Electronic supplementary information (ESI)

Alkali-stable polybenzimidazole anion exchange membranes tethered with *N*,*N*-dimethylpiperidinium cations for dilute aqueous KOH fed water electrolyzers

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Supplementary Tables and Figures

Table S1. DF and IEC values of the membranes in the PBI-monoPip and PBI-bisPip series.

Sample	[a]DF	[b]IEC_{Br} (meq/g)	[b]IEC_{OH} (meq/g)
PBI-MonoPip-1.8	0.39	1.61	1.79
PBI-MonoPip-2.1	0.48	1.84	2.09
PBI-MonoPip-2.3	0.55	2.00	2.29
PBI-MonoPip-2.5	0.65	2.18	2.52
PBI-BisPip-1.6	0.18	1.48	1.63
PBI-BisPip-1.8	0.20	1.63	1.81
PBI-BisPip-2.1	0.26	1.88	2.13
PBI-BisPip-2.3	0.29	2.00	2.29
PBI-BisPip-2.5	0.34	2.16	2.50

[a] Calculated by Equation 1. [b] Calculated by Equation 2.

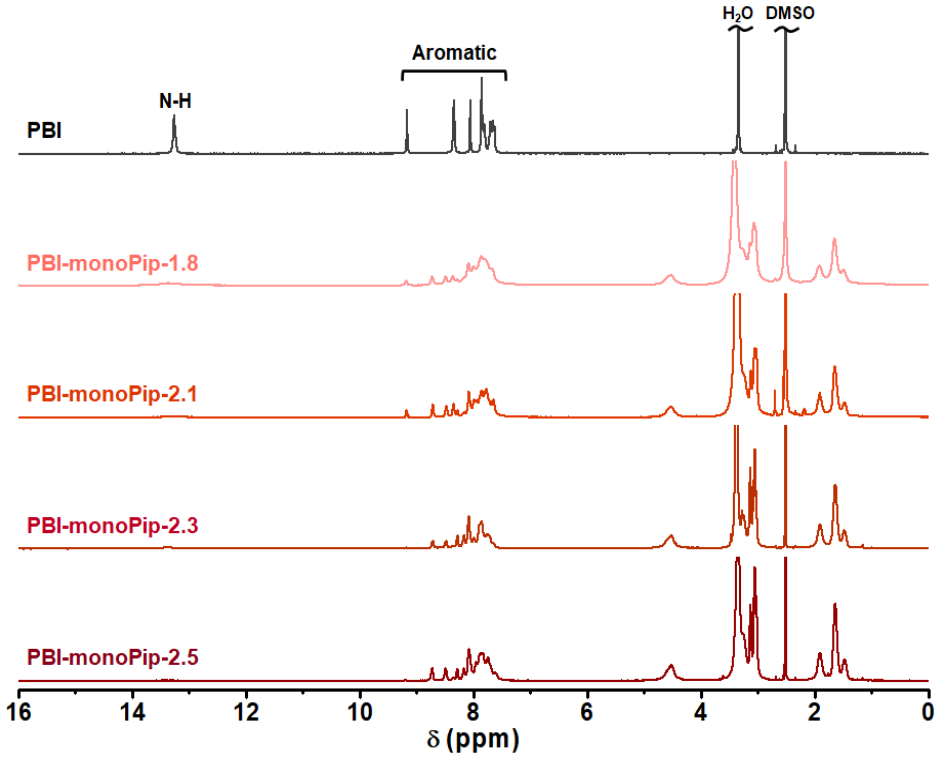

Fig. S1 ^{1}H NMR spectra of the PBI-monoPip samples.

