

Making and breaking sequenced copolyamides by enzymatic catalysis

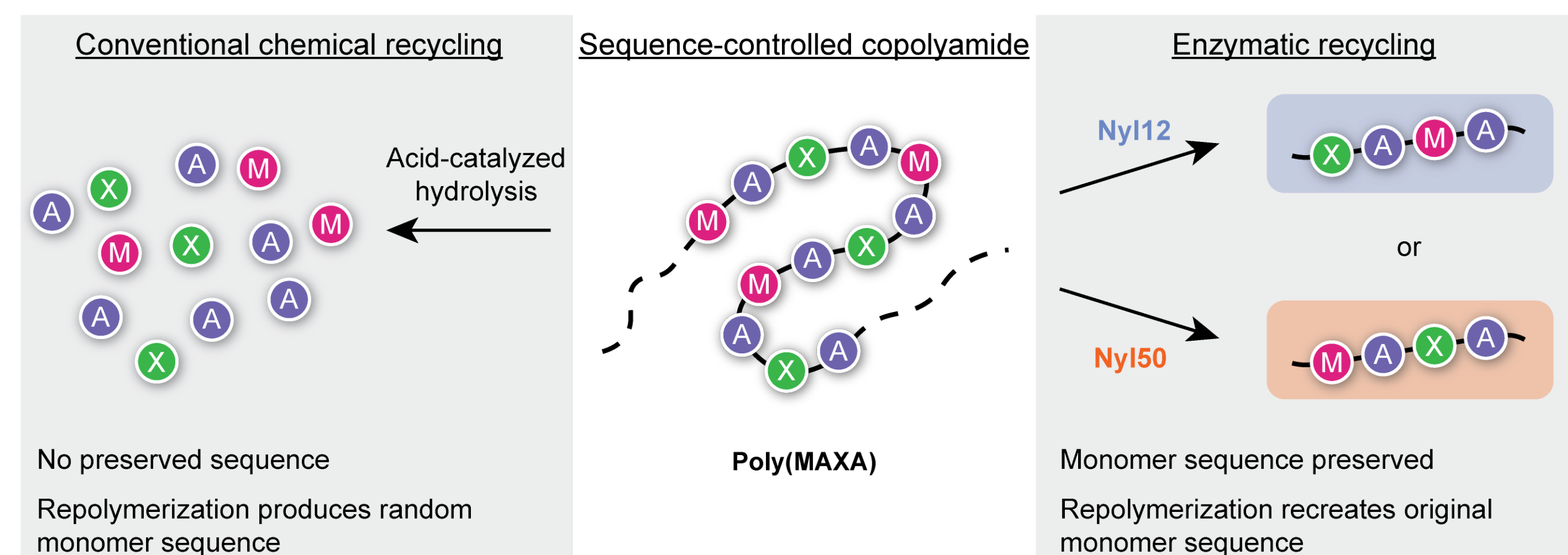
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How do we control polymer sequence across lifecycles?

Monomer sequence profoundly impacts material properties.

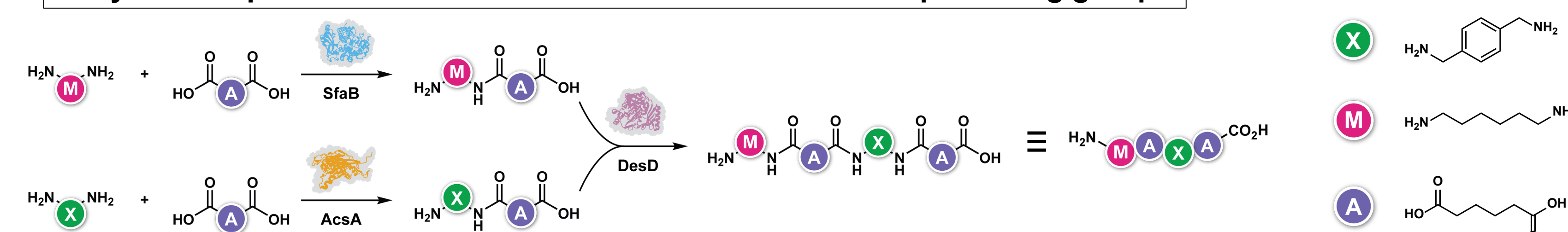
Current approaches to controlling monomer sequence are laborious and unsustainable. Additionally, existing recycling strategies destroy sequence encoded information.

