

## Supplementary Information

# Arginine-functionalised hydrogels as a novel atmospheric water-harvesting material

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# <sup>1</sup>H NMR spectra derived from P1-P4

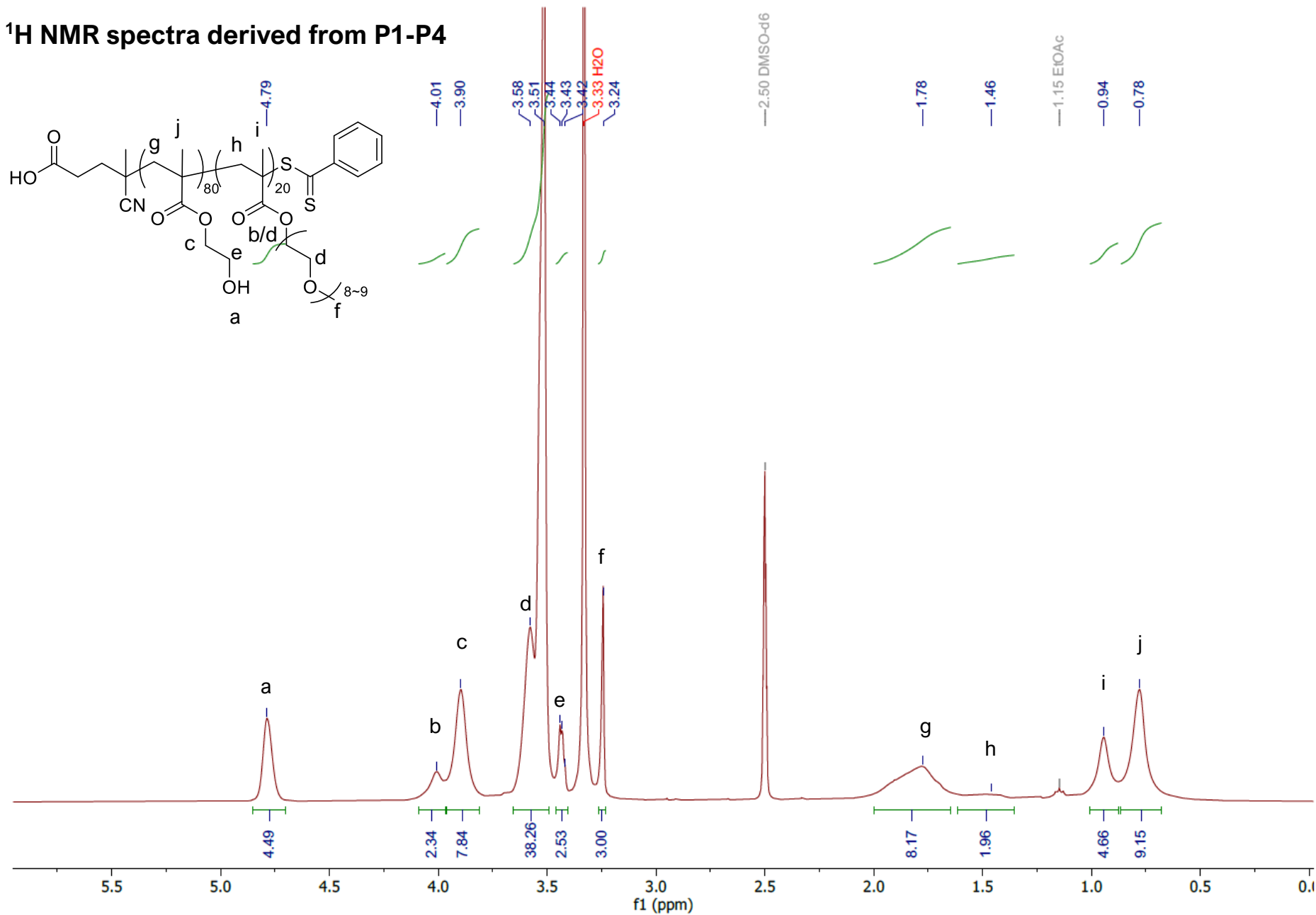


Figure S1: 400 MHz <sup>1</sup>H NMR of poly(HEMA<sub>80</sub>-co-PEGMA<sub>20</sub>) (P1) (Recorded in DMSO-d<sub>6</sub>)

