Size-varying respiratory aerosols modeling*

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Aerosols are constituted with small-sized particles, solid or liquid, evolving in the atmosphere. The inhalation and deposition of those aerosols in the human airways and its implications still remain a major issue in both public health and environment.

The size of the aerosol particles lies in a wide range, from a few nanometers to several dozens of micrometers. If one deals with a therapeutical aerosol (to cure respiratory diseases) or polluting particles (diesel, for example), the aerosol physical characteristics, such as the mass density, can also significantly vary.

The issue of aerosol dynamics in the airways has been often studied from the modeling point of view. It first requires to understand the air behavior in the respiratory system. Then the particles trajectory is given through a differential system set on each particle's position. A fluid-kinetic viewpoint has also been tackled in [1].

The characteristic size of the particles has an important impact on the model behavior, in particular, in the drag term between air and aerosol. The article [2] pointed out that the aerosol size variations because of humidity may not be neglected.

The project will (try to) investigate several leads: understanding the implications of [2], which proposes a static but very detailed model of particle hygroscopic growth, on a dynamic situation, for instance for particles evolving in a simplified model of airways such as [3]. The consequences of this growth on the aerosol deposition, for instance following the deposition criteria contemplated in [4], will be inferred too.

References

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