Electronic Supplementary Information

Poly(allylamine)/tripolyphosphate coacervates enable high loading and multiple-month release of weakly amphiphilic anionic drugs: An in vitro study with ibuprofen

Udaka K. de Silva,[1] Jennifer L. Brown[1,‡] and Yakov Lapitsky[1,2,*]

[1] *Department of Chemical Engineering, University of Toledo, Toledo, Ohio 43606*

[2] *School of Green Chemistry and Engineering, University of Toledo, Toledo, Ohio 43606*

‡*Current Address: Department of Chemical Engineering, University of California, Santa Barbara, California 93106*

A. Raw ITC Data. The raw ITC data, where each peak corresponds to a single ibuprofen injection, is exemplified in Fig. S1. The thermograms reveal flat baselines that enable straightforward integration/determination of the heat absorbed (or evolved) from each ibuprofen injection. The control measurements show that ibuprofen heat of dilution, which is caused by the 10-μl injection of ibuprofen solution into a much-larger (~ 1.5 ml) solution volume inside the sample cell, is weakly exothermic.

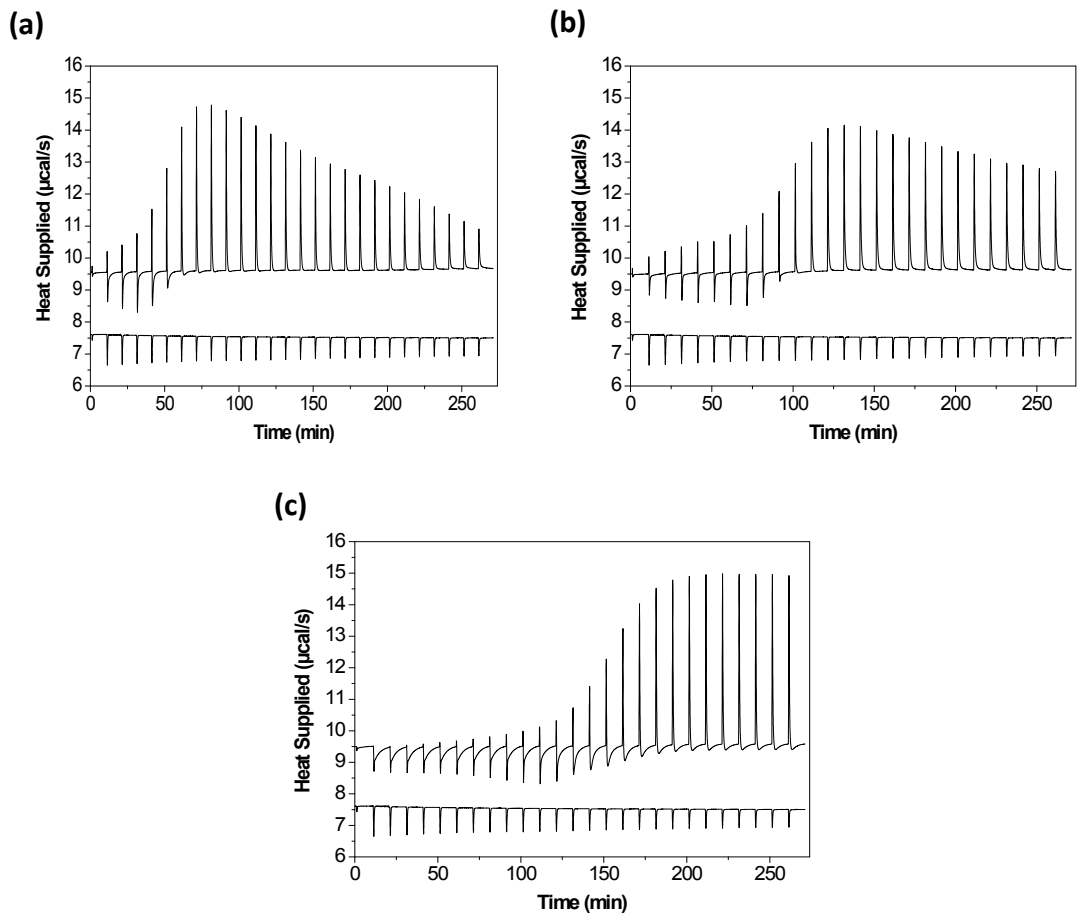

Fig. S1. Representative raw ITC data for 15 mM ibuprofen injected into (a) 5 mM, (b) 10 mM and (c) 30 mM PAH at pH 7.0 (without added TPP). The upper curves were obtained by injecting 15 mM ibuprofen into PAH solutions while the lower curves were the control (heat of dilution) measurements obtained by injecting 15 mM ibuprofen into pH 7.0 water.

Another notable feature of the raw ITC data is that some of the enthalpic peaks, which were obtained upon injecting ibuprofen into PAH solution (particularly those that preceded the CAC; see Section 3.1), had complex shapes. In Fig. S1a and b, for instance, the first few ibuprofen injections resulted in