ANILINE POLYMERIZATION ASSISTED BY SBA-16 TYPE MESOPOROUS SILICA

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ABSTRACT

Polyaniline (PANI) has been used in rechargeable batteries [1], fuel [2] and solar cells [3], coatings [4] and sensors [5] due to its electrical, optical and electrochemical properties. However, the low mechanical stability of PANI limits its use in some applications. To improve mechanical properties without completely sacrificing conductivity of the material is an important aspect in the synthesis of these materials. We propose to synthesis hybrid materials PANI/silica with PANI with high molecular weight can favor the conductivity [6] of electrons and the inorganic matrix permit better mechanical properties for future applications. The preparation of PANI/silica materials was carried out through a two-steps procedure that involves the adsorption of aniline in the porous SBA-16 type mesoporous silica hosts and its subsequent chemical polymerization with ammonium persulfate. The surface area and the aluminium content were varied on these hosts and their effects on the synthesis procedure steps were studied. The quantity of aniline adsorbed on the hosts depended on the surface area but the polymerization was more influenced by the presence of the aluminium. The catalytic effect of this element has been seen in other kind of hosts [7]. Some insights about the mechanism polymerization of aniline assisted by the evaluated SBA-16 type mesoporous silica are given from the kinetic experiments accompanied by the molecular weight determinations for the produced PANI. The presence of these hosts eliminated the induction period during the polymerization process and produced PANI with molecular weight of 697kDa, which is higher than the values reported by other authors that obtain PANI under similar conditions but in the absence of solid hosts [8]. The overall results show that the use of SBA-16 type mesoporous silica had a catalytic effect that is beneficial for obtaining hybrid materials and for improving the polymerization efficiency of aniline for obtaining high molecular weight PANI.

Acknowledgement: The given work was supported by Antioquia University through "Estrategia para la Sostenibilidad de los Grupos de Investigación 2013-2014". The authors thank Dr Daniel Lee in the CEA institute for the NMR measurements. Leidy Hoyos thanks to COLCIENCIAS for her PhD scholarship: Francisco José de Caldas, 2010.

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BASIC CHEMICAL DATA FROM RADICAL COPOLYMERIZATION USING DROPLET-BASED MILLIFLUIDICS

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ABSTRACT

A conventional batch reactor can be miniaturized to the size of a droplet of a few microliters or less by using milli- or micro-fluidic devices.[1] Indeed, one can generate a sequence of monodisperse droplets, i.e. individual micro batch reactors, containing well-controlled amounts of reagents due to the flow rates applied upstream of the droplet generator. Chemicals are thus compartmentalized within droplets since there is no exchange through the inert carrier fluid. Furthermore, using droplets allows one to control exactly the residence time, i.e. the time of the reaction, as well as improving heat transfer thanks to their high surface-to-volume ratio. Finally, using droplets induces a correspondence between space and time, i.e. all droplets reaching a particular position along the channel will have the same time of reaction and hence the same composition. Coupling a non-intrusive analytical system thus allows fast and easy in-situ determination of concentrations.

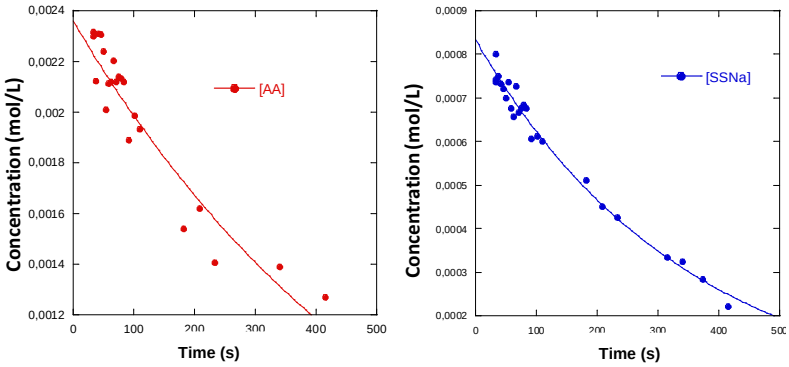

Fig. 1: Concentrations of acrylic acid (AA) and sodium styrene sulfonate (SSNa) vs. time (total concentration is 2.8 mol.L^{-1} for a 80/20 wt% mixture at 70 °C

The aim of this presentation is to show how these tiny droplets can be easily generated "on a bench" and be useful for the chemist in order to obtain basic chemical data from rather fast or exothermic reactions, in particular in radical copolymerization.[2] Examples of the determination of kinetics and reactivity ratios from hydrophilic comonomers at high concentration and temperature, using droplet-based millifluidics coupled to confocal Raman microspectrometry, will be presented. Off-line analysis by SEC coupled to a triple detection will also be discussed according to the effect of this miniaturized process on molecular weights and polydispersity of the polymers.

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