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SOFT MATTERS GROUP

Poly(amino-acid)-mucin interactions: the role of the charge density

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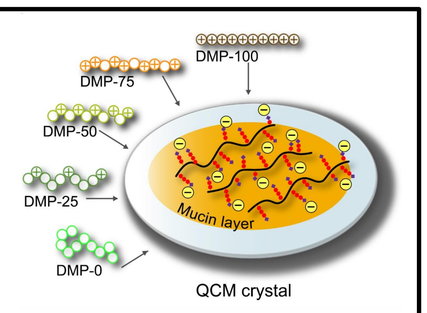
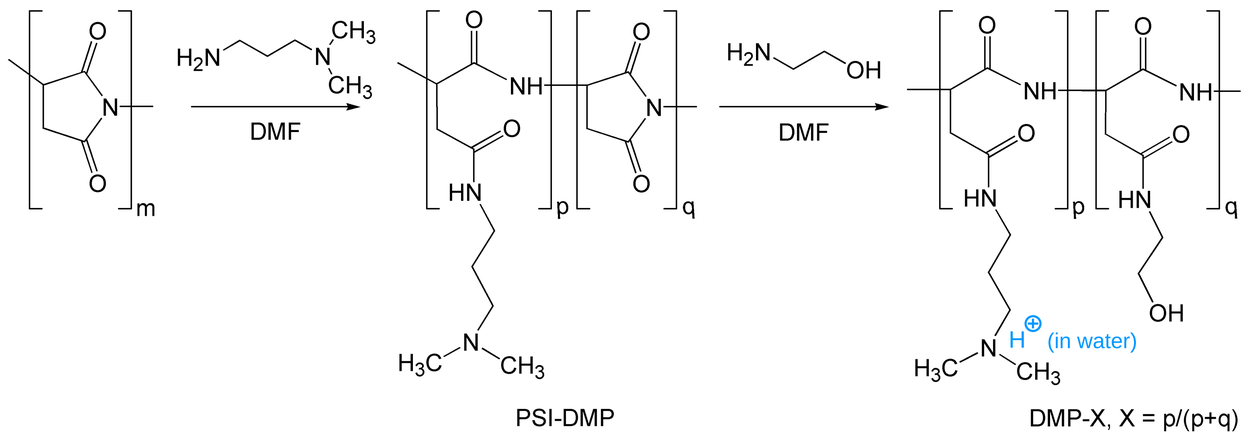
Introduction

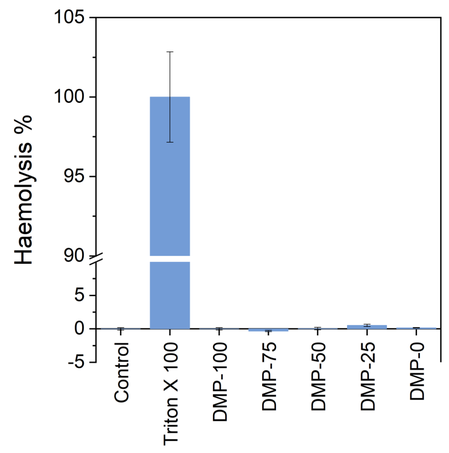
Mucosal surfaces are important targets for drug formulations as they provide high permeability and enable avoiding first-pass metabolism [1]. The two main concepts for utilising these surfaces are mucoadhesion and mucopenetration; both require the fine-tuning of colloidal interactions between the polymer excipient(s) of the formulations and the mucin proteins, the major component of the mucus secreted by the mucosa. Our goal here is to reveal the role of charge density in mucin-polymer interactions both in dispersion and in thin layers [2]. To this end, the class of polyaspartamides was chosen because of their chemical versatility, biocompatibility and biodegradability [3].

