

### **Assembly of Polyethylene Glycol Terminated Thiols (PEG-thiols)**

Polyethylene glycol (PEG) has received a lot of attention over the years due to its non-fouling properties or ability to resist protein adsorption. Early work in creating non-fouling PEG surfaces consisted of immobilizing PEG polymers of various molecular weights to different types of materials. In an effort to further understand the mechanism of non-fouling surfaces, Whitesides and coworkers began testing the protein adsorption behavior of oligo-ethylene glycol terminated self-assembled monolayers (PEG-thiols).<sup>1</sup> This research led to further investigation into the mechanism of non-fouling surfaces resulting not only in interesting insights into the mechanism of PEG protein resistance, but also important facts about PEG-thiols. Including:

- The non-fouling behavior of PEG-thiols depends on the way the thiols are assembled and the final state of the monolayer on the surface.
- The final state of the monolayer depends on:
  - The assembly solvent<sup>2</sup>
  - The assembly temperature
  - The assembly time
- The oligo-ethylene glycol terminus of PEG-thiols may be susceptible to cleavage in the presence of trace metals.

These are very important facts to consider as they suggest that the non-fouling properties of a PEG thiol monolayer are more dependent on the method of self-assembly than on the nature of the thiol itself.

For PEG thiols on gold it has been suggested that:

- Less ordered, amorphous monolayers are more protein resistant than highly ordered, crystalline monolayers.<sup>2,4</sup>
- PEG-thiols adsorbed from 95% Ethanol/5% water form more ordered monolayers<sup>2</sup>
- PEG-thiols adsorbed from pure ethanol or water form less ordered monolayers<sup>2</sup>

It should be noted that no standard definition of "non-fouling" has been established. It is important to understand what criterion is used to determine if a surface is non-fouling or not. In most cases non-fouling is defined as observing little to no adsorption based on the monitoring technique being used. However, different measurement techniques can have widely different sensitivities. Therefore it is possible that what is defined as non-fouling by one measurement technique, may still be found to be fouling by a different technique.

Due to the complexities of assembling PEG-thiol for the generation of non-fouling surfaces, it is recommended that a thorough literature search, combined with trial and error be used in determining the optimum assembly conditions for a given application.

#### **References:**

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