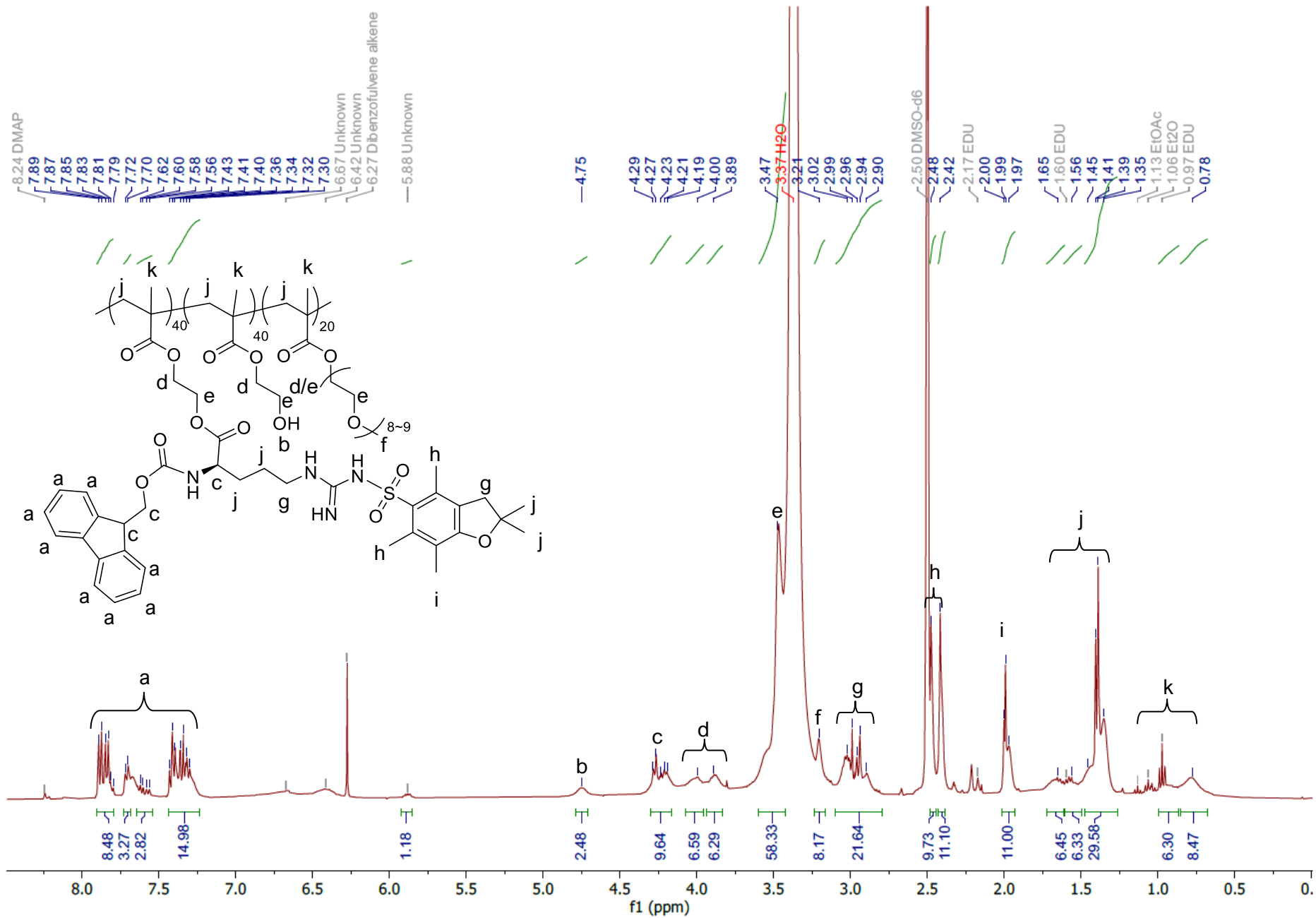


Figure S2: 400 MHz <sup>1</sup>H NMR of poly((Fmoc-Arg(Pbf))MA<sub>40</sub>-co-HEMA<sub>40</sub>-co-PEGMA<sub>20</sub>) (**P2**) (Recorded in DMSO-d<sup>6</sup>)

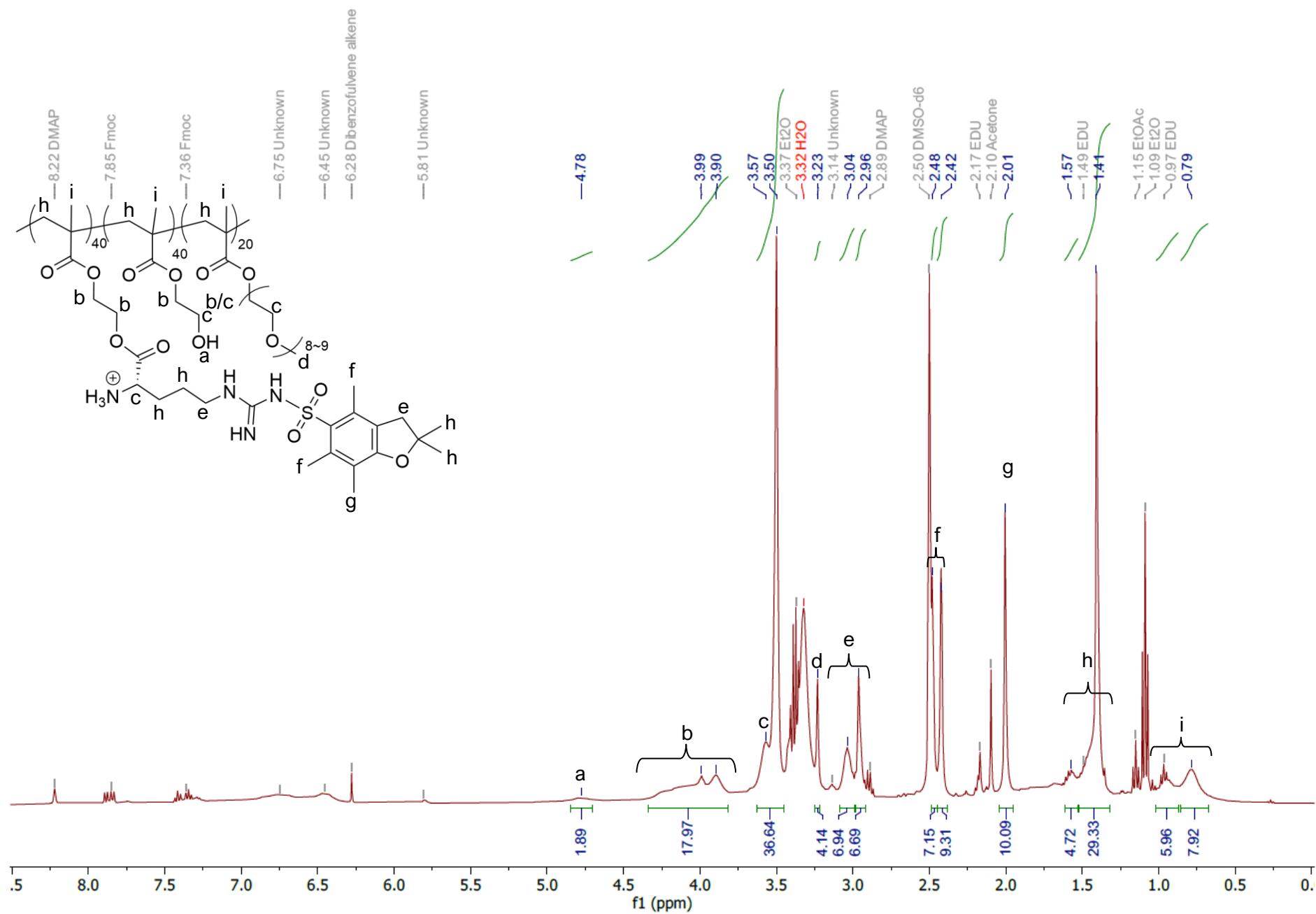


Figure S3: 400 MHz  $^1\text{H}$  NMR of poly(Arg(Pbf)MA<sub>40</sub>-co-HEMA<sub>40</sub>-co-PEGMA<sub>20</sub>) (**P3**) (Recorded in DMSO-d<sub>6</sub>)

