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Superabsorbent polymers (SAP) are able to retain up to 1000 g/g of water relatively to dry weight. As consequence, these materials find important applications in different fields such as sanitary industries, agriculture, environment, construction or controlled release.\textsuperscript{[1]} This work reports experimental and theoretical studies concerning SAP production through the copolymerization of acrylic acid with N,N'-methylenebisacrylamide (bifunctional crosslinker) or trimethylolpropane triacrylate (trifunctional crosslinker). In such way, the influence of the functionality of the crosslinker on the dynamics of gel formation is assessed. Polymerizations are performed in a 2.5 L batch reactor considering solution and inverse suspension operation. An \textit{in-line} FTIR-ATR immersion probe is used to monitor these reactions. Soluble fraction of samples collected at different reaction time are \textit{off-line} analyzed using size exclusion chromatography with refractive index and multi-angle laser light scattering detection (SEC/RI/MALLS). Dynamics of weight fraction of gel is also measured and key properties of SAP production are thus experimentally obtained. Experimental measurements are compared with predictions of a general kinetic approach\textsuperscript{[2-4]} that allows the quantification of the post-gelation period. The Theory of Branching Processes (TBP) is also used to describe these non-linear polymerizations and important differences between the two theoretical approaches are identified. These modeling studies can be useful to design operation conditions leading to improved superabsorbent networks.