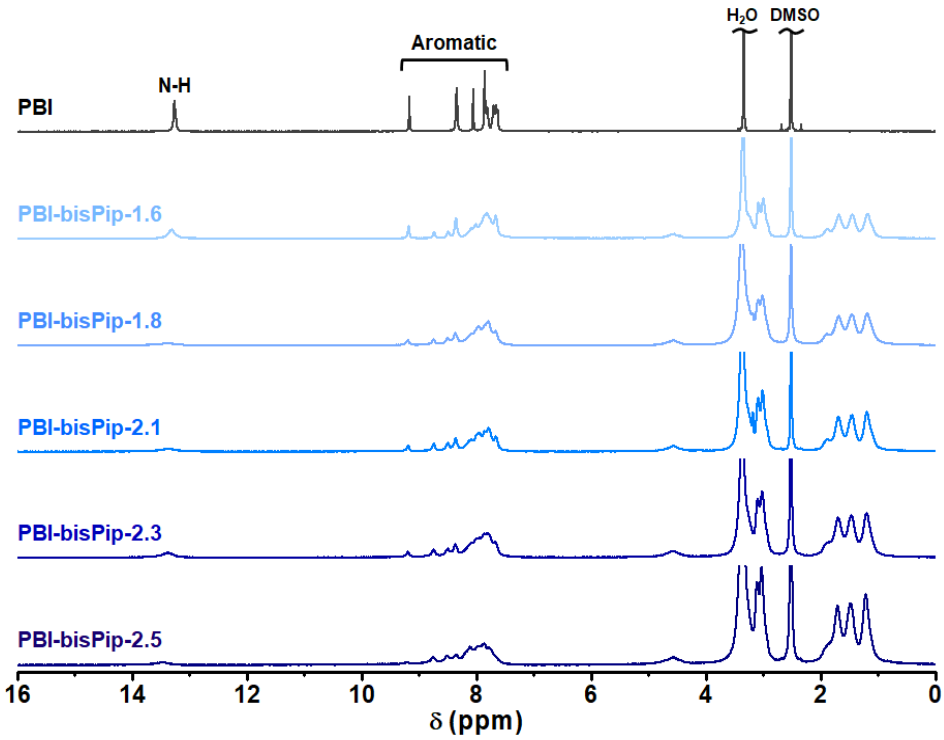

Fig. S2 ^{1}H NMR spectra of the PBI-bisPip samples.

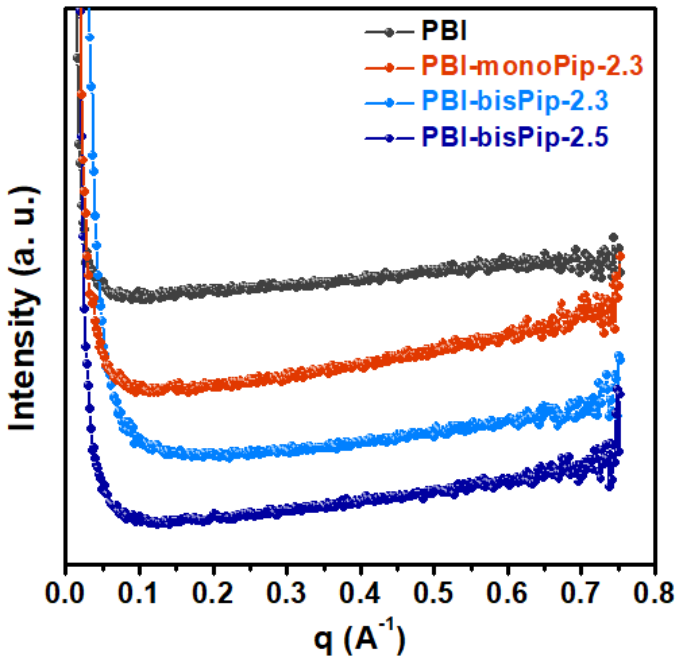

Fig. S3 SAXS profiles of PBI and membranes in the PBI-monoPip and PBI-bisPip series.

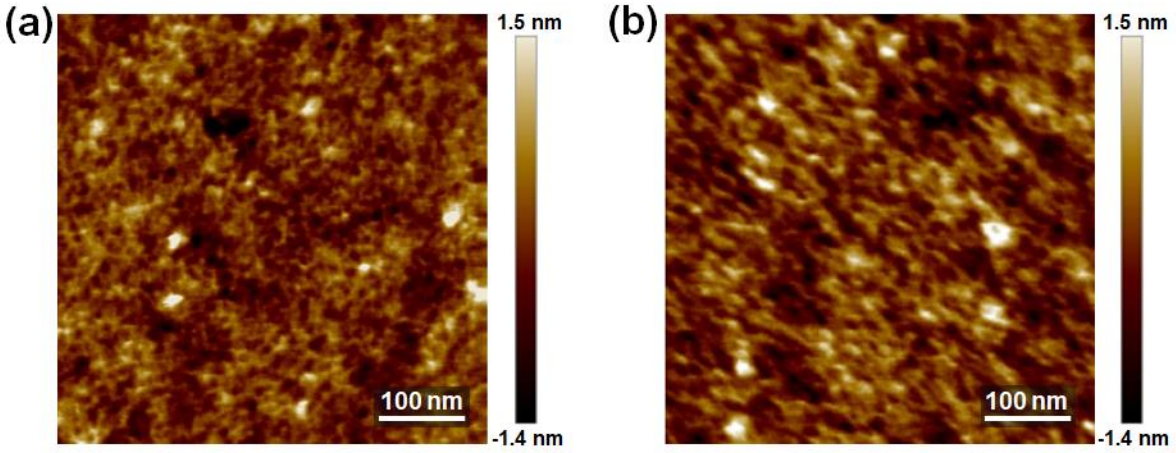

Fig. S4 AFM topological images of the (a) PBI-monoPip-2.5 and (b) PBI-bisPip-2.5 membranes.

