Air flow optimization for energy efficient blower of biosafety cabinet class II A2

M D Ibrahim[1], M Z Mohtar[1], A A Alias[1], L K Wong[1], Y S Yunos[1], M R A Rahman[1], A Zulkharnain[2], C.S. Tan[3] and R Thayan[4]

[1]Department of Mechanical and Manufacturing, Faculty of Engineering, Universiti Malaysia Sarawak, Malaysia
[2]Department of Molecular Biology, Faculty of Resource Science & Technology, Universiti Malaysia Sarawak, Malaysia
[3] Department of Para-Clinical Sciences, Faculty of Medicine & Health Sciences, Universiti Malaysia Sarawak, Malaysia
[4]Virology Unit Department, Institute for Medical Research, Malaysia

E-mail: AbgZaidi87@gmail.com

Abstract. An energy efficient Biosafety Cabinet (BSC) has become a big challenge for manufacturers to develop BSC with the highest level of protection. The objective of research is to increase air flow velocity discharge from centrifugal blower. An aerodynamic duct shape inspired by the shape of Peregrine Falcon's wing during diving flight is added to the end of the centrifugal blower. Investigation of air movement is determined by computational fluid dynamics (CFD) simulation. The results showed that air velocity can be increased by double compared to typical manufactured BSC and no air recirculation. As conclusion, a novel design of aerodynamic duct shape successfully developed and proved that air velocity can be increase naturally with same impeller speed. It can contribute in increasing energy efficiency of the centrifugal blower. It is vital to BSC manufacturer and can be apply to Heating, Air Ventilation and Air Conditioning (HVAC) industries.

1. Introduction

The World Health Organisation (WHO), the U.S. Centers For Disease Control and Prevention (CDC) and other organisation classified BSC into 3 classes. Each classes are distinguished in two ways; level of personal and environmental protection and level of product protection provided. This research focuses on BSC Class II Type A2. This is because it is commonly used due to their versatility and economic designs [1].

One of the important equipment inside BSC is the centrifugal blower. The purpose of this centrifugal blower is to maintain air circulation in certain air speed inflow to BSC and downflow to enclosure work area. Air flow movement generated by centrifugal blower needs to provide a non turbulent airflow distribution inside enclosure work area to ensure that the material inside the enclosure are undisturbed by air flow [2]. Generally, the best design of a BSC is the ones with a non-recirculated air flow. Recirculation of air flow at work area can cause concentrated of contaminate airborne. It will also increase pressure drop due to the increase of flow velocity. Recirculation normally happened caused by turbulent flow. Acceleration of air by centrifugal blower with very less turbulent flow is one of objective in this research. Normally, BSC uses forward curved centrifugal blower type that has high efficiency, low noise level and relatively small air flow with a high increase of static pressure [3].