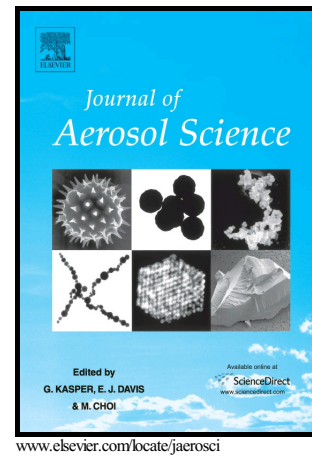


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Numerical Study of Low Reynolds Inertial Impactors with Elliptical Impaction Plate

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Abstract

In the present article, a study on flow field and particles' trajectory inside inertial impactors with elliptical impaction plate is conducted. The shape of impaction plate could have various effects on the collection efficiency of an inertial impactor. The aim is to investigate and provide additional insight about the effects of physical and geometrical properties on flow field pattern and collection efficiency curves using finite volume method. Particles' trajectories were calculated in a Lagrangian reference frame. The effects of aspect ratio of the elliptical plate diameters (AR) on both flow field and collection efficiency curves were investigated numerically. In addition, the effects of Reynolds number on cut-off diameters and on deposition of sub-micron particles were studied. Obtained results revealed that increasing the AR, mainly affect the undersize particles region and did not have a significant effect on the cut-off diameter. Also, using a circular impaction plate with the same surface area as the elliptical ones, leads to a considerable increase in impactor cut-off diameter (about 22%).

Keywords: Impacor; Elliptical impaction plate; Aerosol; Collection efficiency; Submicron particles.

1. Introduction

One stage inertial impactors are one of the simplest devices for collecting atmospheric aerosol particles and are widely used and popular due to their easy operation, transportability and their ability to classify particles by aerodynamic diameter. This technique is applicable in a wide range of fields such as coal dusts, atmospheric exhaust particles, airborne allergens, measurements on adventitious airborne particles as well as in characterizing the size distributions of aerosolized drug particles and powder technology (Ondov et al., 1978, Swanson et al., 1996, Okamoto et al., 2002, and Ho, 2011).

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