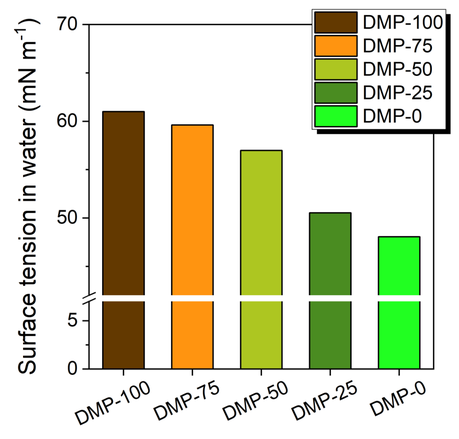


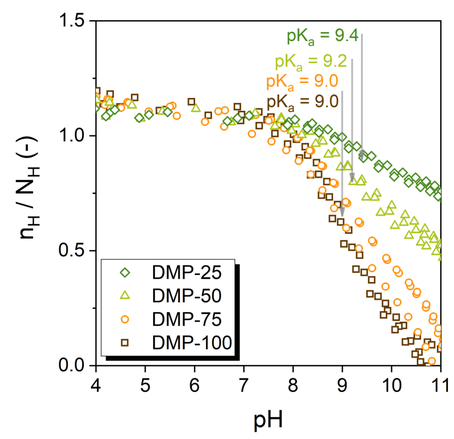
Synthesis and characterisation

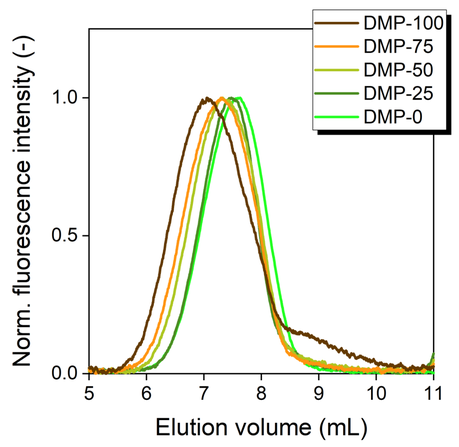


Composition	$X_{DMP, NMR}$ (%)	$X_{DMP, potentiometry}$ (%)	pK_a (-)	Zeta potential (mV)	$d_{h, SEC}$ (nm)
DMP-100	98	100	9.0	11.4 ± 1.0	8.3
DMP-75	74	75	9.0	9.8 ± 2.7	7.4
DMP-50	51	50	9.2	8.3 ± 1.7	7.0
DMP-25	23	28	9.4	0.6 ± 1.0	6.5
DMP-0	0	-	-	-4.2 ± 3.9	6.2