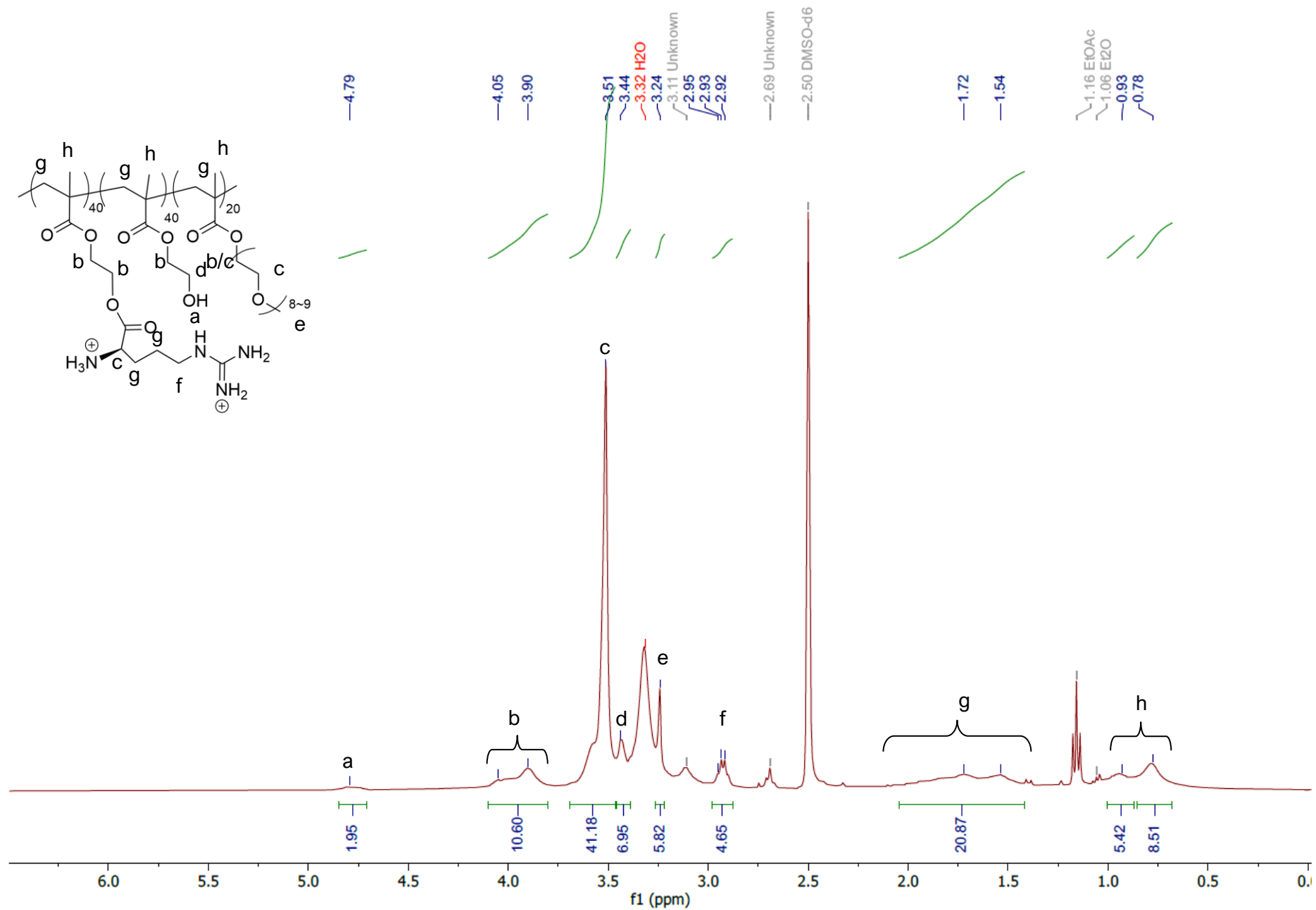


Figure S4: 400 MHz <sup>1</sup>H NMR of poly(ArgMA<sub>40</sub>-co-HEMA<sub>40</sub>-co-PEGMA<sub>20</sub>) (P4) (Recorded in DMSO-d<sub>6</sub>)

## FTIR

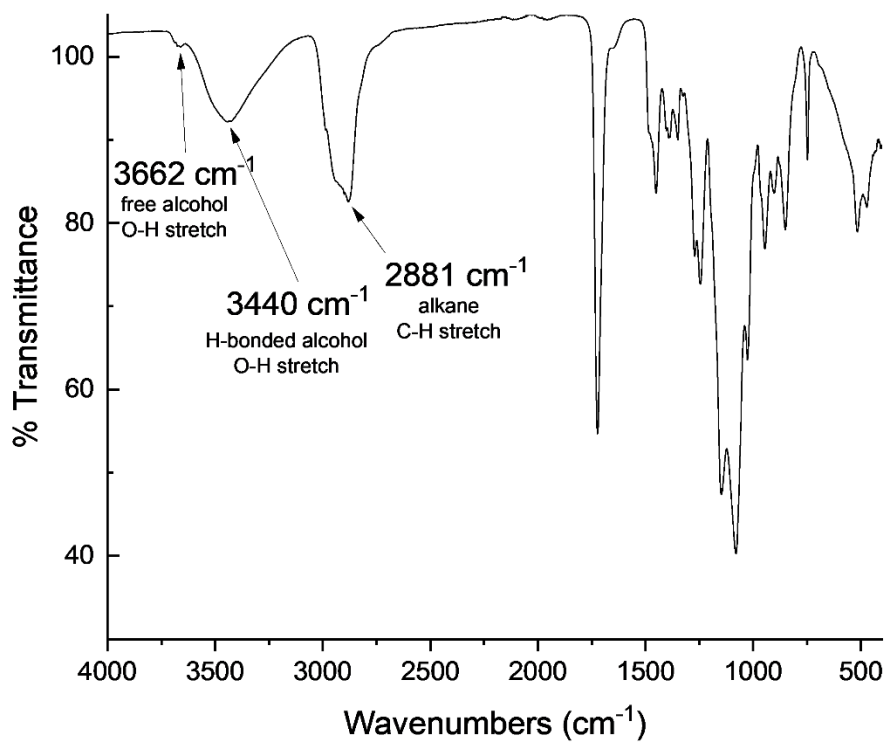


Figure S5: FTIR spectrum of poly(HEMA<sub>80</sub>-co-PEGMA<sub>20</sub>) (P1)

