ABSTRACT

The aim of the present thesis was the construction and the evaluation of various types of twin-fluid pneumatic atomizers in different operating conditions for the synthesis of nanoparticles continuously and simultaneously on a large scale. For this purpose there have been made measurements of the diameter and the concentration of the produced droplets for different air and liquid flow rates at the output of each nebulizer. The measurements were carried out with the aim of the optical method Phase Doppler Particle Analyser (PDPA). The first atomizer that was examined (Atomizer A), was used as a benchmark for the evaluation of the other atomizers examined since this atomizer was already used in laboratory scale for the synthesis of nanoparticles. The other atomizers tested were air-assist atomizers of internal and crossflow mixing. With internal mixing of air and liquid (Atomizer B) and with the increase of the air flow, there has been a significant increase of the concentration and the diameter of the produced droplets. At that point it was found that more than 1 stage in the process of nebulization was required. With the introduction of porous material (Atomizers C and E) after the initial nebulizer, was found that a secondary break-up process of the droplets took place resulting in an increase of the concentration. Despite all the above the nebulization system could not be stable. By testing the Atomizer F, an additional nozzle was introduced at the atomization system, from which the droplets pass through a ceramic filter and then break up into even smaller droplets. Finally with wiremesh as porous material (Atomizer G and H) the concentration of the droplets that were produced was 3 orders of magnitude higher than that measured with the Atomizer A. In conclusion, Atomizers F, G and H were considered that can be used to produce nanoparticles in large scale.