# Flow visualization within a Ventricular Inhaler Device using Open Source CFD for Performance Enhancement

**N. AHMED[a], T.ASIM[b], R.MISHRA[c], B. NSOM[d]**

a. Faculty of Science and Engineering, University of Wolverhampton, Wolverhampton, UK (hmu.design@gmail.com)
b. School of Engineering, Robert Gordon University, UK (t.asim@rgu.ac.uk)
c. School of Computing & Engineering, University of Huddersfield, UK (r.mishra@hud.ac.uk)
d. Université de Bretagne Occidentale, IUT de Brest, IRDL UMR CNRS 6027, France (blaise.nsom@univ-brest.fr)

## Abstract :

*A Ventricular Inhaler Device (VID) is used as a quick-relief medication for treating wheezing and shortness of breath. VID uses Albuterol (a bronchodilator) to relax muscles and open airways. The flow distribution of Albuterol within the VID is the primary parameter that dictates the performance of the device. Poorly designed VIDs can cause accumulation of Albuterol in outlet section of the device, causing flow blockages, which lead to inefficient performance of the device and inappropriate drug delivery. In the present study, Computational Fluid Dynamics (CFD) based advanced techniques have been used in order to visualize the complex flow behavior within a conventional VID, with a purpose to enhance the performance of the device. It has been observed that the pressure coefficient within the injector and outlet duct remains constant, while it decreases in the cyclone separator. Thus, the inlet flow velocity has been seen to have dominating effect on the performance of the VID compared to the rotational velocity of the blades. It has been further noticed that as the flow rate of the drug increases, the efficiency of VID also decreases to a minimum value, after which it remains constant. Moreover, lower rotational speeds of the blades increase the efficiency of the device at higher drug flow rates.*

**Mots clefs : Computational Fluid Dynamics (CFD), Ventricular Inhaler Device (VID), Pressure coefficient, Design of Experiments (DoE).**