

# ML 11

## LOADING AND RELEASE OF BIOCIDES IN BLOCK-COPOLYMER MICELLES

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The kinetics of loading of polystyrene<sub>197</sub>-block-poly (acrylic acid)<sub>47</sub> (PS<sub>197</sub>-b-PAA<sub>47</sub>) micelles, suspended in water, with thiocyanomethylthiobenzothiazole (TCMTB) biocide, and its subsequent release was investigated. Loading of the micelles was found to be a two step process. First, the surface of the PS core of the micelles is saturated with biocide, with a rate determined by the transfer of solid biocide to micelles during transient micelle – biocide contacts. Next, the biocide penetrates as a front into the micelles, lowering the  $T_g$  in the process (Non-Fickian case II diffusion). The slow rate of release is governed by the height of the energy barrier which a biocide molecule must overcome to pass from the PS into the water, resulting in a uniform biocide concentration within the micelle, until the  $T_g$  is increased to the point that diffusion inside the micelles becomes very slow. Maximum loading of biocide into micelles is around 30 % (w/w) and is achieved in one hour. From partition experiments it can be concluded that the biocide has a similar preference for polystyrene as for ethylbenzene over water, implying that the maximum loading is governed by thermodynamics.