Back To School
Making Of A "Personal Air Purifier For Schoolchildren's Chair"

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Abstract

There are many schoolchildren who have a minor chemical sensitivity and cannot go to school just because of the activities take place such as arts & craft or just opening the text book. The solution to for those children to go school is to protect them from those chemicals. However a renovation to make the whole classroom into a chemical free room is not a realistic solution for just one child not just because of it's cost but also the effect to the other schoolchildren going in and out from chemical free room because of the risk of rebound. Hereby in this paper will propose a personal air purifier would be effective for the children who have minor chemical sensitivity so that they could go to school and study with their schoolmates. The personal air purifier is able to attach and detach easily to a schoolchildren's chair, which is regularly used in schools. In addition, the air stream from the outlet of the personal air purifier to the breathing zone of the sitting child will be determined.

Keywords: Personal Air Purifier, VOC, Schoolchildren, Air Stream Visualization

Introduction

There are many schoolchildren whom cannot go to school because of chemical sensitivity. Among those chemical sensitivity schoolchildren, some have severe chemical sensitivity and for those it is not easy to lead a normal life, but some of them are in a mild case. For those school children who have a mild chemical sensitivity can about go about their normal daily activities without difficulty. There are many activities, especially in lower grades, which will emit chemical which might become a trigger of chemical sensitivity e.g. arts & craft, waxing the floor or even the textbook itself. However a renovation to make the whole classroom into a chemical free room is not a practical solution not just for it's cost but also the effect to the other schoolchildren going in and out from chemical cleanroom is not known. Subjected to the strong desire of the parents whom have a chemical sensitivity child, our wish to see the child study and play with their schoolmates in school, we have started to think seriously about developing a personal air purifier would be effective for the children have minor chemical sensitivity whom can almost go to school.

This paper will propose a personal air purifier, which could be attached and detached to a schoolchildren's chair, which is regularly used in schools. Moreover the air stream visualization from the air purifier to the breathing zone of the children was determined.

Specification of Personal Air Purifier

The personal air purifier was made to be able to attach on most kind of chairs for schoolchildren. The personal air purifier is made of 2 components, the air purifying component and the air-handling component. The air purifying component is made of stainless steel which the size is W x D x H = 405(mm) x 305(mm) x 400 (mm). The outlet capacity of the fan is 0.45m^3/min. (=27m^3/h) and the static pressure of the fan is 4.2 kPa. There is an activated carbon for VOCs and the air supplied from the outlet will be as low as 30 ug/m^3 in TVOC. The air-handling component is made of stainless

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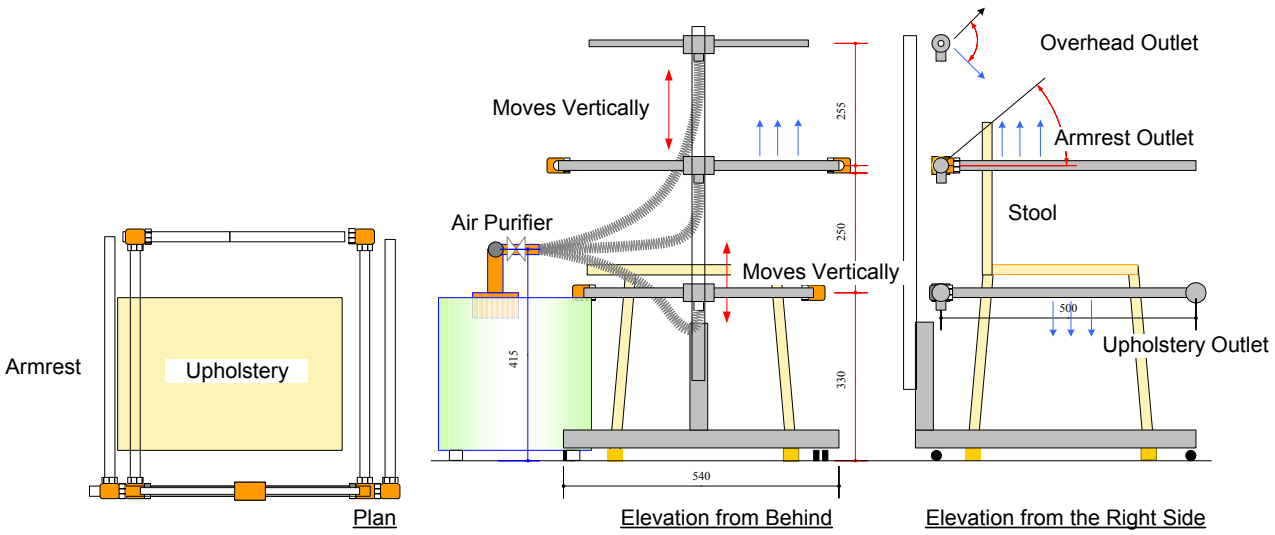
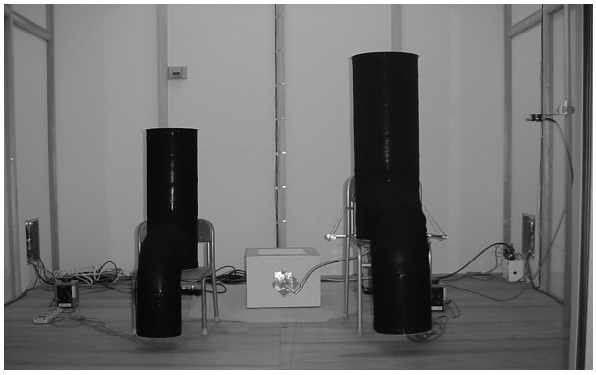


Fig.1 Diagram of the Personal Air Purifier



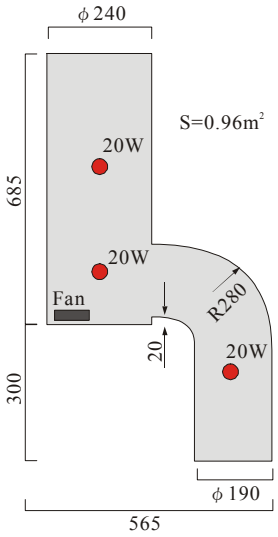


Fig.3 Diagram of a Child Heat Load Simulator

flexible duct and the outlet is made of stainless steel pipe. The chemicals, which might be adsorbed on all of the parts of the component, were purged and baked out before connected as a component.

Air Stream Visualization Around The Human Body

The air stream surrounding the child sitting and the air stream from the personal air purifier to the to the breathing zone of the child was measured by laser light sheet. A 4W Argon-Ion Laser (SpectraPhysics Stabilite 2017, U.S.A.) was used as a laser light source and was passed through a cylindrical lens to a laser radiation sheet. Seeding particles were generated by a smoke generator (SAFEX F2010, Germany), which was supplied through the outlets of the personal air purifier. The experiment was taken place in an isothermal condition, which was set to 20 ℃ to fulfill the tranquility condition. The angle of the outlet was set to 90 degrees.

Results and Discussion

The air stream from the outlet to the child heat load simulator is shown in figure 4. The supplied air is confirmed to approach the child heat simulator, however there is not enough air to comply the air needed at the breathing zone. If the air velocity is higher the supply air will breakthrough the rising heat prume, which will avoid the purified air to the breathing zone. From this further discussion on the angle of the outlet is necessary.

Conclusion

An attachable air purifier for a schoolchildren's chair was proposed. The purified air guided from the outlet to the breathing zone was confirmed; however further discussion is necessary on the angle of the outlet.

References

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