

Surface hydrophilicity of dental copolymer modified with dimethacrylates possessing quaternary ammonium groups

Patryk Drejka, Izabela Barszczewska-Rybarek

Department of Physical Chemistry and Technology of Polymers, Faculty of Chemistry, Silesian University of Technology, Poland

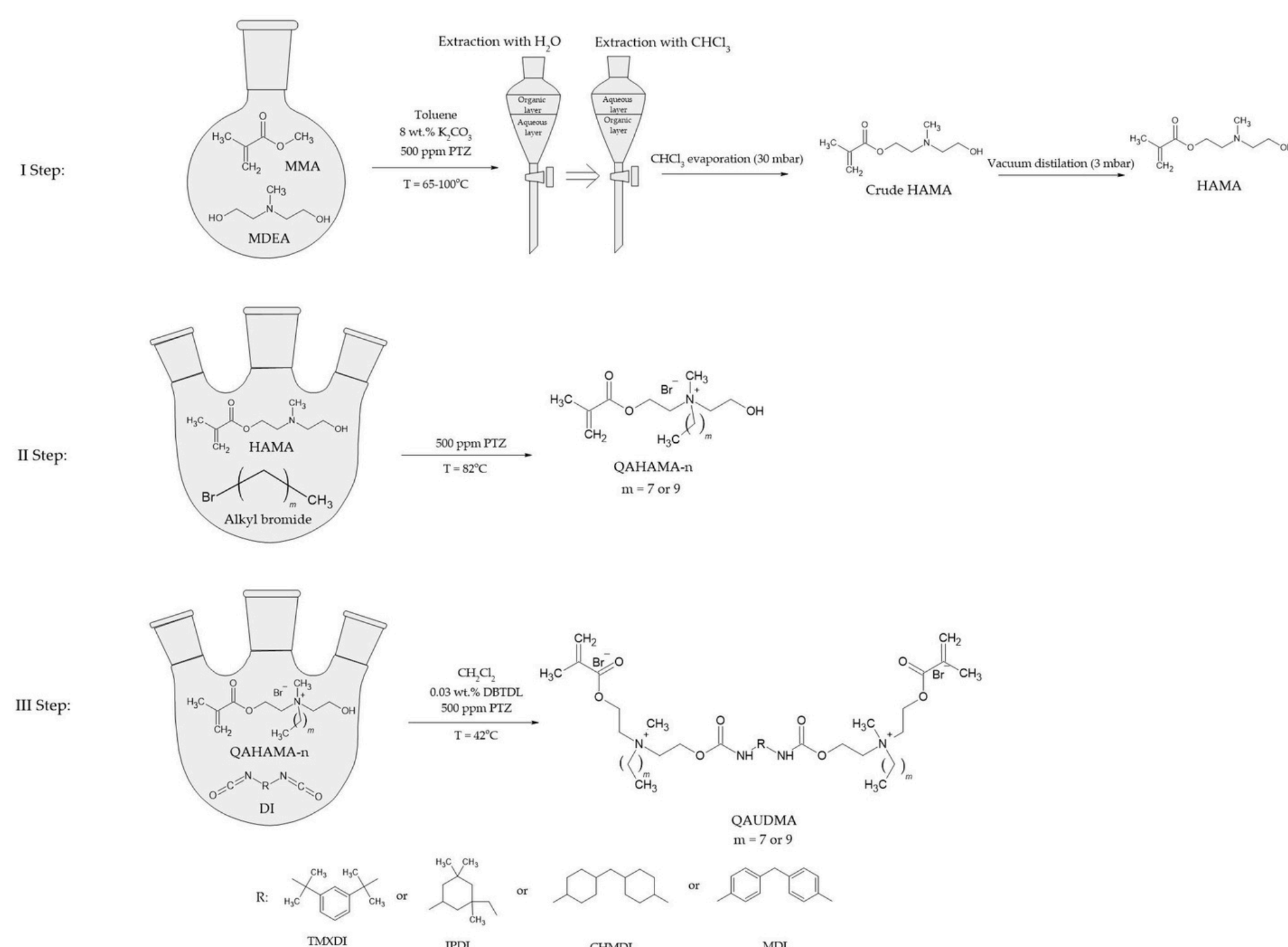
INTRODUCTION & AIM

The human mouth is a challenging environment due to the presence of bacteria, its relatively high temperature, and high moisture levels. This poses a challenge to designing materials possessing satisfactory functional properties. One of those aspects is to achieve low water sorption and water leachability, because water, which is present in humans' saliva, can cause excessive swelling of the material and leaching out of uncured monomer.