Here, we demonstrate complementary strategies that harness enzymatic catalysis to sustainably control monomer sequence across both polymerization and depolymerization cycles.

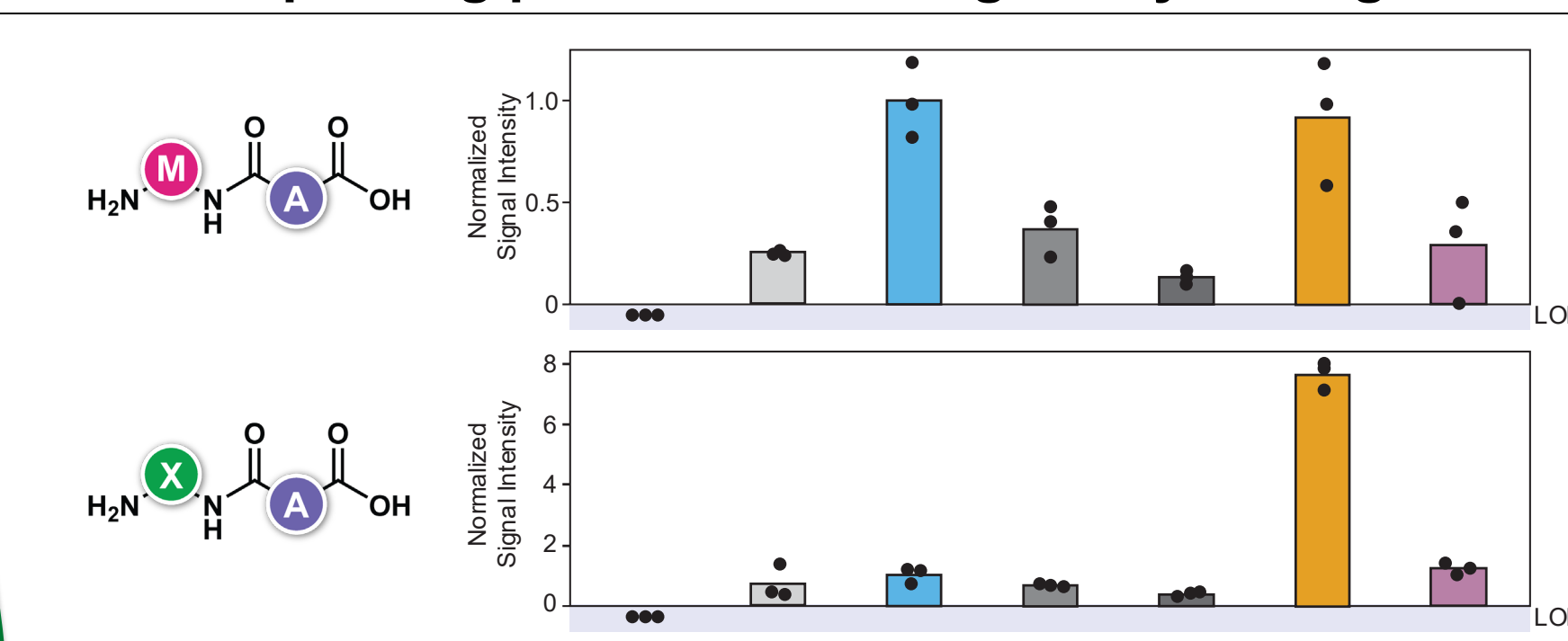


Enzymatic synthesis of sequence-defined oligomers

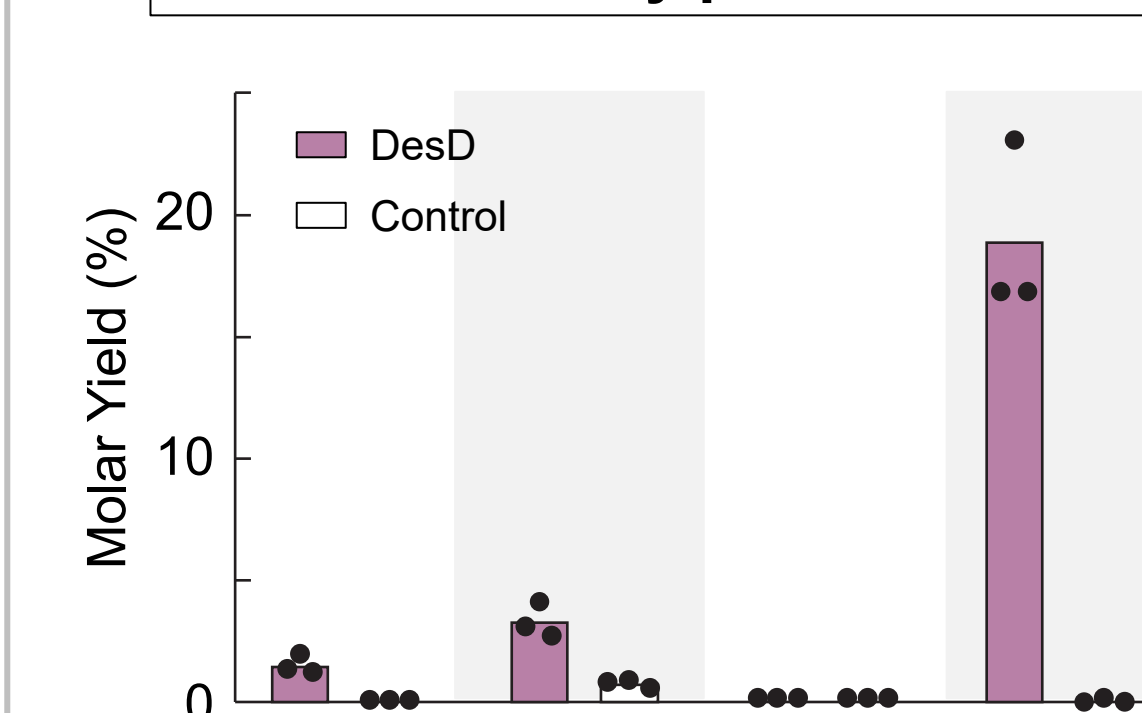
Enzymes couple difunctional substrates without the need for protecting groups



