INCORPORATION OF FLUORESCENT TAGS IN POLYMERS

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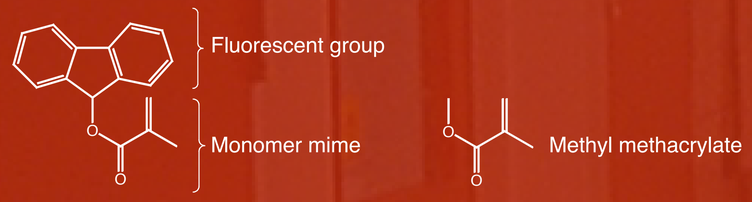
Recent developments in the Polymer Group has led to routes for the preparation of amphiphilic triblock copolymers such as PDMAEMA-PDMS-PDMAEMA that will be studied for medical applications.

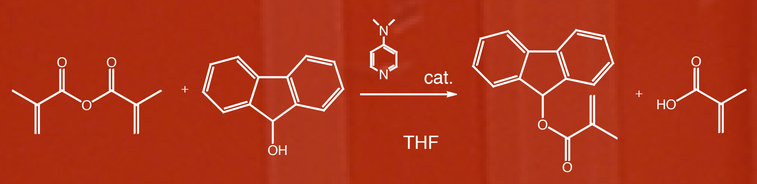
To evaluate them as new medications we had the idea to incorporate fluorescent tags so that polymers will have the ability to be tracked in a biological environment. We studied PMMA because it is a more simple process and comparisons can easily be made with PDMAEMA.

Synthesis of the fluorescent monomer 9-Fluorenyl methacrylate

The properties of 9-fluorenyl methacrylate rely on the fluorenyl group which introduces the ability to fluoresce and the methacrylate part that ensures it's incorporation into the polymer because of it's close structure to the methyl methacrylate monomer.

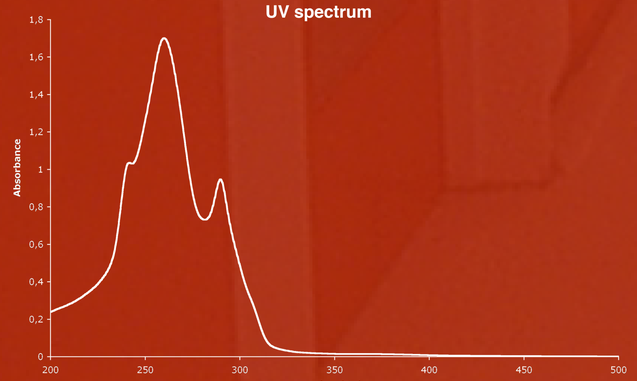


Its synthesis starts from the 9-hydroxyfluoren alcohol which is coupled with methacrylate anhydride.

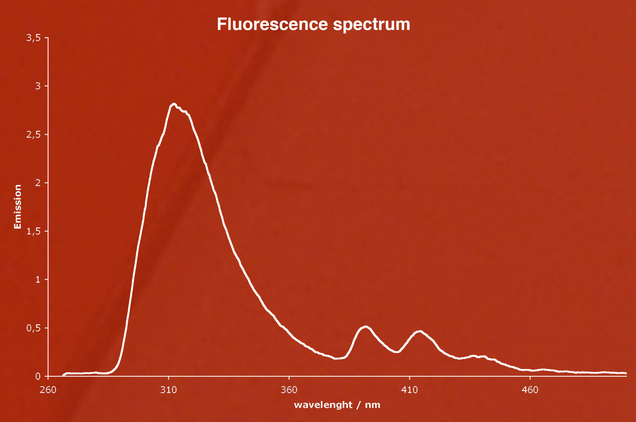


Optical properties of 9-fluorenyl methacrylate

UV spectroscopy reveals a maximum absorbance at 260 nm.

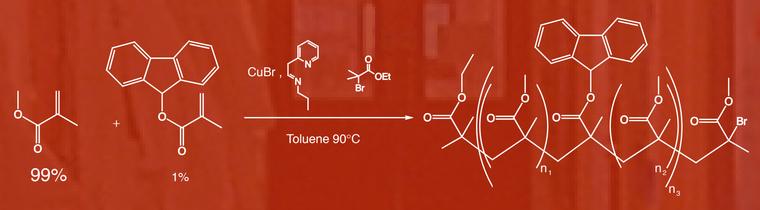


The fluorescence spectrum at an excitation wavelength of 260 nm which will be compared with the spectrum of the tagged polymer