The aim of the study is the modification of dental copolymer with urethane-dimethacrylate monomers possessing quaternary ammonium groups and the determination of their water sorption, water solubility and water contact angle.

METHOD

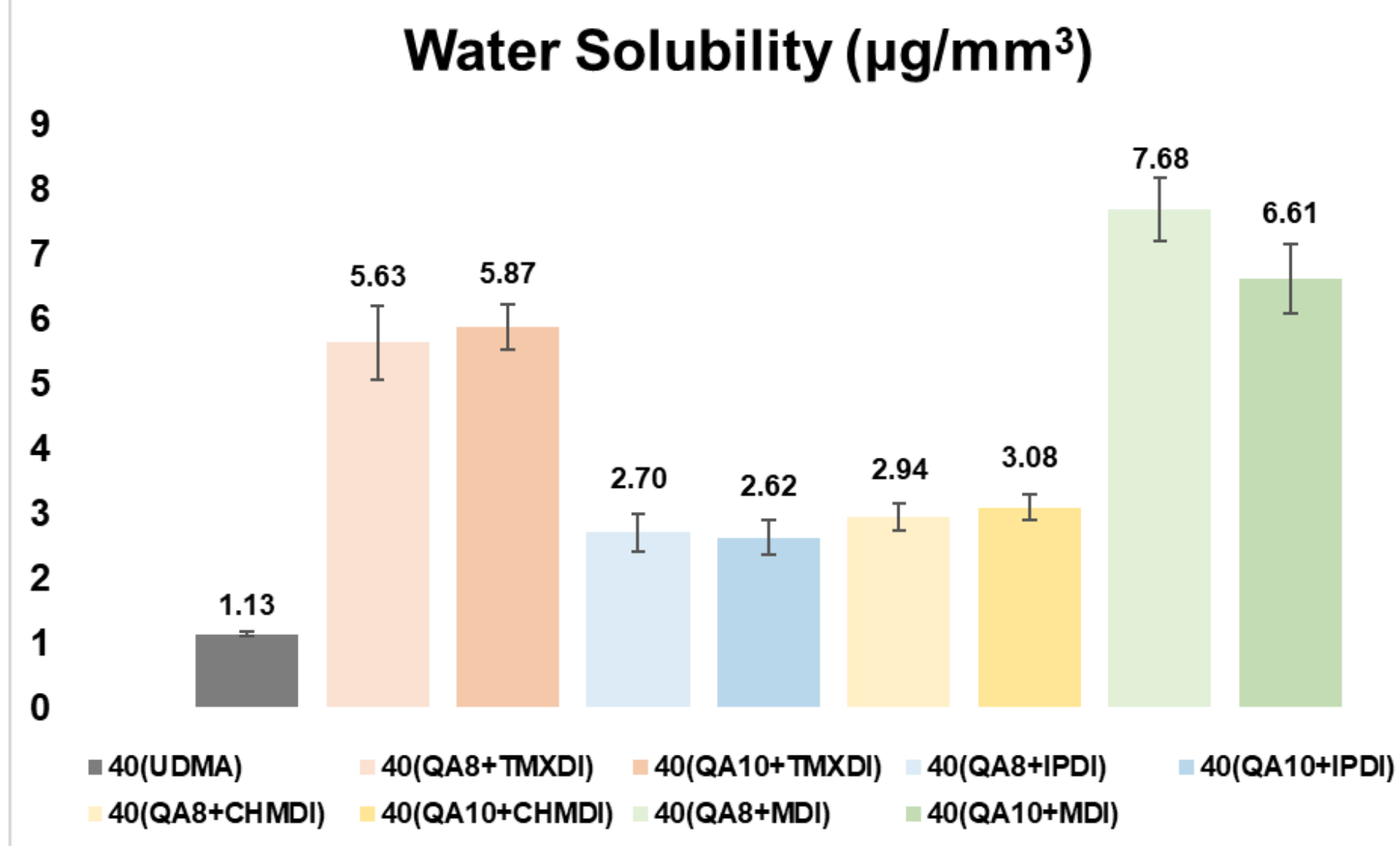
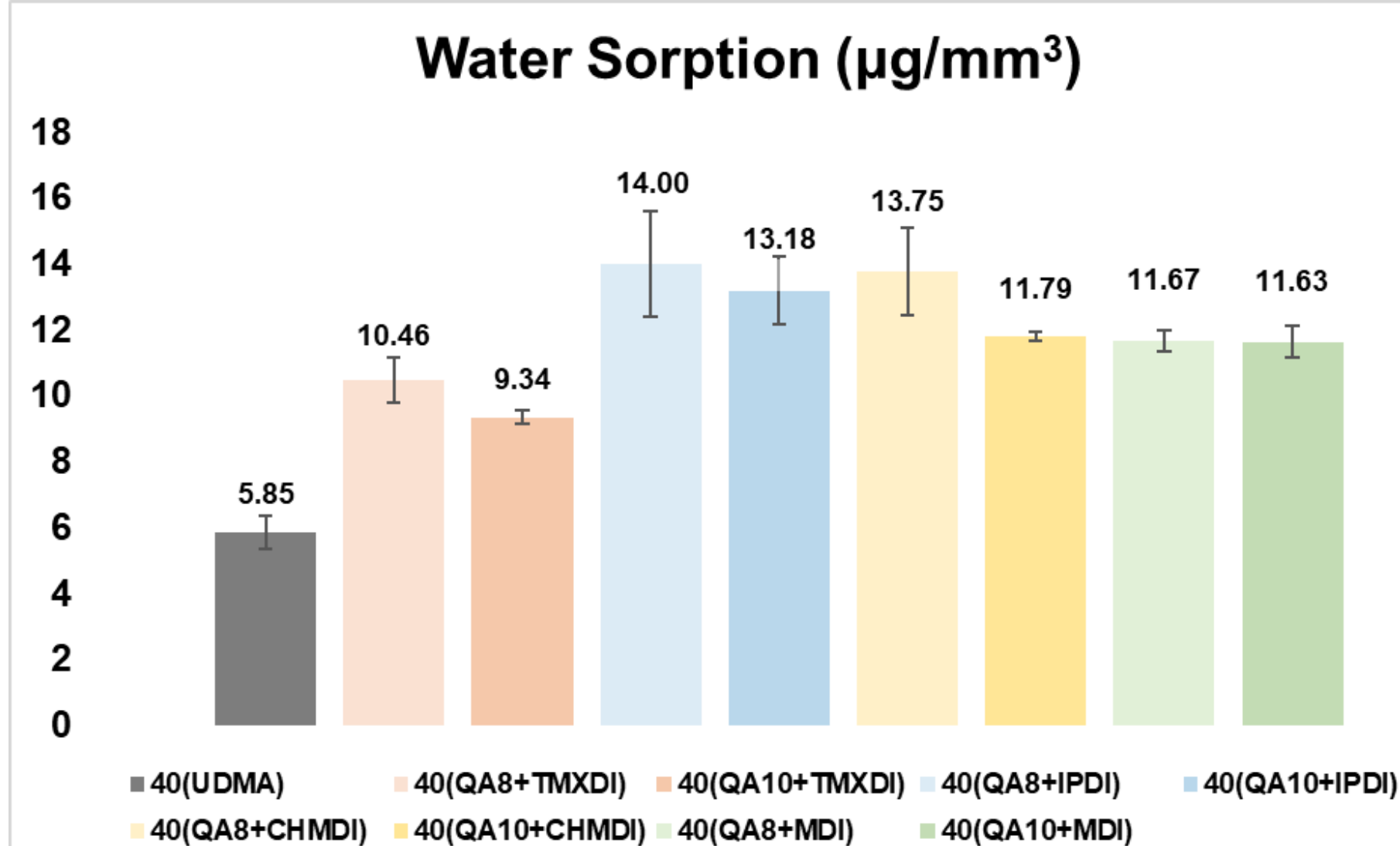
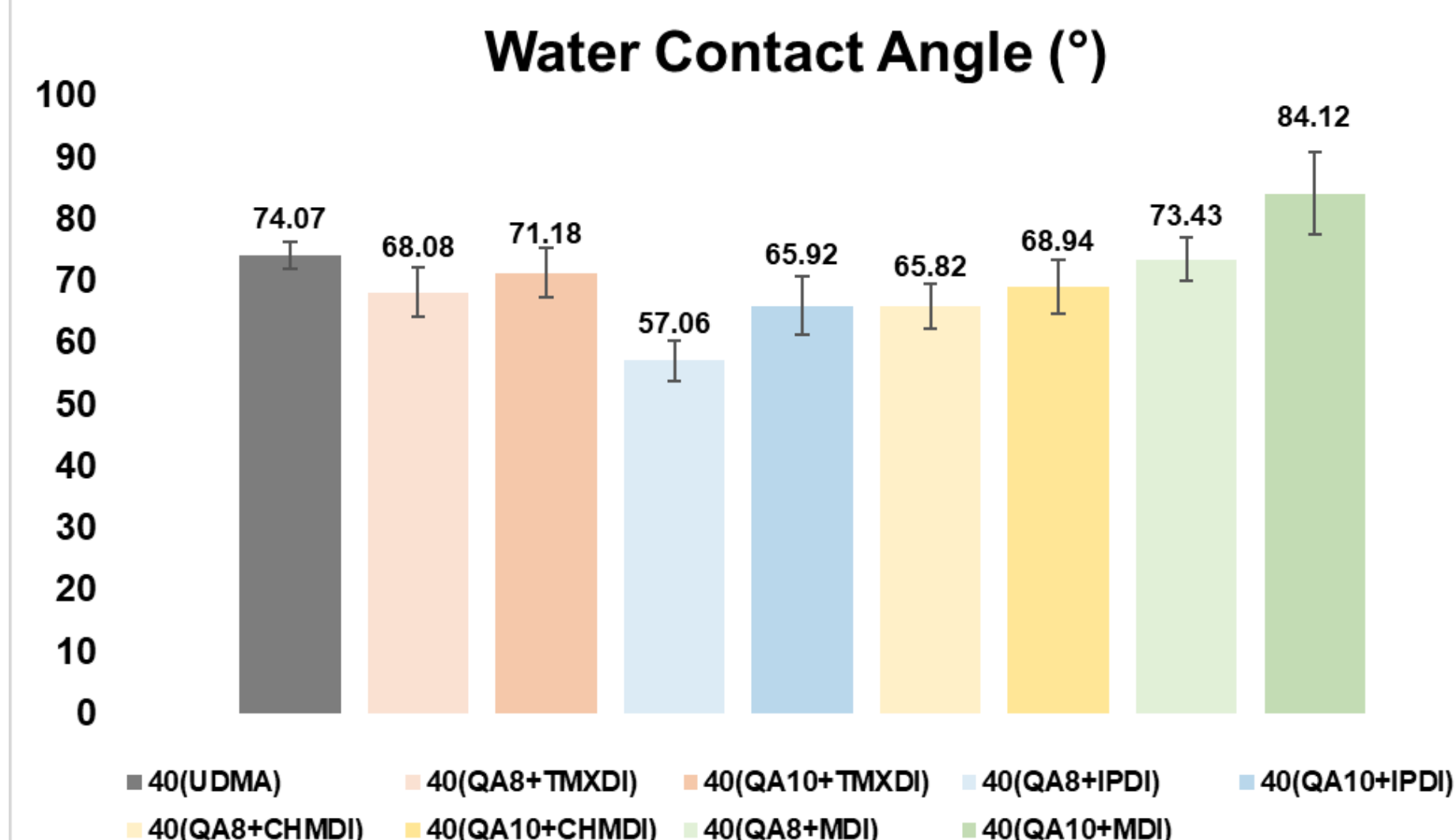
The monomers were synthesised in a three-step process involving: transesterification of MMA, then N-alkylation with alkyl bromide and finally addition to diisocyanate (1,3-bis(2-isocyanatopropan-2-yl)benzene, isophorone diisocyanate, 4,4'-methylenedicyclohexyl diisocyanate, and 4,4'-diphenylmethane diisocyanate). In the process, eight monomers were obtained.



The monomers were mixed with commercial monomers: 40 wt. % bisphenol A glycerolate dimethacrylate and 20 wt. % triethylene glycol dimethacrylate, and the initiating system: 0.4 wt. % camphorquinone and 1 wt. % N, N-dimethylaminoethyl methacrylate. The reference composition containing 40 wt. % urethane-dimethacrylate monomer was also prepared. The copolymers were obtained in the photopolymerization process. The samples were dried to constant mass, followed by immersion in deionised water for one week. Then the samples were dried again. The mass of samples was noted at every step to calculate water sorption and water solubility.

The water contact angles of polymer surfaces were determined with the application of a goniometer, where the volume of one water droplet was 4 μl .

RESULTS & DISCUSSION



CONCLUSION

In the research, eight new copolymers were obtained. Their water sorption, water solubility and water contact angle were tested. The main factors that influenced the copolymers' properties were the N-alkyl substituent length and the diisocyanate core.

FUNDING

This work was funded by the Polish Budget Funds for Scientific Research in 2025 as core funding for research and development activities at the Silesian University of Technology – funding for young scientists grant number 04/040/BKM25/0314.