Supporting Information to

“Impact of Molecular Weight on Electrochemical Properties of Poly(TEMPO methacrylate).”

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Figure S1. $^1$H NMR spectrum (400MHz) of 2,2,6,6-tetramethylpiperidin-4-yl methacrylate (TMPM) in DMSO-$d_6$.

Figure S2. $^{13}$C NMR spectrum (100MHz) of 2,2,6,6-tetramethylpiperidin-4-yl methacrylate (TMPM) in DMSO-$d_6$. 
**Figure S3.** SEC traces of PTMA oxidised from PTMPM by H₂O₂ in methanol, the traces were recorded in THF SEC using polystyrene as standard.

**Figure S4.** Typical ¹H NMR spectrum (400MHz) of PTMPM₆₆ in CDCl₃.
**Figure S5.** Comparison of two different oxidation methods to convert PTMPM$_{228}$ to PTMA$_{228}$, (a) SEC traces and (b) the UV-Vis spectra of PTMA$_{228}$ oxidised by H$_2$O$_2$ in methanol and mCPBA in dichloromethane.

**Figure S6.** Solubility of PTMA in DMC with 1 M LiPF$_6$ determined by UV-Vis: (a) Absorption of 4-hydroxyl TEMPO with different concentration in THF, (b) Calibration curve (c) Absorption of PTMA in THF and (d) Solubility of PTMA with different DPs determined by UV-Vis.
Figure S7. Oxidation efficiency determined by EPR: (a) EPR spectra of 4-hydroxyl TEMPO with different concentration in DCM, (b) Calibration curve based on integration of EPR spectra (c) EPR spectra of PTMA with different DPs oxidised from PTMPM by H$_2$O$_2$ and (d) Number of radicals per unit vs DP of PTMA determined by EPR.
Figure S8. Oxidation efficiency determined by UV-Vis: (a) Absorption of 4-hydroxyl TEMPO with different concentration in DCM, (b) Calibration curve (c) Absorption of PTMA with different DPs oxidised from PTMPM by H₂O₂ and (d) Number of radicals per unit vs DP of PTMA determined by UV-Vis.
Figure S9. (a) Temperature dependence of the paramagnetic susceptibility $\chi_p$ of PTMA$_{66}$ with both field cooling (FC) and zero-field cooling (ZFC) modes. (b) Temperature dependence of the paramagnetic susceptibility $\chi_p$ and its inverse $\chi_p^{-1}$ of all PTMA polymers with FC mode. All the measurements carried out at an applied magnetic field strength of 10 KOe.
Figure S10. Cycling property and coulombic efficiency of (a) PTMA$_{66}$, (b) PTMA$_{96}$, (c) PTMA$_{228}$, (d) PTMA$_{483}$, and (e) PTMA$_{703}$ as cathode with mass ratio of PTMA/SP carbon/PVdF=0.25/0.65/0.1, charging/discharging at 1C over 300 cycles.
Figure S11. Nyquist plot of PTMA with different DPs as cathode at mass ratio of PTMA/SP carbon/PVdF=0.25/0.65/0.1, and 0.1 M LiPF$_6$ in DMC as electrolyte.