We are improving production through enzyme engineering

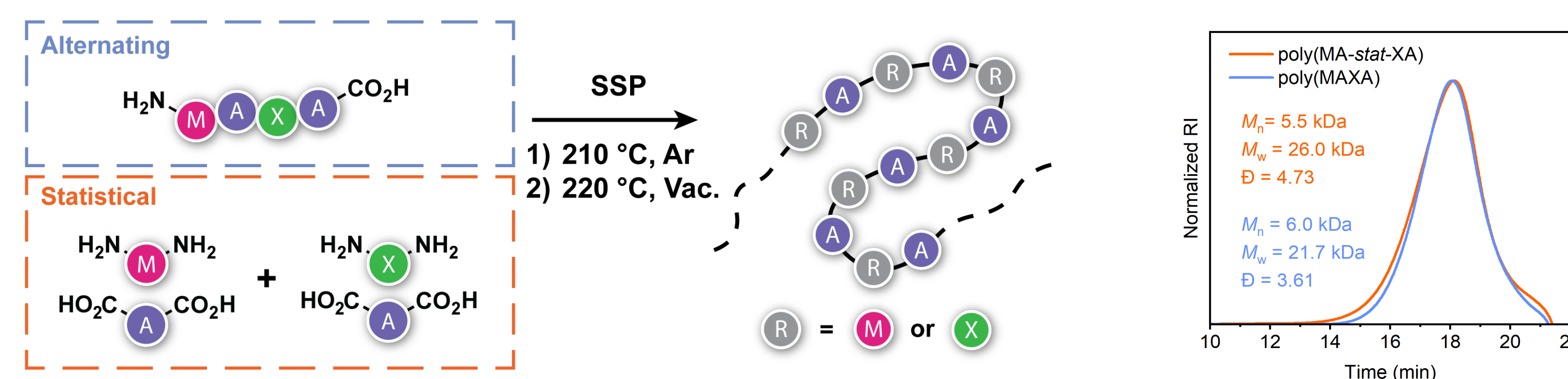


DesD selectively produces MAXA

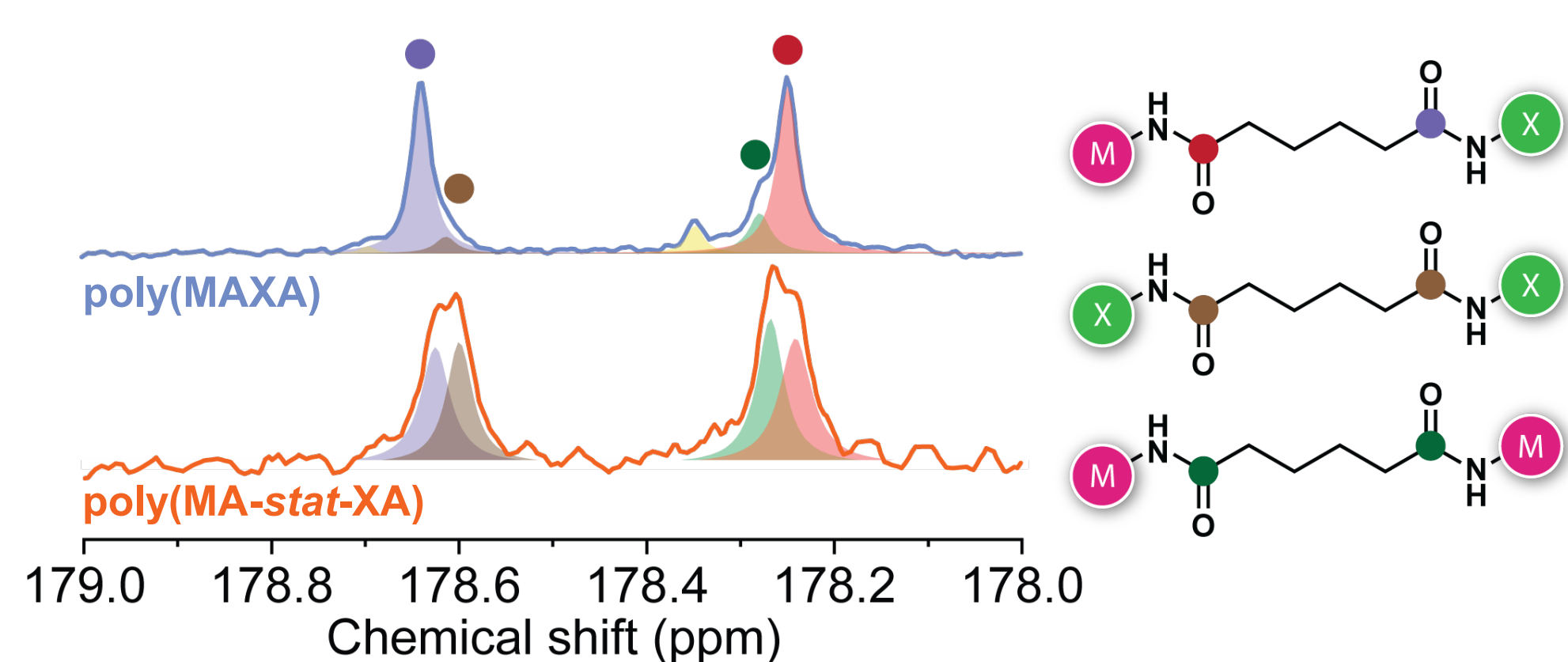