endothermic peaks, immediately followed by exothermic ones. These complex peaks likely reflected the initial endothermic binding of ibuprofen to the PAH being followed by the exothermic PAH/ibuprofen dissociation. Here, the initial binding was caused by the local ibuprofen concentration at the injection site being above the CAC, while the subsequent dissociation occurred as the PAH/ibuprofen mixtures became uniformly mixed (and

ibuprofen concentration dropped below the CAC throughout the entire sample cell). Once the CAC was exceeded, however, the complex peak shapes in Fig. S1a and b disappeared (since the initially formed PAH/ibuprofen complexes ceased to dissociate upon mixing), and further ibuprofen addition yielded simple endothermic PAH/ibuprofen binding peaks. In Fig. S1c (where the PAH concentration was much higher), the PAH/ibuprofen binding was weaker than at the lower PAH concentrations (in Fig. S1a and b) and the complex peaks did not develop until later in the thermogram. Moreover, the dilution/dissociation exothermic peaks in this thermogram were significantly broader, possibly due to the slower mixing of the more concentrated and viscous PAH solution.

B. Rheology of SDS- and SDBS-Loaded PAH/TPP Coacervates. Unlike the uptake of weakly amphiphilic and weakly binding ibuprofen, the uptake of strong anionic amphiphiles, SDS and SDBS, significantly softened the coacervates (especially at low oscillation frequencies; cf. Figs. 4 and S3). This effect likely reflected the strong PAH/SDS and PAH/SDBS binding interfering with PAH/TPP association.

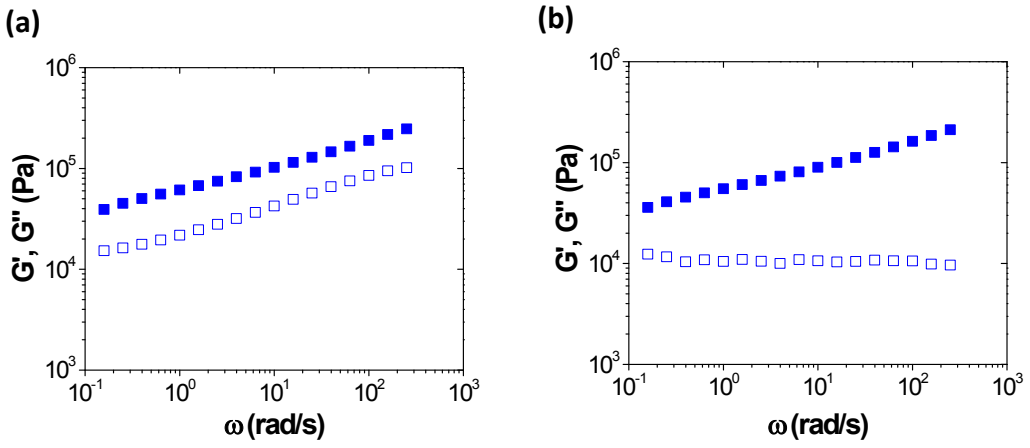

Fig. S3. Frequency sweeps comparing (■) G' and (□) G" of PAH/TPP coacervates formed in the presence of 24.3 mM (a) SDS and (b) SDBS.