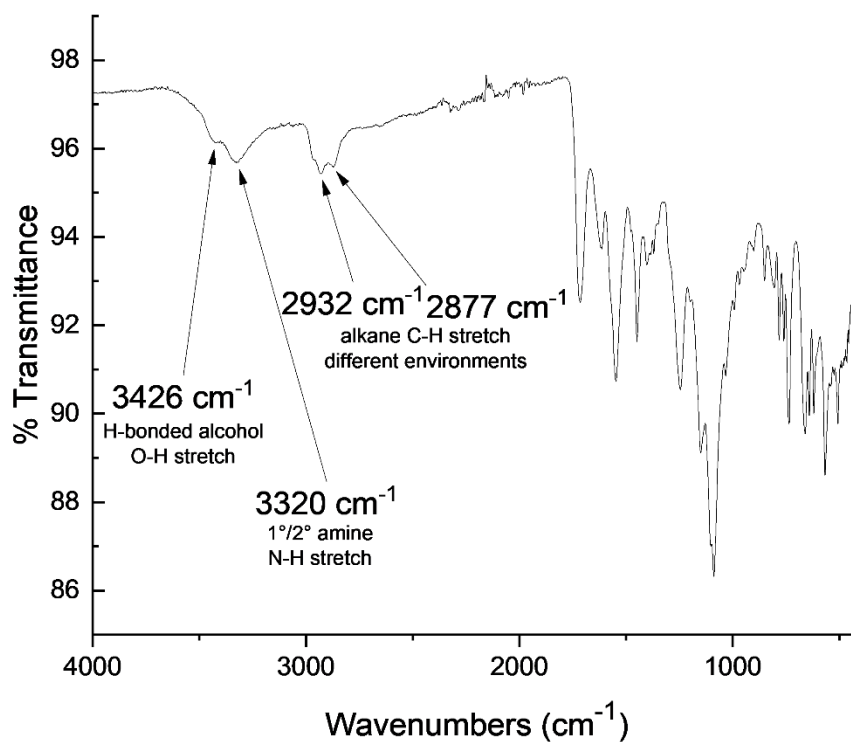
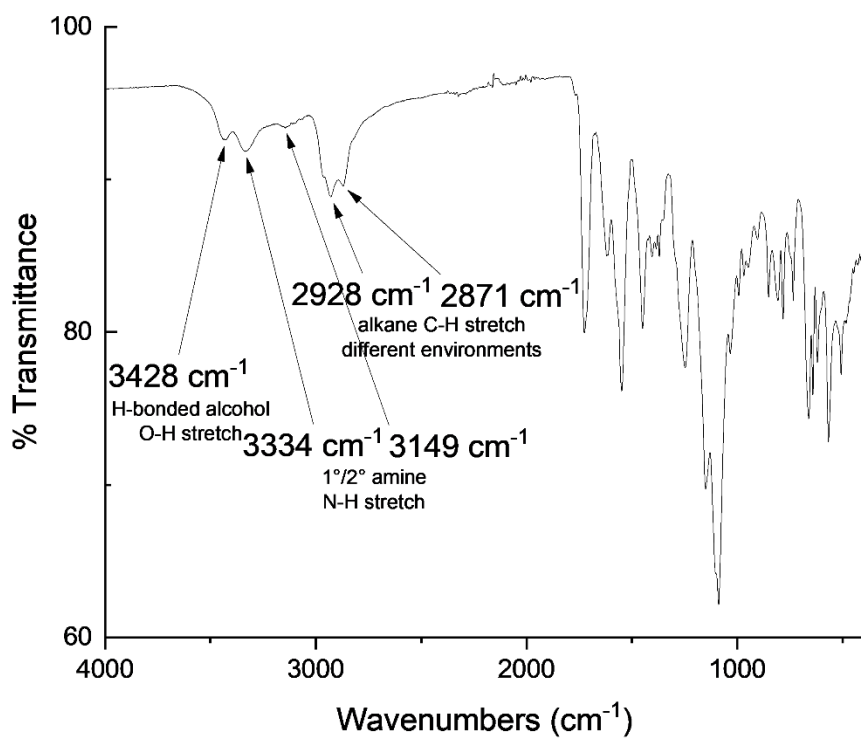
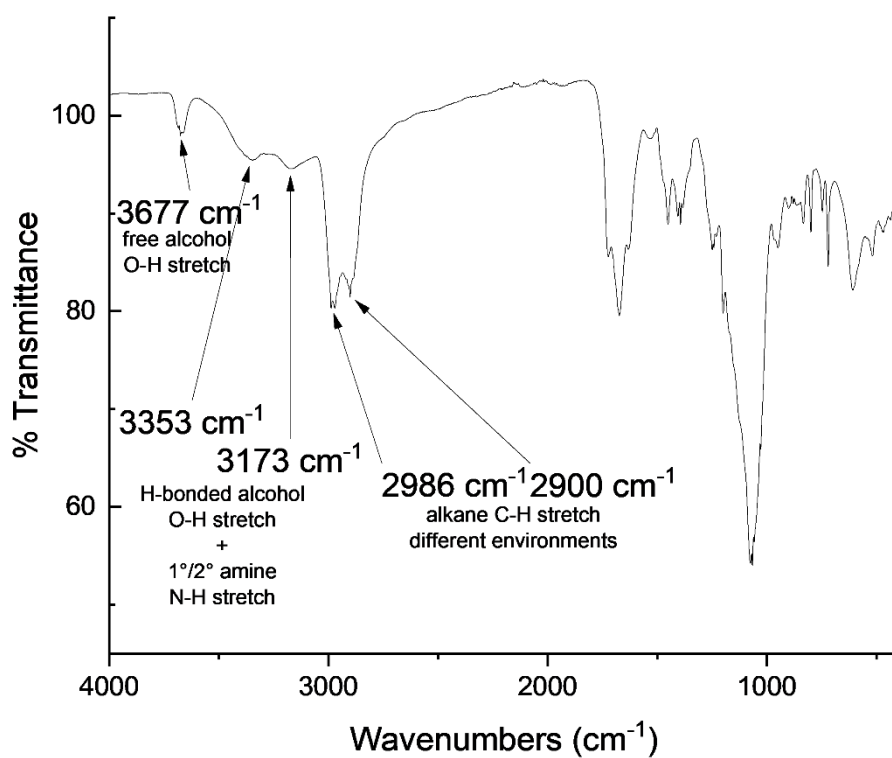