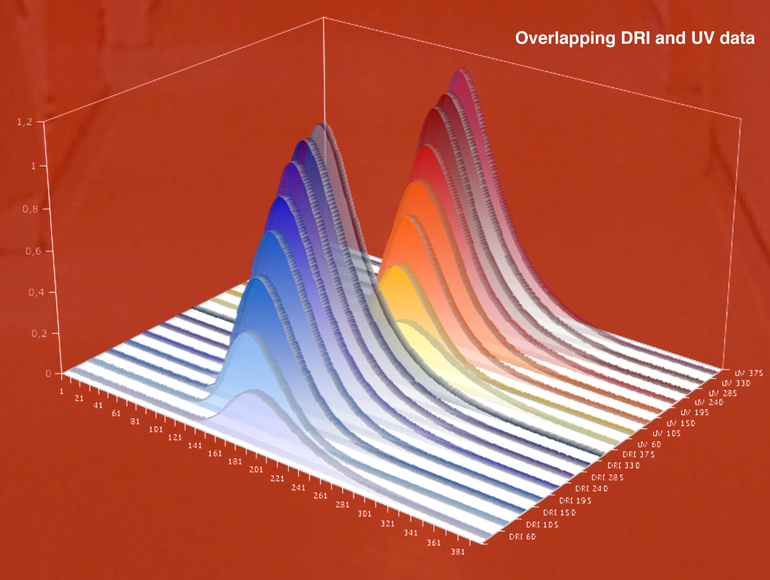


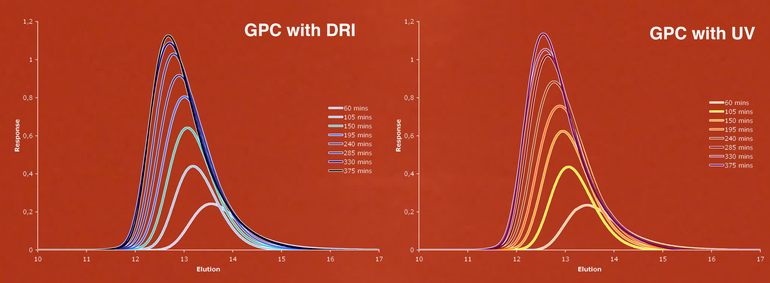
Copolymerization of MMA with 9-fluorenyl methacrylate

The reaction scheme is close to that for a normal PMMA synthesis with the exception of the presence of a fluorescent monomer.

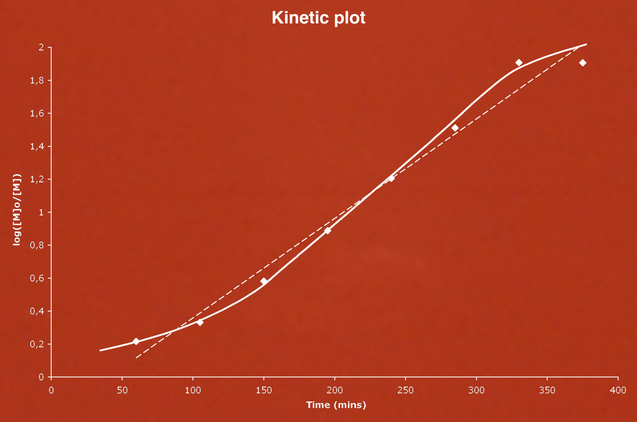


Polymerization was monitored by GPC using both DRI and UV detectors but only the fluorescent tag is responsive to UV absorbance. Overlapping of DRI and UV data makes obvious the incorporation of the fluorescent monomer in the polymer chain.





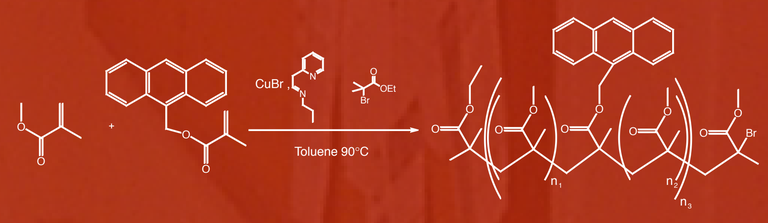
The rate of reaction is excellent with 85% conversion achieved after 6 hours and polydispersity is narrow at 1.17 for a M_n of 6620 g.mol^{-1}.



Optical properties of tagged polymers

A fluorescence spectrum at 260 nm of the polymer shows that the target of tagged PMMA was successfully reached.

Similar experiments were carried out with 9-anthracenemethyl methacrylate as the fluorescent monomer which led to equally successful results.



Latest experiments has shown that copolymerizations with our fluorescent monomers were possible with DMAEMA to lead to a tagged PDMAEMA as succesfully as PMMA before.

Conclusion and future work

We have carried out the synthesis of a new range of monomers with the ability to fluoresce. Moreover, the method we performed can easily be used to prepare many other fluorescent monomers as well as other functionalised monomers.

We succeeded in carrying out well-controlled copolymerizations of MMA and DMAEMA with our new fluorescent monomers with satisfying kenetics to give tagged polymer with narrow polydispersities.

To promote the studies of the biological properties of the PDMAEMA-PDMS-PDMAEMA it could be useful to perform a copolymerization of DMAEMA and a fluorescent monomer during its synthesis.

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