Abstract

The characterization of flow, mass and heat transfer during moving droplets of diameter inferior to the millimetre makes the object of our study.

In the first part, we present the theoretical and experimental knowledge of the aerodynamic behaviour as well as the thermal mechanisms of heat and mass transfer between a dispersed and continuous phase. In the second part, we studied the evaporation of a free falling droplet in the air. We realized an experimental setup to carry out the measurements and to predict the evaporation of the droplet according to the physical properties and to the hygrometry of the air. A predictive model based on empirical correlations was used and validated in a previous study in the laboratory. A good agreement is observed. In the third part, we make a simulation of the interaction between the spherical particles in laminar flow. At first, we proposed and validated a simple model which we neglect the interaction phenomena. Our results are compared to the literature. After, we studied the interaction between three identical and co-aligned particles. This model takes into account the nature of the particle, the Reynolds number and the separation distance. In the last part, we study the dispersion of droplets in a homogeneous and isotropic turbulent flow. For that, we proposed a Lagrangien approach to analyse the trajectories. The production of the turbulence is assumed by a grid turbulence condition. We considered that the average characteristics of the continuous phase are known. The selection of the fluctuations is proposed by a probability method which we developed. The fluctuation is kept during a time defined by turbulence, and it is changed during the calculation. This regeneration of the fluctuation is given by turbulence time characteristic.

Keywords: heat and mass transfer, evaporation, drops, drag coefficient, dispersion, fluctuations, homogeneous and isotropic turbulence.