Measuring respiratory resistance of disposable dust masks in highly humidified conditions

Takashi Hamamoto[1], Toshihiko Myojo[2], Shoko Kawanami[1], Jinro Inoue[1] and Seichi Horie[1]

[1]Department of Health Policy and Management, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan
[2]Department of Environmental Health Engineering, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan

Background: Workers using disposable dust masks in a hot environment often complain of difficulties in breathing, especially when the humidity is increased and sweat accumulates inside the masks. However, the respiratory resistance of masks under highly humidified conditions cannot be evaluated by the current methods defined by the Japanese Industrial Standard T8151.

Purpose: We aimed to develop a new method for measuring respiratory resistance (Pa) of disposable dust masks in highly humidified conditions and evaluated several masks using this method.

Methods: We developed a chamber (0.027m^3) with two pipes (d=40 mm), one attached to an orifice flowmeter and the other connected to the test mask and a humidifier, and alternately connected them to a vacuum pump creating a constant flow (85L/min) to simulate ventilation under heavy workload (Figure 1). We evaluated each of five different DS2 masks with and without an exhaust valve after 5 min expiration and 1 min inspiration.

Results: The weights of the masks with and without an exhaust valve were significantly increased at 3.47 to 4.97 g and 7.33 to 8.07 g, respectively. Differences in the manufacture were not observed. The ratio of after/before expiratory resistance was significantly increased at 1.43 to 1.77 and 1.77 to 15.65; and that of inspiratory resistance was also significantly increased at 1.10 to 2.19 and 1.04 to 5.21.

Discussion: These results indicate that the humidification speed was almost constant and stable. This newly developed method was useful to evaluate the respiratory resistance of masks under highly humidified conditions.

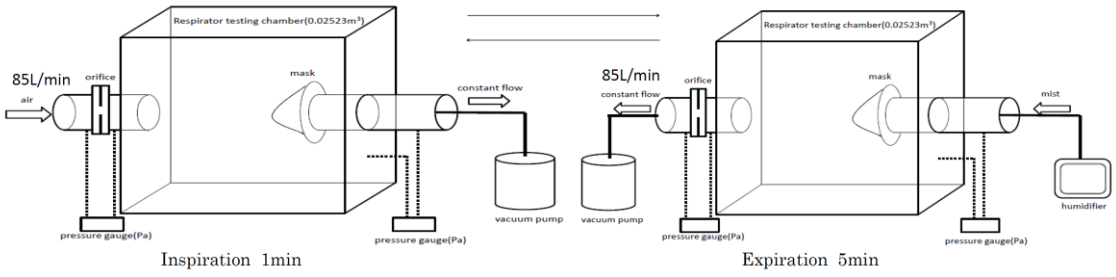

Fig1. Experimental devices