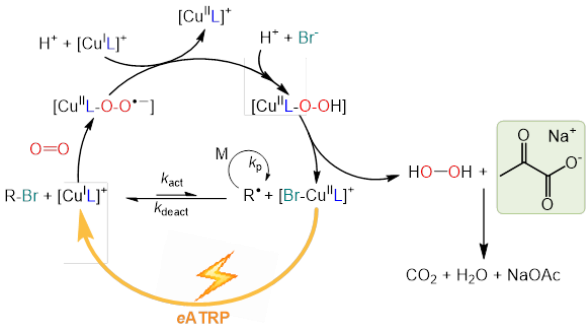
Technology Offer

Scalable and Self-Degassing Process for Atom Transfer Radical Polymerization Controlled by Electrochemistry

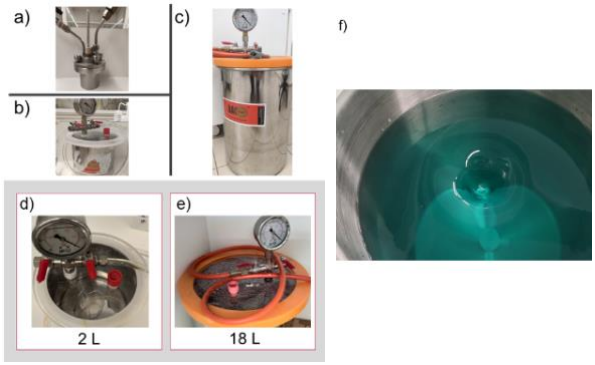
KEYWORDS: ATRP; Controlled Radical Polymerizations; Oxygen Tolerance; Polymers; Scale-up.

Existing methods for large scale controlled radical polymerization still do not include deoxygenation of the polymerization mixture. Since degassing of a (very) large mixture is not feasible at (very) large scale, dissolved oxygen has to be (electro)chemically washed out of the mixture. Our technology enables the production of various (co)polymers on a large scale by integrating an electrochemical cycle for oxygen scavenging into the polymerization equilibrium:

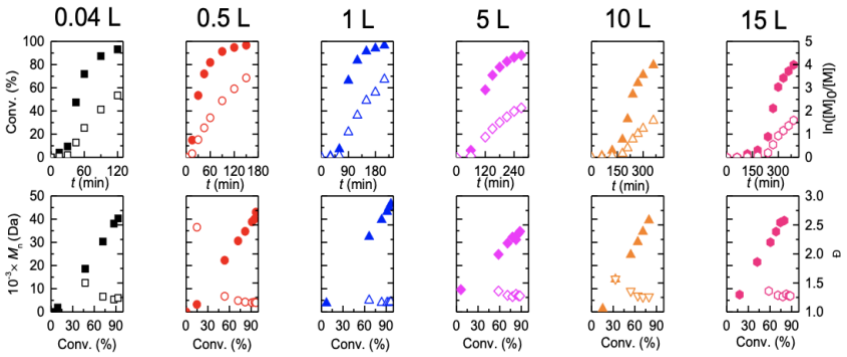


1. The reaction is then easier to prepare, handle and trigger in the presence of the low-cost sodium pyruvate scrubber. The control over the macromolecular properties is very tight;

2. Our reactors do not require expensive electrodes, are scalable beyond 15 L, and are powered by renewable energy. At 15 L, the maximum power is 1 watt.



Unlike existing methods, there is no need for high-vacuum degassing, purging, or extensive surface cleaning prior to electrolysis. The reactor cleans its own surface and the oxygen is converted into harmless by-products by the same catalyst used in the polymerization. This process is compatible with a wide range of hydrophilic monomers, and can be used for scalable production of high-specialty polymers.



The 18 L full scale reactor loaded with 15 L of polymerization mixture | Kinetics of eATRP of acrylamide from 0.04 to 15 L

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ADVANTAGES	APPLICATIONS
• Electrochemical self-degassing of the polymerization mixture with inexpensive ROS scavengers. • Electrochemical self-cleaning of surface reactor before the electrolysis. • Tight control of molecular weight and dispersity up to 15 L and beyond. • Near room temperature process. • Compatible with water and aqueous mixtures. • Minimal energy requirements (only 1 W of peak power at 15 L). • No expensive electrodes are needed. • Further scalability beyond 15 L. • Operates as batch reactor, with semibatch possibilities.	• Large volume synthesis of controlled linear homopolymers for different application (e.g thickening agents, flocculants, thermoresponsive (co)polymers…). • Large volume synthesis of controlled star-shaped (co)polymers (e. g rheology modifiers). • Large volume synthesis of controlled cationic (co)polymers (e.g antimibrobial polymers). • Large volume synthesis of controlled statistical (co)polymers (e.g lubricants additives). • Large volume synthesis of controlled biocompatible (co)polymers. • Large volume synthesis of engineered cellulose-(co)polymer materials.

STAGE OF DEVELOPMENT: TRL 3

IPR LEGAL STATUS: Patent Panding n.° 117852 filed on 11/03/2022.

OWNERSHIP: The rights to the technology are held by the University of Coimbra.

COLLABORATION SOUGHT: The University of Coimbra is seeking commercial partners interested in further developing the technology under a collaboration and license agreement or acquiring the existing rights.

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