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Clean Unit System Platform (CUSP) and Connected CUSP Booth (CCB)

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1. Introduction

A high-quality environment is indispensable for work, life, and even future social development. Now we focus on researching how to provide a humane clean environment for indoor life while maintaining low energy consumption. Therefore, we propose an isolated closed cleaning unit system platform (CUSP). Both theory and experiment show that the clean unit system platform (CUSP) composed of 100% feedback fan filter unit (FFU) and multi-stack gas exchange membrane (GEM) can reduce the density of airborne particles [dust and microorganisms] The aspect has many uses, and the density of airborne particles (dust and microorganisms) can be controlled in any enclosed space according to the rule of scale. CUSP returns all the exhaust gas filtered by the FFU to its air supply side and forms an isolated system that exchanges air molecules between inside and outside of the closed space [1]. When there is a concentration gradient across the GEM, the gas-molecule concentration control is achieved by diffusing molecules in the GEM, which is in sharp contrast with the conventional system of concentration control by mechanical ventilation. In this system, CUSP actively collects dust in the room through the FFU to achieve cleaning, and the FFU is isolated from the outside world, which is also very different from the traditional system. CUSP will provide a clean space for all of us, mainly used to improve sleep quality and clean air in the medical environment.

2. Experimental

CUSP is mainly used for sleep quality testing and medical environment cleaning. As shown in the figure1 below, it is a connected CUSP booths, for cleaning medical environment, also known as CCB. There is a window in the middle of each booth to divide the CCB into two parts: the doctor's booth (DB) and the patient's booth (PB). As shown in Figure 2, the FFU is located on the innermost side. The DC170 device for detecting the number of particles is placed in the middle of each CUSP. The two windows above the two CUSP connections are windows that simulate the diagnosis when the doctor treats the patient. We measure the number of particles on both sides to calculate the degree of PB to DB diffusion and the degree of particle size distribution in space.

Fig. 1 Outlook of the CCB.

Fig. 2 Experimental setup in CCB

3. Results and Discussion

In the case of CCB, we measured the diffusion coefficient of molecules through the exchange membrane through the burning candle experiment. And we have confirmed that even if a large amount of PM is generated in PB, the PM density in DB is very low. Therefore, CCB will be a very effective tool for our response to Covid-19.In the application of the medical environment cleaning system (CCB), based on the current experiments, we will study the relationship between the dust density on the PB side and the DB side over time in order to better improve the environment on the DB side.

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Reference

1. T. Hsieh, Y. Liu, S. Liang, M. Yasutake, and A. Ishibashi: "The Tent-type Clean Unit System Platform for Air Cleaning and Non-contact Sleep Assessment", Proc. 3rd Int. Conf. on Computational Biology and Bioinformatics (ICCBB 2019), Association for Computing Machinery, New York, NY, United States: 47–51 (2019).