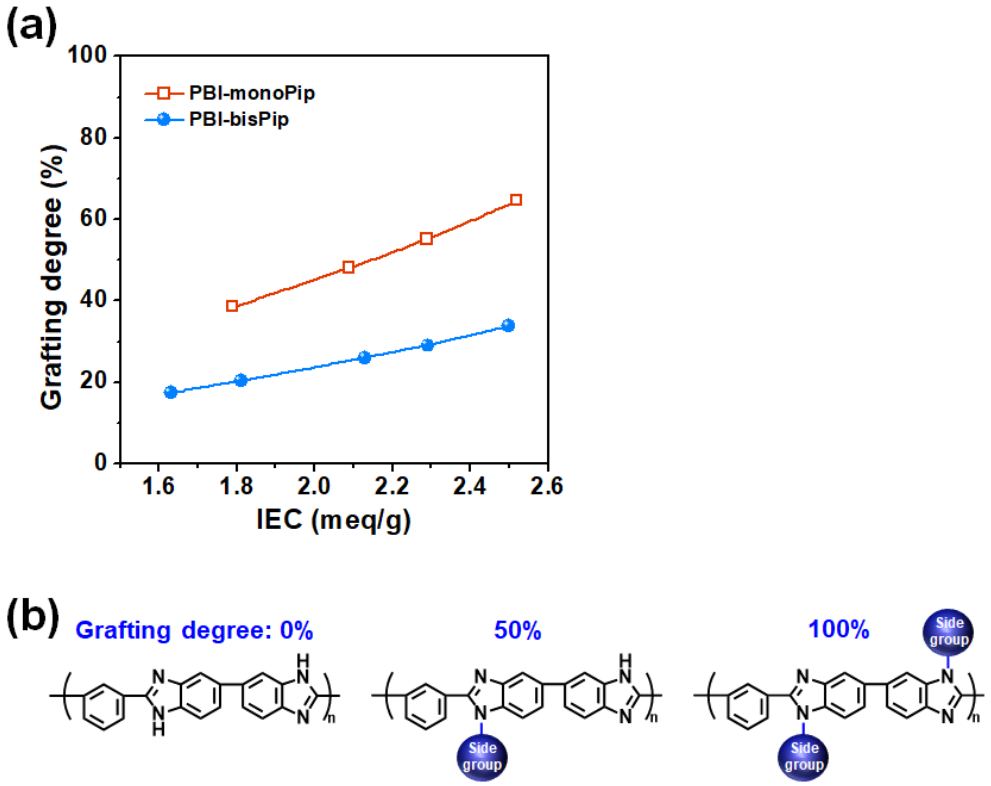

Fig. S5 (a) Grafting degree vs. IEC of the PBI-monoPip and PBI-bisPip membranes, and (b) schematic representations of PBI units with different grafting degrees.

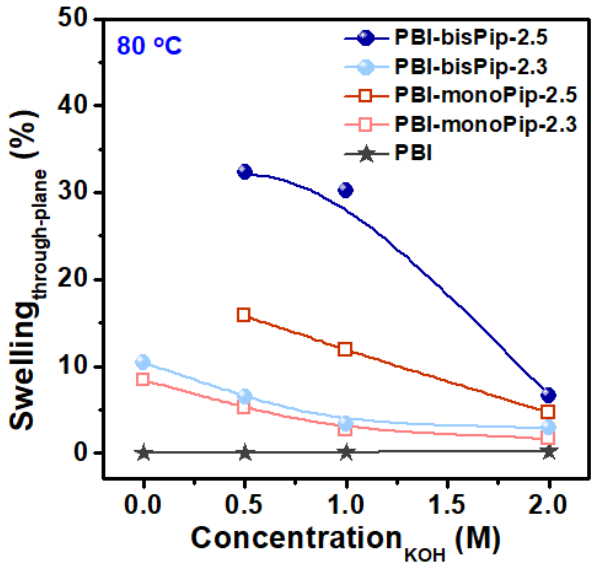

Fig. S6 Through-plane swelling of the membranes as a function of the aq. KOH concentration.

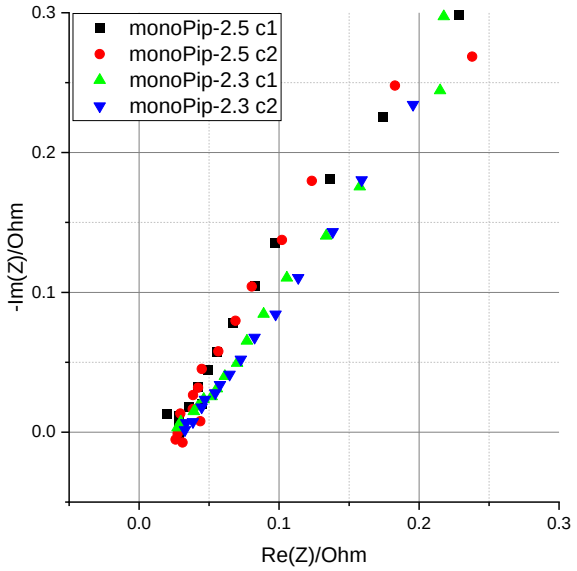

Fig. S7. High frequency end of the impedance spectra of the cells with the PBI-monoPip membranes. The c indicates the number of the cell.