Sequence-controlled solid-state polymerization

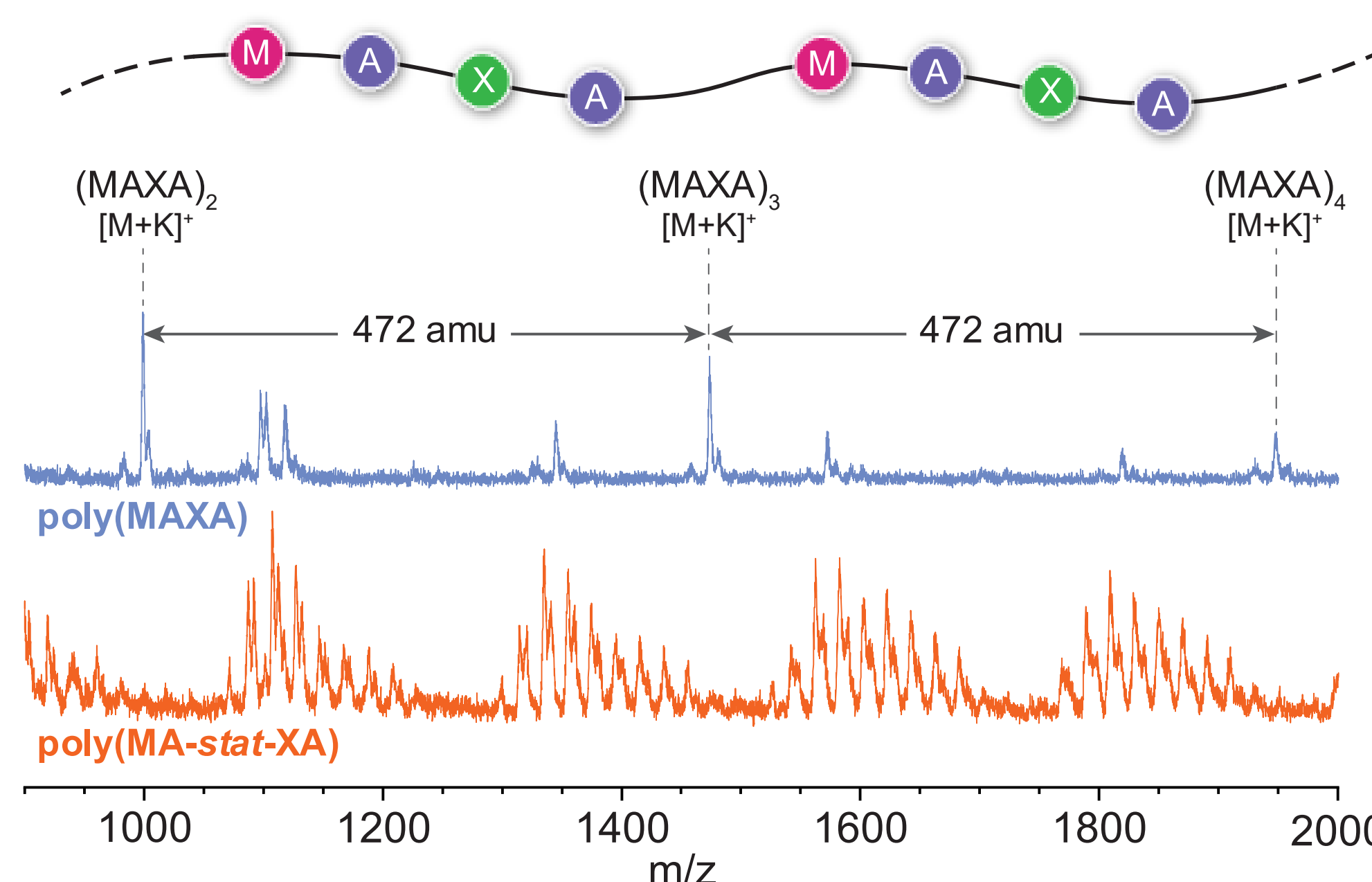
Solid state polymerization (SSP) produces high MW polymer with controlled monomer sequences