Figure S6: FTIR spectrum of poly((Fmoc-Arg(Pbf))MA<sub>40</sub>-co-HEMA<sub>40</sub>-co-PEGMA<sub>20</sub>) (P2)



**Figure S7:** FTIR spectrum of poly(Arg(Pbf)MA<sub>40</sub>-co-HEMA<sub>40</sub>-co-PEGMA<sub>20</sub>) (**P3**)



**Figure S8:** FTIR spectrum of poly(ArgMA<sub>40</sub>-co-HEMA<sub>40</sub>-co-PEGMA<sub>20</sub>) (**P4**)

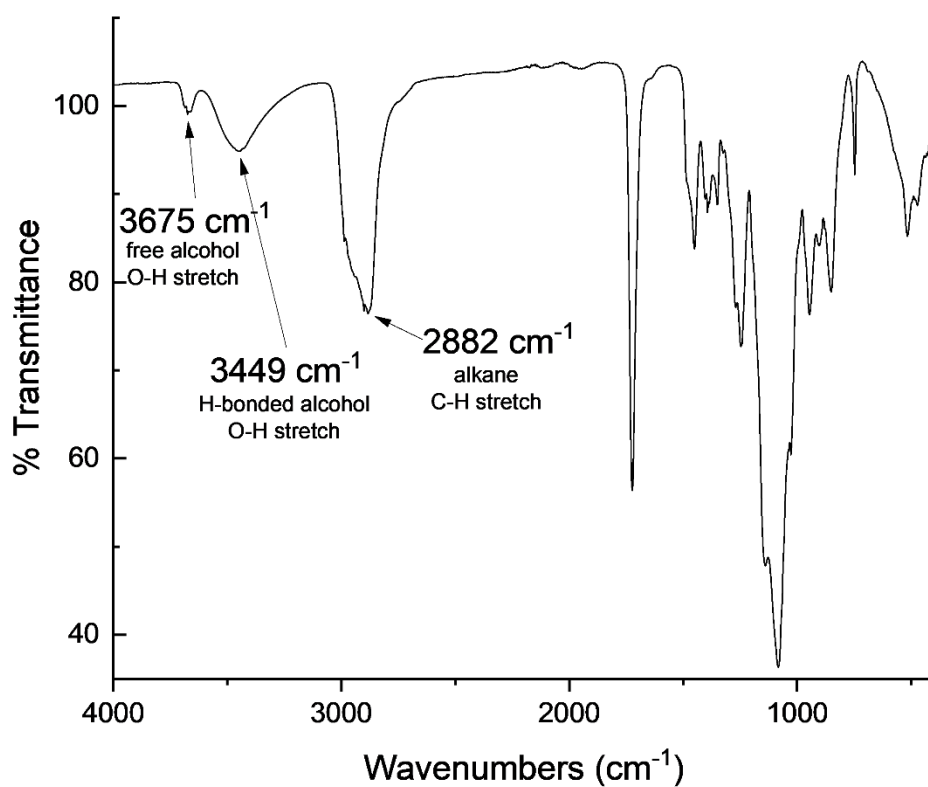


Figure S9: FTIR spectrum of poly(HEMA-co-PEGDMA-co-PEGMA) (G1)

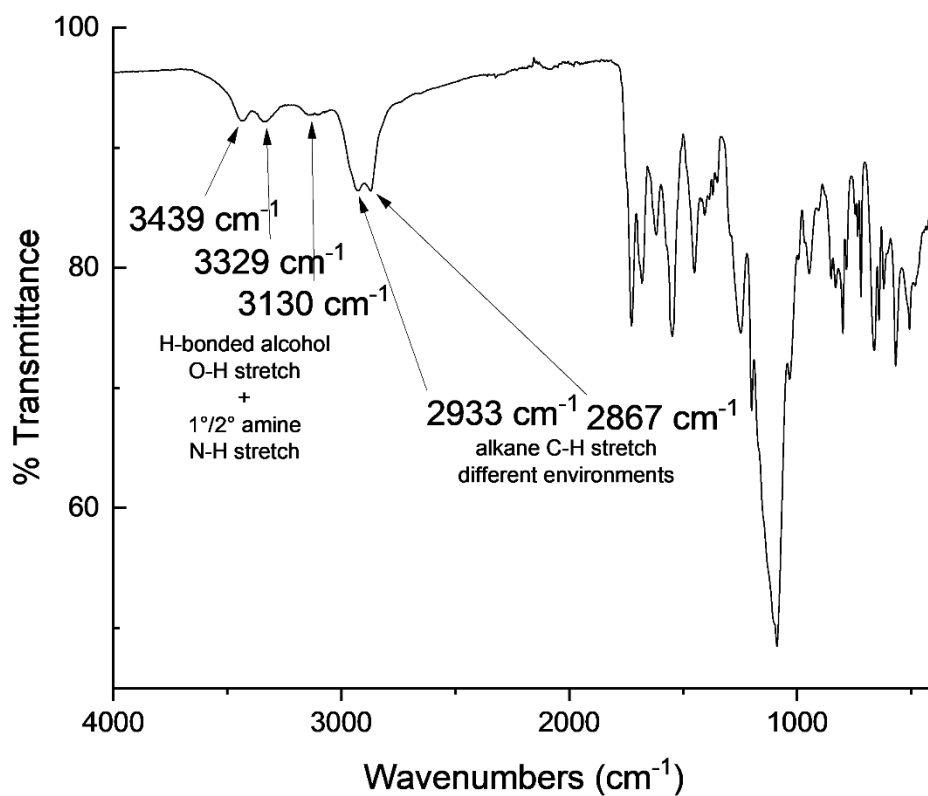
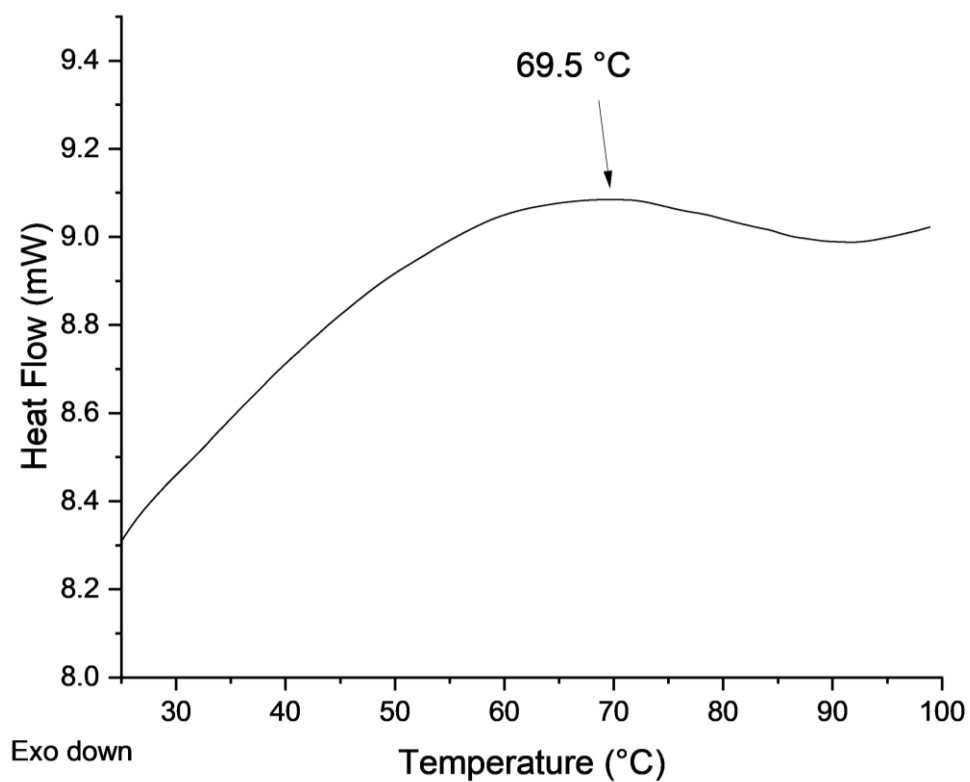