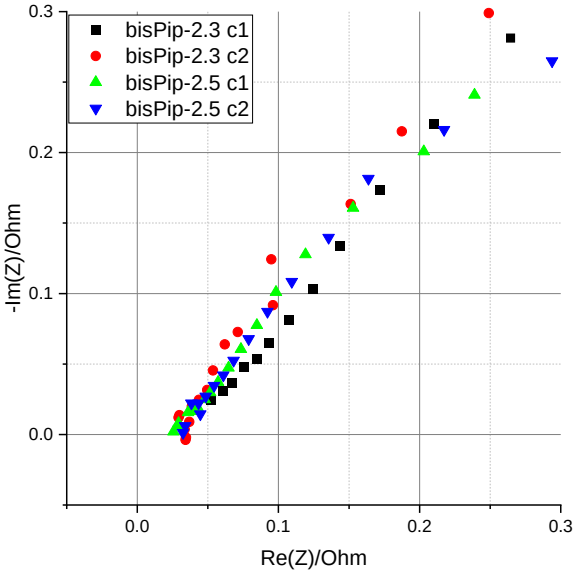

Fig. S8. High frequency end of the impedance spectra of the cells with the PBI-bisPip membranes before the 100 h test. The c indicates the number of the cell.

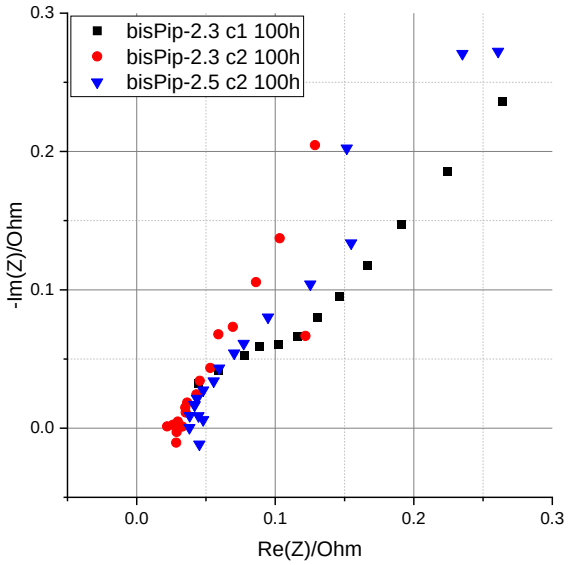

Fig. S9. The high frequency end of the impedance spectra of the cells with the PBI-bisPip membranes after the 100 h test shows no significant change of the intercept. No spectrum was available for PBI-bisPip-2.5 c1. The c indicates the number of the cell.

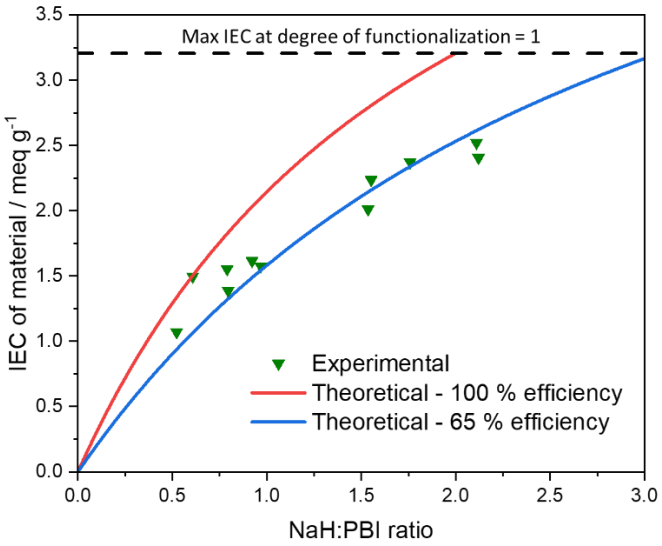

Fig. S10 Comparison of NaH to PBI molar ratios used and the impact on the final IEC of monoPip materials. Shown are also the theoretical values for 100 % (DF=Ratio/2) and 65 % (DF=0.65*Ratio/2) effective reactions.

References

[1] A. Vasilev, T. Deligeorgiev, N. Gadjev, K.-H. Drexhage, *Dyes Pigments*, 2005, **66**, 135-142.