UNIVERSITI TEKNOLOGI MARA

EFFECT OF BAFFLE DESIGN CONFIGURATION TO THE FLOW PERFORMANCE OF A SERVCO FUME CUPBOARD

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ABSTRACT

Fume cupboard is a commercial product which has played a significant role in science and technology industry. An efficient fume cupboard should be able to maintain a safe level of airborne contaminants in workplace by controlling and removing them from the worker's environment. Airborne contaminants sometimes leak into the user's breathing zone due to inefficient design of the fume cupboard. This happened when the contaminants entrapped in the recirculation region leak to the vicinity area of the fume cupboard. Leakage of the hazardous chemical out of the fume cupboard's working chamber may pose a threat to the users depending on the types of the chemicals. One of the main components in a fume cupboard is a baffle that helps in distributing airflow in the working chamber up to the exhaust duct. The position, shape and size of the baffle create different flow behaviours inside the fume cupboard thus affect the recirculation region. They also in turn influence the flow in the vicinity of the fume cupboard. The aim of this study is to improve the flow pattern in a fume cupboard by introducing different openings and perforation on the baffle. In this thesis, a Servco fume cupboard equipped with a half Y-shaped baffle with different openings and perforation are simulated and analysed using computational fluid dynamic (CFD) NUMECA software. Prior to that, grid independence study and parameter validation are carried out with respect to the experimental result. It is observed that the flow uniformity index at the inlet of the fume cupboard is improved when openings with different location and shapes are applied to the baffle. Introduction of opening on the baffle at the location just below the slanted component of the baffle shows improvement of flow quality in comparison to other locations and the original baffle without opening. It is also noticed that the baffle with circle shape perforations produces better uniformity index in comparison to the others. Aside from that, the number of perforations on the baffle also leads to the improvement of uniformity index. For validation purpose, the same fume cupboard with original baffle is simulated and the result is compared with experimental data. Both results are in close agreement with each other for the selected points of comparison with less than 10% error.

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