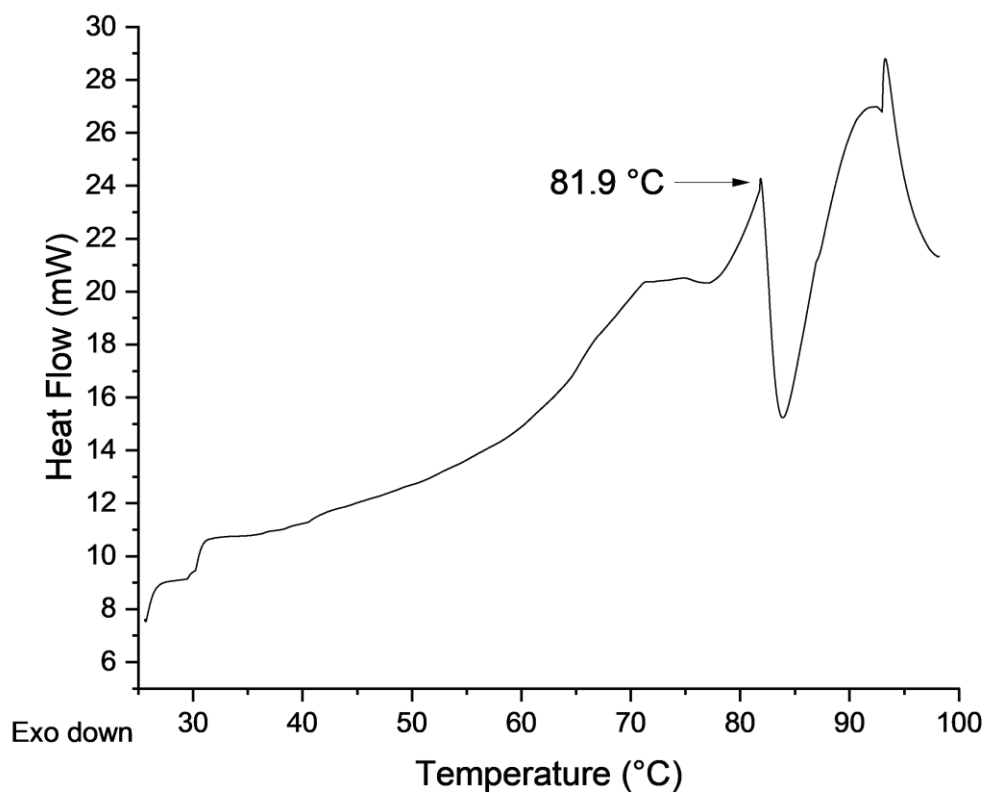
Figure S10: FTIR spectrum of poly(HEMA-co-ArgMA-co-PEGDMA-co-PEGMA) (G2)