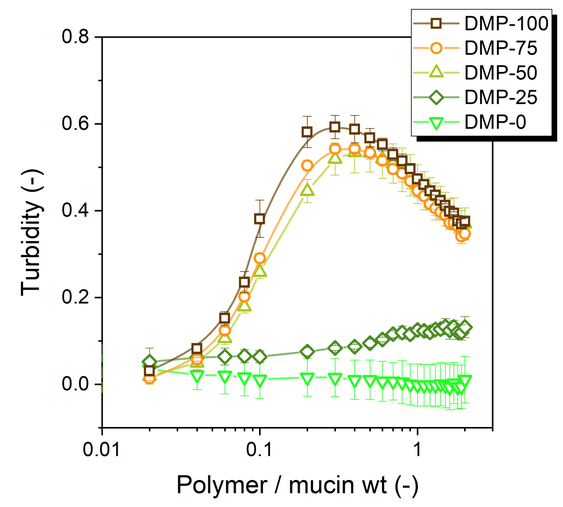


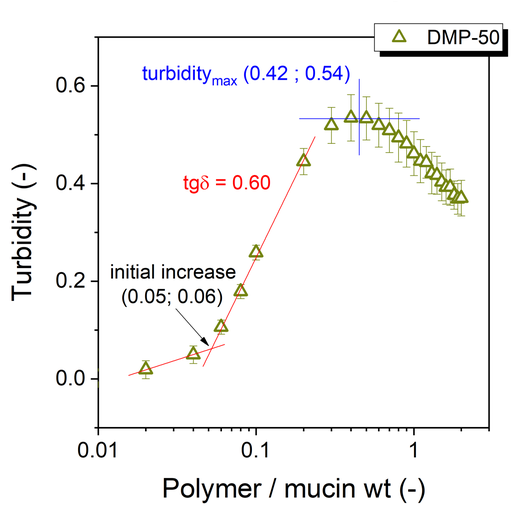


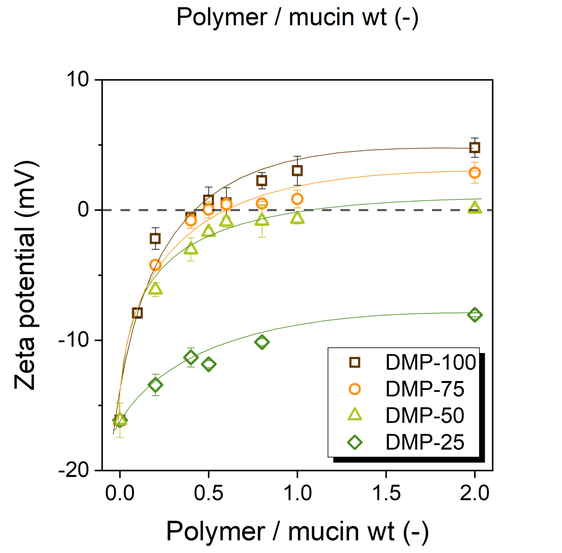


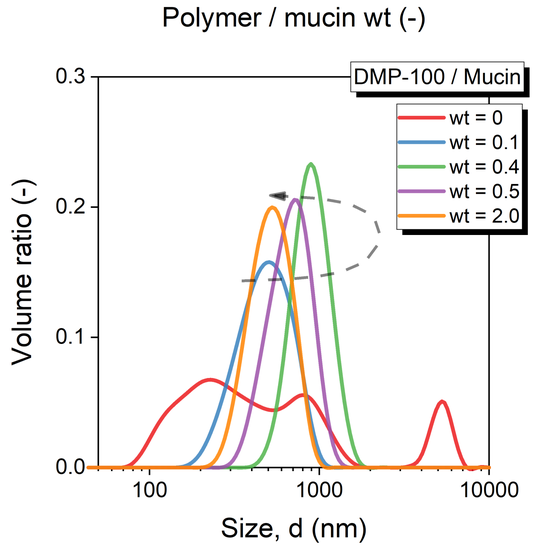


Polymer-induced aggregation of mucin in dispersion

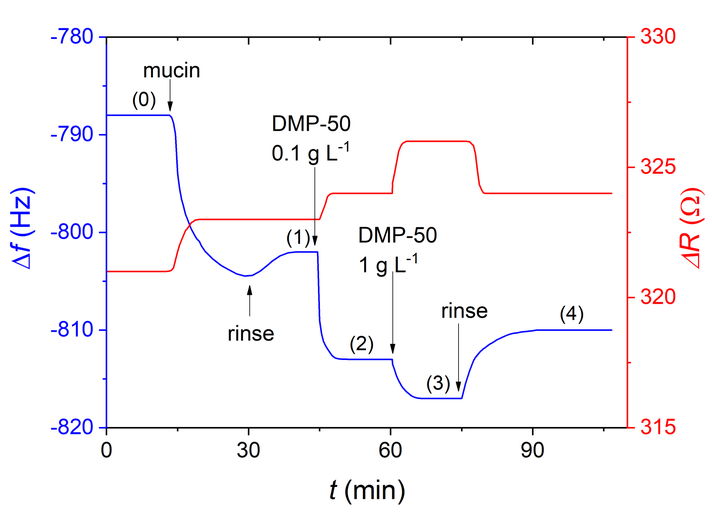


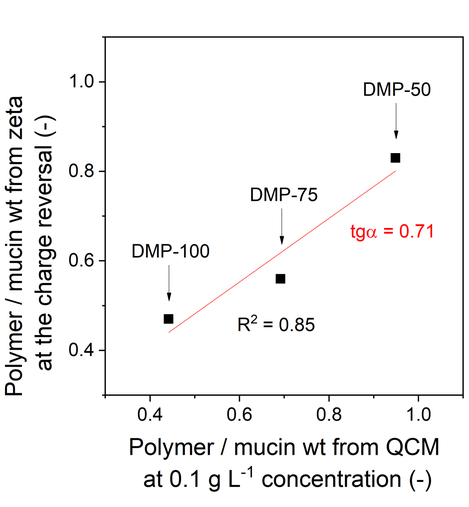


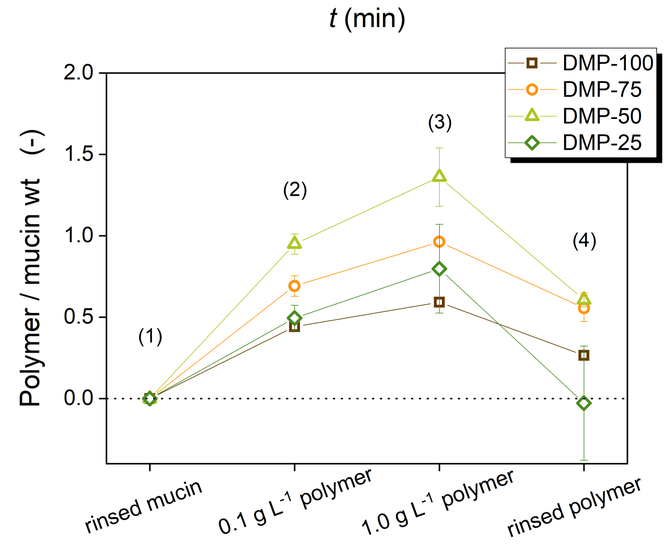


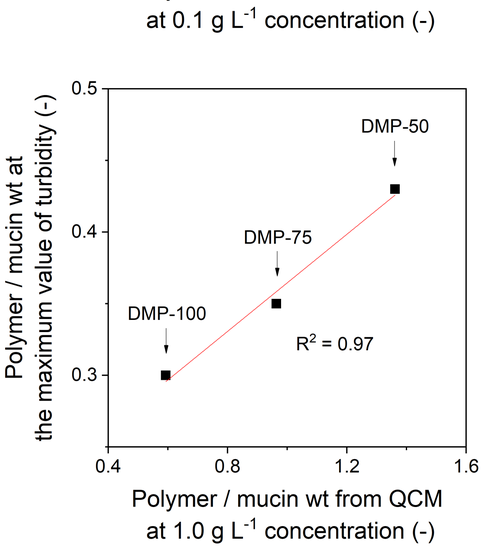


Polymer-mucin interaction in a thin layer









Conclusions

- Cationic polyaspartamides with controlled cationic group content were synthesised
- The strength of mucin-polymer interactions changed non-linearly with composition
- The highest adsorption was at intermediate cationic side group content shown by QCM
- A close correlation was found between the bulk (3D) and thin layer (2D) interactions

References

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