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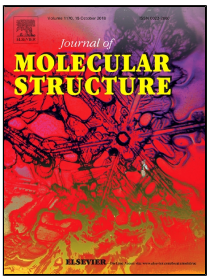

Effects of Junction angle and gas Pressure on Polymer Nanosphere Preparation from Microbubbles Bursted in a Combined Microfluidic Device with Thin Capillaries

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EFFECTS OF JUNCTION ANGLE AND GAS PRESSURE ON POLYMER NANOSPHERE PREPARATION FROM MICROBUBBLES BURSTED IN A COMBINED MICROFLUIDIC DEVICE WITH THIN CAPILLARIES

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ABSTRACT

This study describes polymethylsilsesquioxane (PMSQ) nanospheres preparation from microbubble bursting in a 100 µm capillaries embedded combined microfluidic device based on effects of junction angle and flow rate of liquid solution. The effects of the junction angle (Ø=0° to 60°) between the liquid and gas channels and the gas pressure ratios (50 to 400 kPa) are considered. The digital microscope results indicate that the microbubble size during the bubble generation process generally decreases with the increase of junction angle at the same flow rate and gas pressure. In addition, the nanosphere size in the combined microfluidic junction device with 100 µm capillaries decreases as junction angle increases with the same flow and gas pressure conditions. When junction angle is about 60°, there always exists the smallest nanosphere formation in the device with thin capillaries used. The microbubble formation in the device used in this work depends significantly on the gas pressure, and the combined microfluidic junction device with thin capillaries becomes a microbubble generation when N_2 gas pressure is greater than 50 kPa at the same junction angle and liquid flow rate. Furthermore, the resulting microbubble and polymer nanosphere size in the device used decreases with an increase of N_2 gas pressure. To evaluate chemical structure of the polymers used before and after the microfluidic processing, PMSQ raw materials and the resultant Polymer nanospheres obtained were also characterized using an FTIR spectroscopy. The understanding of polymer nanosphere generation from microbubble bursting in the device with thin capillaries used could be very useful for many applications, such as cell transplantation in biomedical therapy, advanced therapeutic applications and food industry.