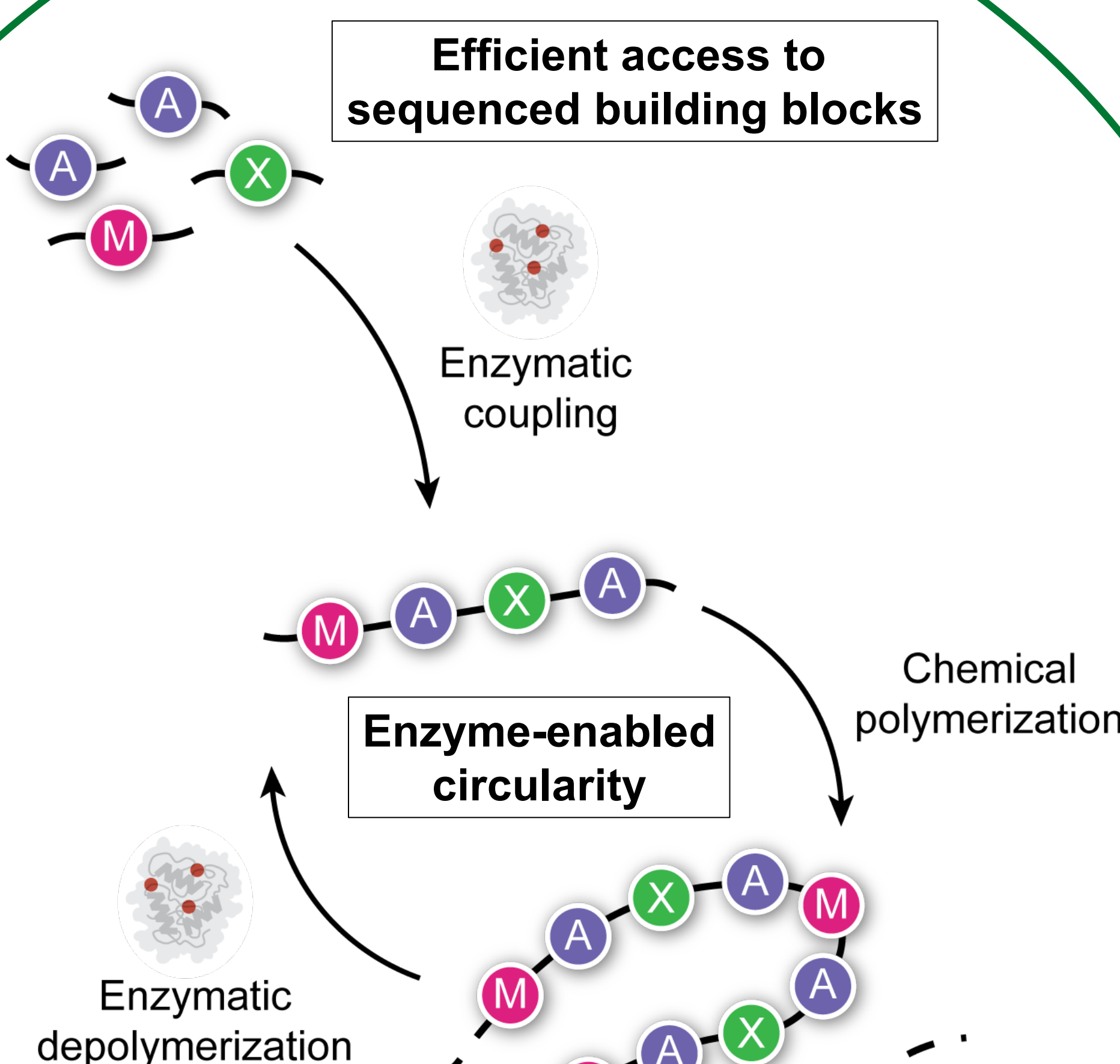
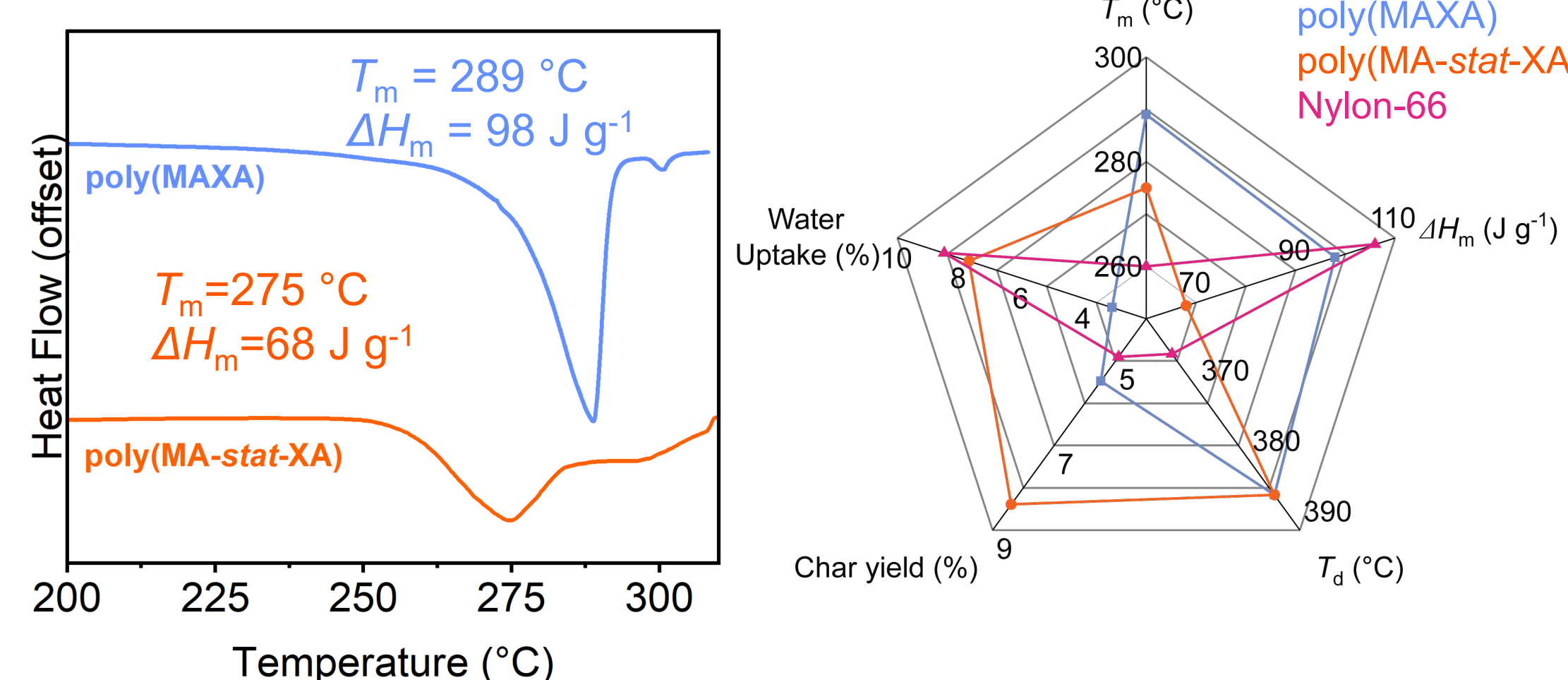
Sequence quantification by ¹³C NMR spectroscopy



