

Development of a Virus Cleaner

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It has been reported that the chance of infection is exceptionally high when the nurses or clinical assistants service the SARS patients inside SARS triage wards (STWs), such as the insertion of flexible pipes into the throats of these patients. SARS triage wards normally house all the new cases with high viral load and therefore they are the most dangerous sites in Hong Kong, demanding full cleaning of air respired from the patients. Spitting out saliva is the most natural response of a patient and such body fluid contains the virus. The conventional ventilation and air-conditioning (VAC) systems in hospitals in Hong Kong has not been designed for the accommodating patients with highly infectious diseases. Normally, fresh air is mixed with the return air from the wards, then cooled down, dehumidified, and filtered before it is supplied back to the wards. Filtering is mainly for removing the dust which is much larger than that of virus. This kind of VAC system is totally useless in preventing the spreading of SARS virus when it is attached to tiny water droplets or particles which are conveyed by the air stream. The traditional guideline of 100% supply and exhaustion adopted for operating theatres (OTs) in hospitals, though applicable to STWs accommodating SARS patients, has a big problem. The exhausted air from OTs may not be harmful to the general public whereas that from SARS patients, or patients with highly infectious diseases, is extremely toxic. An efficient filtering, or in other words cleaning, system has to be designed.

SARS virus is new to the world and most of its behaviour is still unknown to us. Information obtained so far reveals that SARS virus can be destroyed under high temperature, i.e. 38°C or above, and SARS virus can be killed by bleaching water, with a ratio of 1:49. Furthermore, it has been estimated that an air extraction rate of around 10 l/s/patient may be good enough to prevent SARS virus from staying in an indoor environment even when the patient coughs or spits. Our design is based on the three factors just mentioned. Immediate air extraction around the mouth and nose of the patient is an obvious solution to deal with this problem so that the fluid can be extracted and exhausted with the air stream so as to prevent the fluid from getting near to the doctor, the nurse or the assistant.

A very simplified model, or a prototype, has been developed in our laboratory, initially tested and made known to the general public. Air at a flow rate of 20 l/s/patient is drawn into a hood placed by the side of the face of the patient. Such air is mixed with bleaching water spray through a mixing medium composed of spirals. Bleaching water forms the primary stage of sterilization. Then, air is blown through a high-pressure blower and heated up to 70°C for exhaustion, which is the second stage of sterilization. It is estimated that such air flow rate will not seriously affect the existing VAC system inside the ward but it can effectively extract the toxic air coming out from the nose and mouth of a patient.