Abstract
Micro-gel beads (200–1,200 μm in diameter) were produced by atomization of sodium alginate solution or a sodium alginate-perfluorocarbon mixture with a rotating disk. At any rotation speed of the disk (N) and low volumetric flow rate of the alginate solution (Q), direct drop formation was observed at the edge of the disk. However, with increases in the volumetric flow rate, there was a transition from the direct drop formation to a ligament type of disintegration. The length of the ligaments increased with an increase in Q. Although the diameter of the micro-gel beads showed a bimodal distribution with the number of satellite beads increasing with an increase in Q and a decrease in N, the volume percentage of the satellite beads was negligible. The mean volume diameter of the micro-gel beads (dv) was represented by a dimensionless equation: , where D is the diameter of the disk, NWe, NRe and NZ are the Weber, Reynolds, and Ohnesorge numbers, respectively. By immobilizing viable baker's yeast cells in micro-gel beads 500 μm in diameter, the effectiveness factor for oxygen consumption at a DO concentration of 0.022 mol/m3 was 6 times higher, while the apparent Km value was 50% lower, than when they were immobilized in gel beads 3.2 mm in diameter.