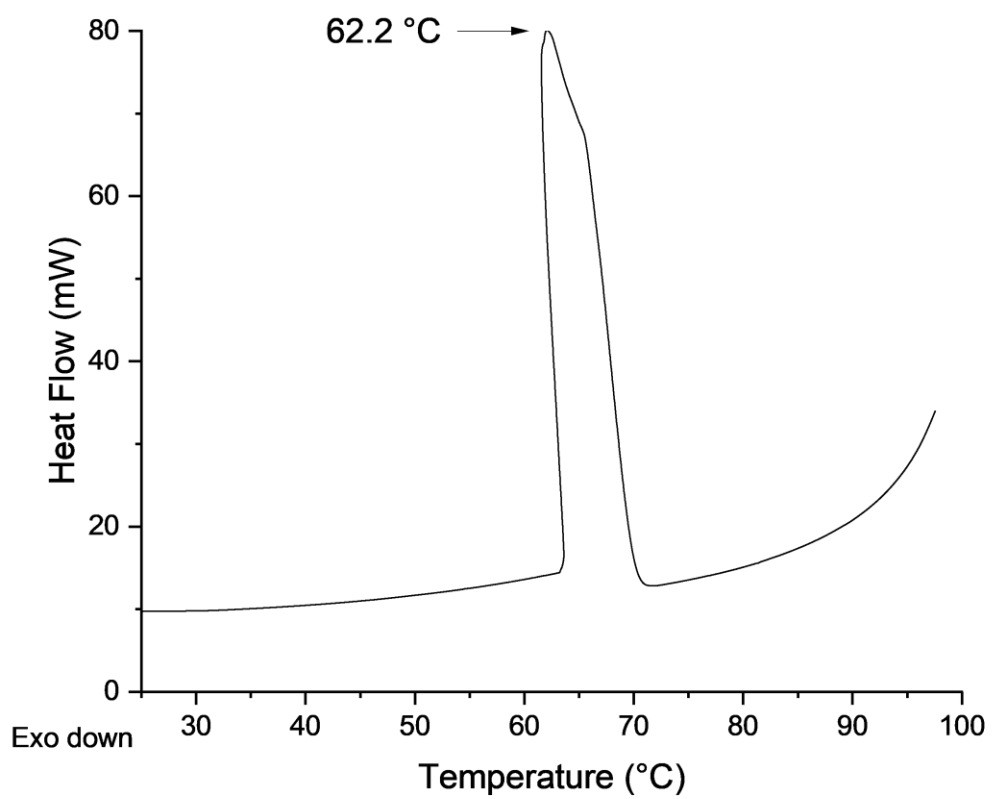
## DSC



**Figure S11:** DSC trace of swollen poly(HEMA<sub>80</sub>-co-PEGMA<sub>20</sub>) (**P1**)

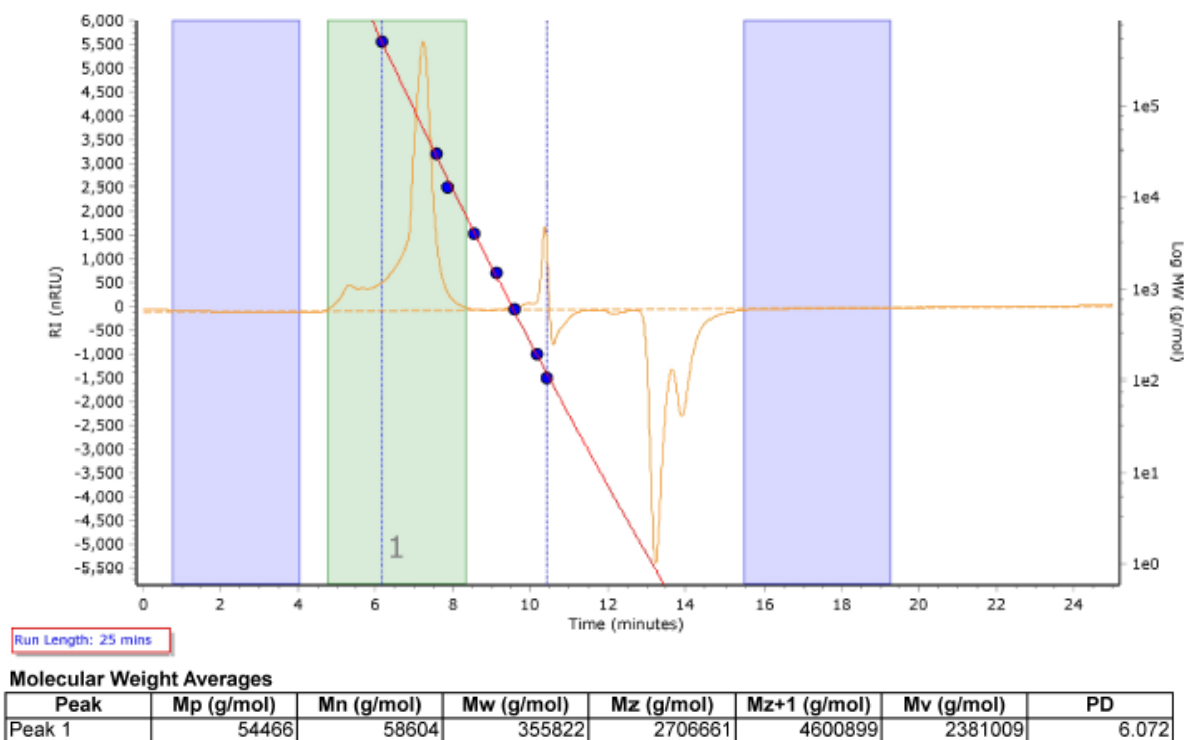


**Figure S12:** DSC trace of swollen poly(ArgMA<sub>40</sub>-co-HEMA<sub>40</sub>-co-PEGMA<sub>20</sub>) (**P4**)



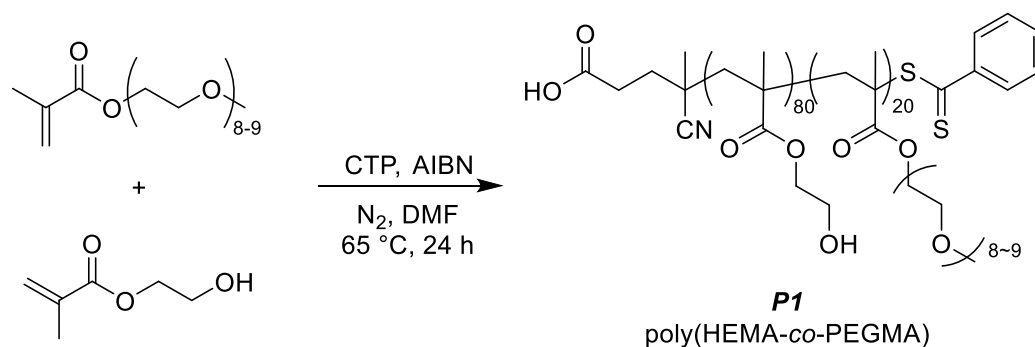
**Figure S13:** DSC trace of swollen poly(HEMA-co-ArgMA-co-PEGDMA-co-PEGMA) (**G2**)

