Investigation of a Submicron-Particle Inertial Impactor for Size-Selective Inlet of the Electrical Mobility Spectrometer

Panich Intra*

College of Integrated Science and Technology, Rajamangala University of Technology Lanna, Chiang Mai 50300, Thailand

**Corresponding author, E-mail: panich_intra@yahoo.com*

ABSTRACT

An inertial impactor is widely used for sampling, separating and measuring aerosol particles of aerodynamic size. In this study, a prototype of the submicron-particle inertial impactor for size selective inlet of the electrical mobility particle sizing instruments was designed, constructed and investigated. The effects of major design parameters on the cut-off diameter were analytically investigated including the aerosol flow rate, acceleration nozzle-to-impaction plate distance, and acceleration nozzle diameter. A prototype of the impactor was preliminarily tested experimentally to investigate the particle collection efficiency of the impactor and the deposited particles on the surface of the impaction plate inside the impactor. The combustion aerosol generator was used to generate a polydisperse carbonaceous diffusion flame aerosol in the size range of approximately 10 nm – 10 μm for this experiment. It was shown that the theoretical 50% cut-off diameter decreased with increasing aerosol flow rate and also decreased with decreasing acceleration nozzle diameter. Finally, the results of the preliminary experimental tests and the photograph of particle deposited on the surface of the impaction plate inside the impactor was presented and also observed in this paper.

Key words: Particle aerosol, Inertial impactor, Size-selective inlet, Electrical mobility Spectrometer

INTRODUCTION

Inertial impactors have been widely used for many years for sampling and separating airborne aerosol particles of aerodynamic size for further chemical analysis because they are simple in construction with high separation and collection capabilities (Hinds, 1999). It consists of an acceleration nozzle and a flat plate, called an impaction plate. In inertial impactor, particles with sufficient inertia are unable to follow the streamlines and will impact on the impaction plate. Smaller particles will follow the streamlines and not be collected on the impaction plate. The aerodynamic particle size at which the particles are separated is called the cut-point diameter. Numerous extensive studies had been carried out in the past (May, 1945; Ranz and Wong, 1952; Andersen, 1966; Lundgren, 1967; Cohen and Montan, 1967; Mercer and Chow, 1968; Mercer and Stafford, 1969; Marple, 1970; Marple and Liu,