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Structural investigation on PTX-loaded poly(2-oxazoline) molecular brushes

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Poly(2-alkyl-2-oxazoline)s (POx) feature tunable thermoresponsive properties and good biocompatibility, which make them suitable for biomedical applications, e.g. as drug carriers. In the present work, two POx-based molecular brushes, featuring PMeOx-b-PBuOx block copolymer side arms densely grafted on a poly(methacrylic acid) backbone, are investigated in aqueous solution. Whereas the hydrophobic PBuOx blocks are attached to the backbone, the hydrophilic PMeOx blocks form the periphery of the molecular brush. This architecture is suitable for drug delivery applications, since the PBuOx core can accommodate the hydrophobic anticancer drug, Paclitaxel (PTX), whereas the PMeOx shell ensures water solubility.

Using small-angle neutron scattering (SANS) at KWS-1, FRM II, the inner structure of the PTX-loaded molecular brushes with different degrees of polymerization of the backbone was investigated. The PTX/polymer weight ratio was varied from 0.1/10 to 5/10. Both brushes are elongated ellipsoids of core-shell type, with the dimension in polar direction corresponding to the backbone length. Upon PTX loading, the structure of the molecular brushes stays unchanged up to a PTX/polymer weight ratio of 1/10, whereas, above, the molecular brushes form aggregates. The brushes with higher PTX loading have significantly different structures and precipitate within few months. The stability of the drug-loaded molecular brushes is thus strongly dependent on the amount of the drug.

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