Itaconic Acid: from oligomers to microgels

Angela Giunta[1], Frederic Becquart[1], Jean-Charles Majeste[1], and Fabien Dutertre*[1]

[1]Ingénierie des Matériaux Polymères – IMP@UJM, CNRS, UMR 5223, Université Jean Monnet - Saint-Etienne – France

Résumé

Itaconic acid (ITA) has been identified as one of the most promising bio-based chemical building blocks, and a potential sustainable substitute for the widely used thickener agent based on poly(acrylic acid). Previous researches have investigated the radical homopolymerization of ITA in aqueous media, showing slow kinetics, small conversion and low molecular weight. In this study, we deeply investigate the radical polymerization of ITA to overtake the current limit, reaching the optimal condition in term of monomer solubility and polymerization rate. Then, we propose a straightforward approach to fabricate bio-based soft colloids composed entirely of ITA, for applications in cosmetic formulations. Microgel-like particles were obtained through mechanical fragmentation of pITA hydrogels. Their properties in aqueous suspension were investigated utilizing steady, oscillatory rheology, and confocal microscopy. The effects of polymer concentration and degree of ionization on microstructural properties and rheological behavior were investigated. The resulting soft colloids exhibit different architectures, ranging from slightly branched polymers to compact microgels with heterogenous shape. As expected for weak polyelectrolyte microgels, their rheological properties are governed by concentration and pH, peaking at intermediate pH, corresponding to the half-neutralized form. This optimal degree of ionization aligns with the microscopy results that demonstrate a maximal swelling ratio in this condition.

*Intervenant