

Résumé pour la thématique 1 : Concevoir les équipements et procédés de production

Experimental study of particle deposition for undeveloped turbulent flow within typical ventilation duct of food factory

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The quality of air within factories is controlled by many food manufacturers. Ventilation system hygiene must be controlled by regular cleaning to prevent the build up of dust, product or condensate that may provide a focus for microbial growth. In the frame of the national project CLEANAIRNET, in-situ measurements have been performed to analyze flow conditions, particle mass concentration and characteristics of the ventilation ducts in different factories. Theoretical models from the literature have been found inadequate to predict particle deposition in these cases because they were mainly designed for restrictive configuration (fully developed flow, small dimension).

New measurements of particle deposition rates have been then performed in laboratory at real scale with a stainless steel duct system for undeveloped turbulent flows (figure 1). The goal of this study was to conduct aerosol deposition tests to investigate the influence of particle size, air velocity, orientation of the deposition surface and position along the duct on particle deposition velocity. At a Reynolds number $Re=10^5$, particle deposition velocity was analysed as a function of the particle sizing from $1\mu\text{m}$ to $6\mu\text{m}$, and the impact of parameters and mechanisms was studied in terms of position along the duct. Air velocity measurements improved the theoretical model and the prediction of deposition for large particles. Measurements confirm that particle deposition velocity increases when the flow is not fully developed. The measurements allowed us to propose a new empirical model to predict particle deposition velocity in duct surfaces and bends. This contributes to a better design of ventilation systems and a better estimation of particle deposition. Findings of this work may help to identify the specific parameters for cleaning procedures.

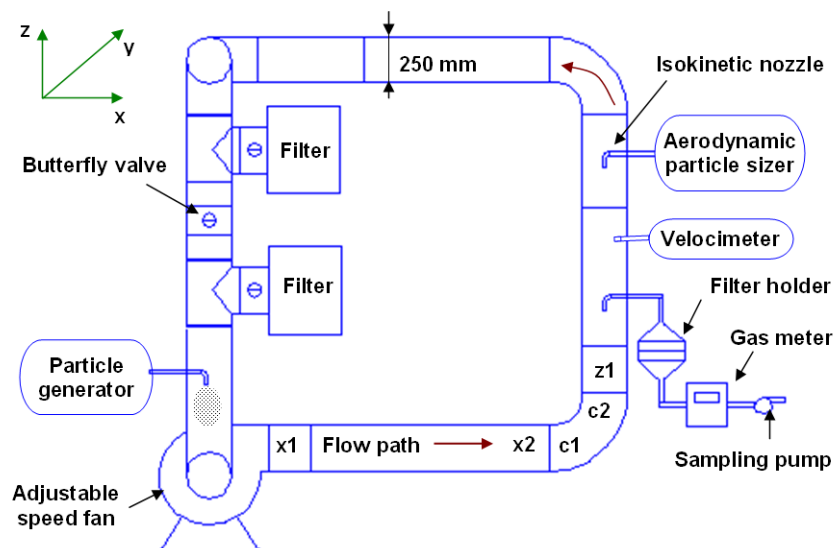


Figure 1: scheme of the experimental setup.