## GPC

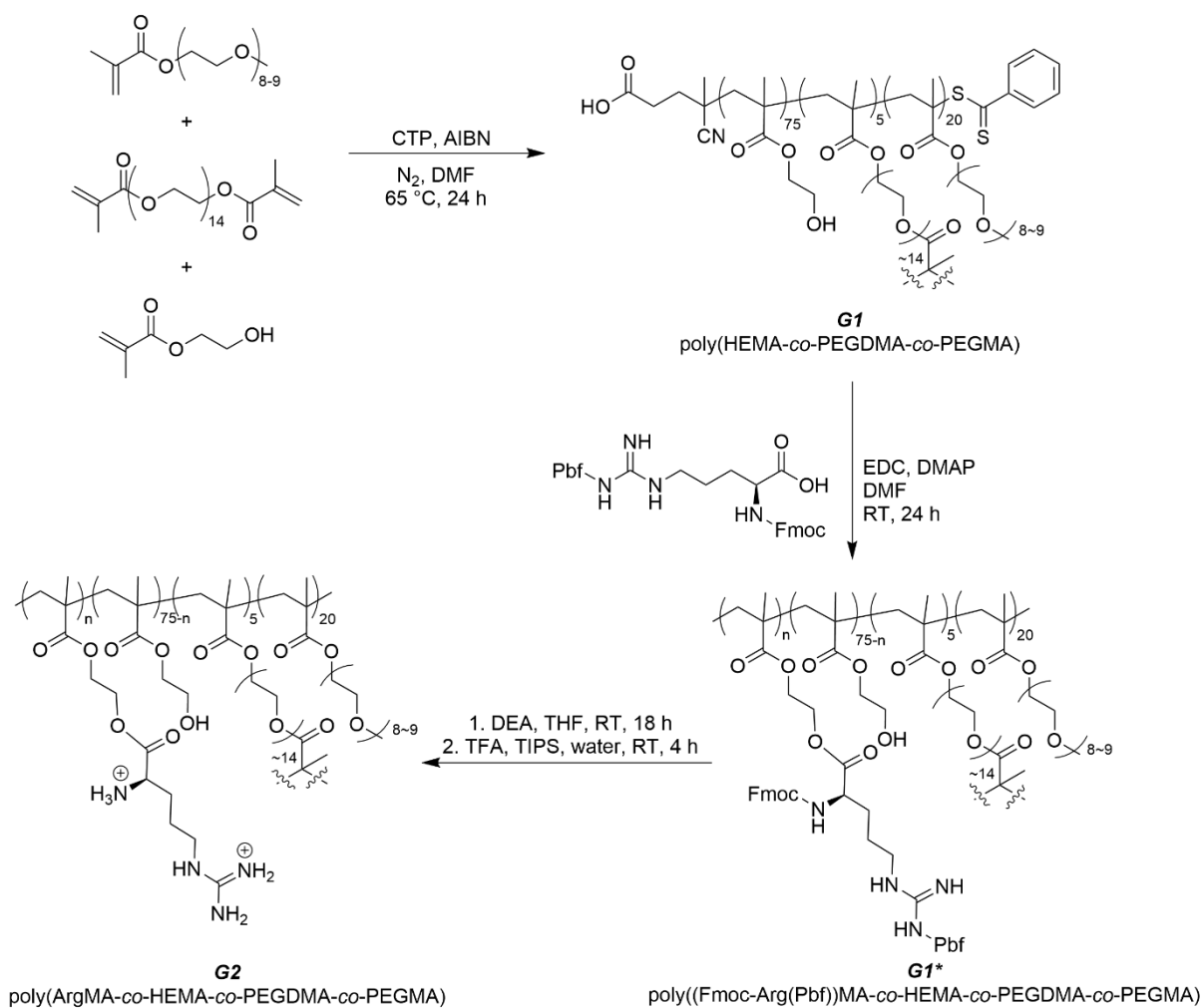


**Figure S14:** GPC trace derived from poly(HEMA<sub>80</sub>-co-PEGMA<sub>20</sub>) (**P1**) (N,N-dimethylacetamide used as eluting medium). Samples **P2-P4** do not dissolve in DMAc and thus could not be characterised with this method.

## Reaction Schemes

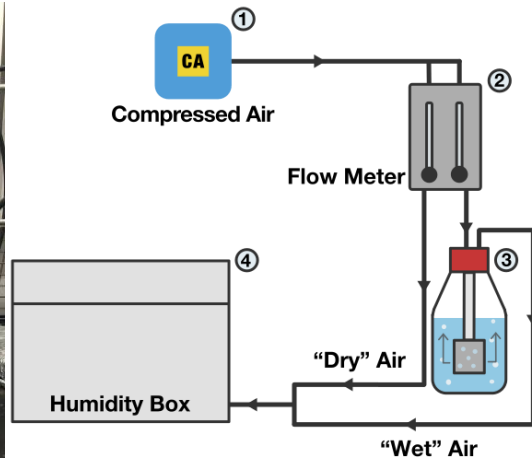
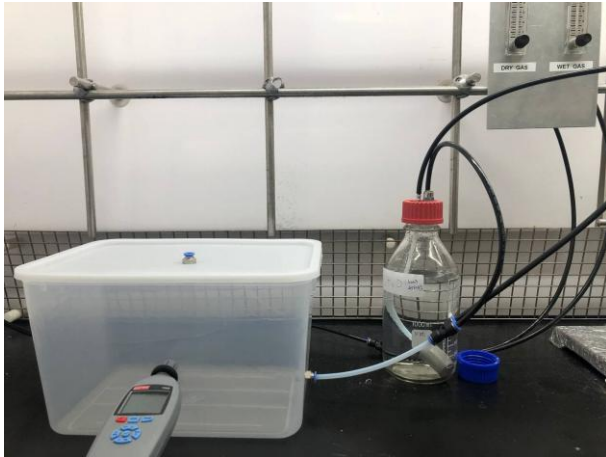


**Scheme S1:** Synthetic pathway for base poly(HEMA-co-PEGMA) copolymer.



**Scheme S2:** Hydrogel synthesis (top), arginine functionalisation (right) and deprotection (bottom), analogous to copolymers **P1-P4**

## Humidity Apparatus



**Figure S15:** Custom humidity apparatus used for water uptake experiments, photo (left) and illustration (right).

The humidity box operates on a constant flow of compressed air (CA) (1). Two adjustable lines of air are controlled by a flow meter (2): the “dry” air coming directly off the CA, and the “wet” air which is bubbled through a bottle of water first (3). The proportions of each type of air can be adjusted at will. There is no need for insulation of the humidity box (4) as the constant positive flow of air through the system is sufficient to approximately maintain the environment in the box.