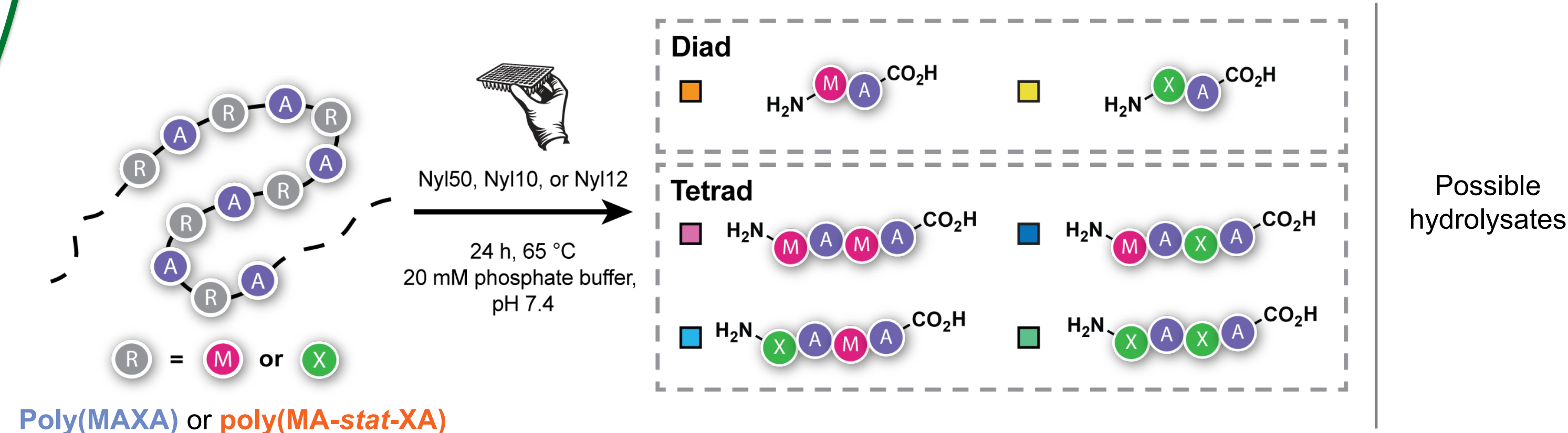
MALDI-TOF mass spectrometry



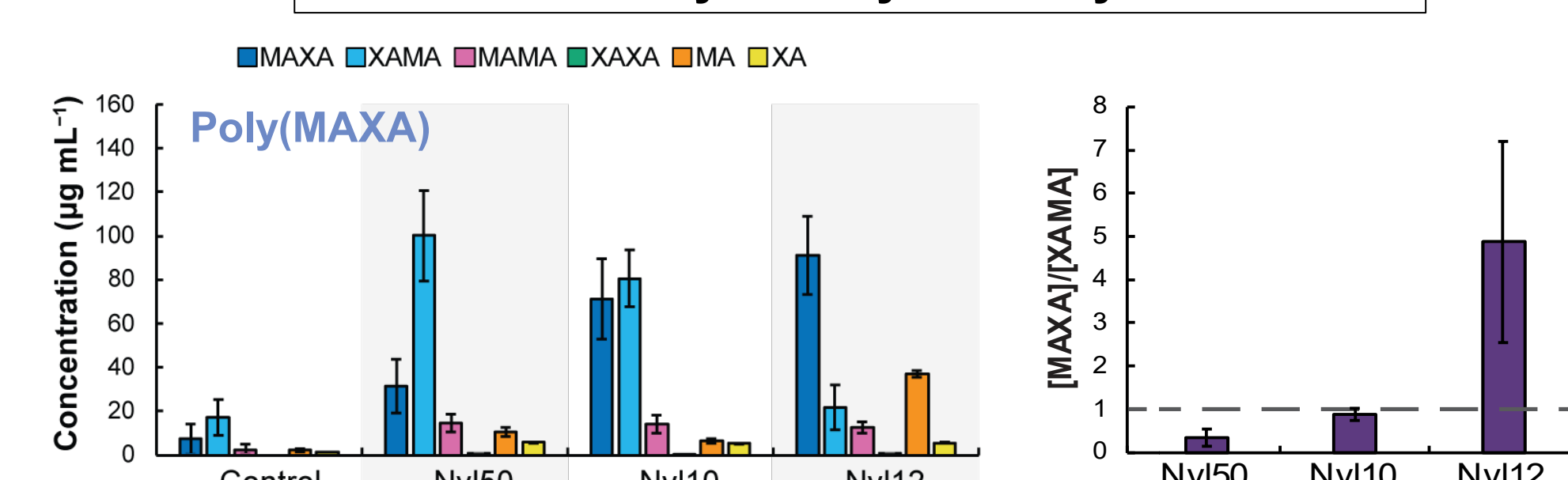
Sequence controls material performance



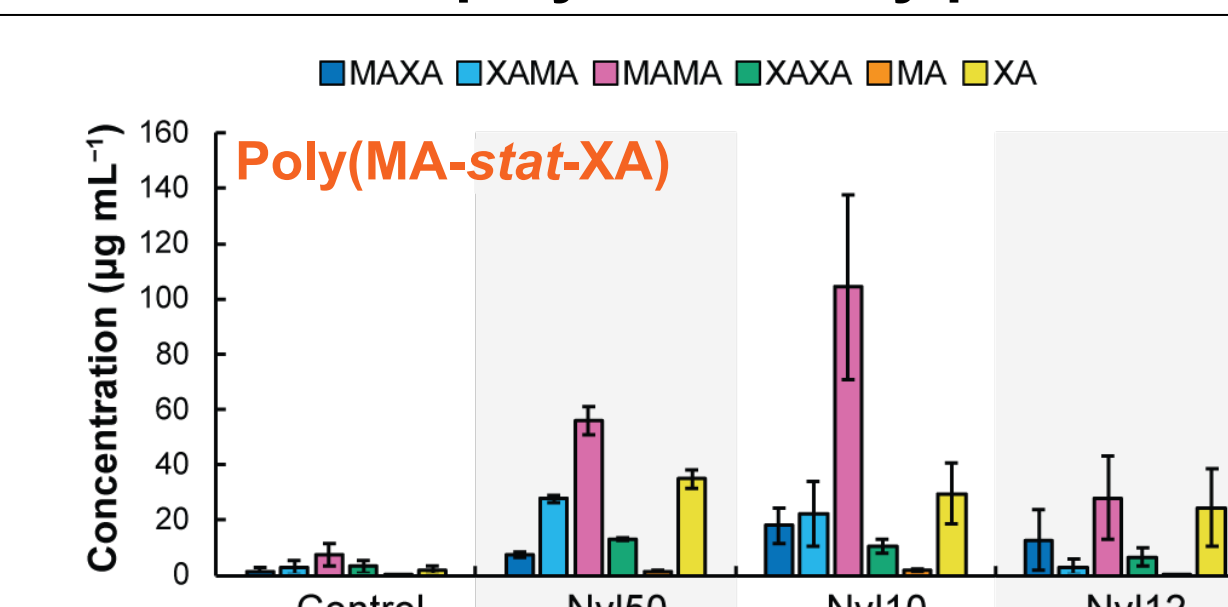
Regioselective enzymatic depolymerization



Tetrad selectivity is enzymatically determined



The statistical copolymer mostly produces MAMA



Enzyme-substrate interaction models explain regioselectivity

