

Abstract Submitted
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Miniaturized inertial impactor for personal airborne particulate monitoring: Numerical model¹ LUCA CORTELEZZI, SILVIA PASINI, ELENA BIANCHI, GABRIELE DUBINI, Politecnico di Milano — The rising level of fine particle matter's (PM₁₀, PM_{2.5} and PM₁) pollution in the world has increased the interest in developing portable personal air-quality monitoring systems. To answer this need, we conceived a miniaturized inertial impactor. The development of such an impactor becomes more challenging as the diameter of the particles to be collected becomes smaller, since the velocities required to induce the impact of finer particulate matter become higher. To overcome these challenges, we modeled numerically the fluid dynamics and particles transport within the impactor. Our simulations show that the fluid flow within the impactor becomes unstable as the Reynolds number is increased to capture finer particles. Furthermore, the onset of these instabilities depends not only on the Reynolds number but also on the geometry of the impactor. The unsteady flow within the impactor influences the trajectories of the particles to be collected, especially the smaller particles. The particles trajectories shows that the impaction location varies substantially as the Reynolds number increases and, consequently, the efficiency of the impactor deteriorates. Finally, we optimize the design of our impactor to maximize its collection efficiency.

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