

In-Process Thermochemical Analysis Of In Situ Poly(Ethylene Glycol Methacrylate-Co-Glycidyl Methacrylate) Monolithic Adsorbent Synthesis

Abstract

Thermomolecular mechanisms associated with the synthesis of polymethacrylate monoliths are critical in controlling the physicochemical and binding characteristics of the adsorbent. Notwithstanding, there has been limited reported work on probing the underlining synthesis mechanism essential in establishing the relationship between in-process polymerization characteristics and the physicochemical properties of the monolith for tailored applications. In this article, we present a real-time thermochemical analysis of polymethacrylate monolith synthesis by free-radical polymerization to probe the effects on the physicochemical characteristics of the adsorbent. The experimental results show that an increase in the crosslinker monomer concentration from 30 to 70% resulted in a peak temperature increase from 96.3 to 114.3 °C. Also, an increase in the initiator (benzoyl peroxide) concentration from 1 to 3% w/v resulted in a temperature increase from 90.7 to 106.3 °C. A temperature buildup increases the kinetic rate of intermolecular collision associated with microglobular formation and interglobular interactions. This reduces the structural homogeneity and macroporosity of the polymer matrix. A two-phase reactive crystallization model was used to characterize the rate of monomeric reaction after initiation and microglobular formation from the liquid monomeric phase to formulate the theoretical framework essential for evaluating the kinetics of the polymer formation process. © 2016 Wiley Periodicals, Inc.