzoquinones.

In order to translate these results to the actual nature of the modified membrane, solid phase membrane mimicry will be employed. Either one unit of 4-hydroxybenzoic acid or a small poly(ethersulfone) fragment can be immobilized on a resin which in essence mimics the (mono-functionalized) membrane. This mimic can then undergo laccase modification after which it can be isolated from the bulk. After cleavage of the resin one is left with small molecules which are ready for further analysis.