

A Study on Reduction Effect of Volatile Organic Compounds in Autumn by Plants

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ABSTRACT: Of late in Korea, as concern about well-being has risen, there has appeared a movement to make clean air, and improve residential environment using already purified air. To reduce indoor air pollution, air is ventilated by an air-conditioner, and contaminants are controlled by many means. This study made use of an air purifying plant for indoor setting to create pleasant air not by mechanical way, but natural way. The effect was confirmed with that experiment, on which three plants(*Aglaonema*, *Pachira aquatica*, *Ficus benjamiana*) having good effect were selected. The initial experiment to the three kinds of plants was conducted in order to reduce the concentration reduction of VOCs produced in autumn. The concentration of Benzene, Toluene, Ethylbenzene, Xylene, Styrene, Formaldehyde were monitored, since they were known as most toxic materials. In the experiment regarding planting and growing amount, the plants were divided by 10% and 5% of the experiment space, and that to the placement of planting and growing, sunny spot placement, and scattered placement were measured respectively. The measurement was made on the apartment measuring method at three in the afternoon for three days in a row after 5 hour closed state for 5 hours after ventilation for 30 minutes in the morning. The experiment findings are as follows. (1) In decrease of Formaldehyde, the effect was the best at set-up in the change of planting volume and arrangement, and in decrease of Toluene, the decrease effect was excellent at *Pachira aquatica* set-up. (2) The plating and growing amount experiment was most effective with *Pachira aquatica* set up by 10% of the experiment room space. (3) In the plating and growing placement experiment, the sunny-spot placement of *Pachira aquatica* was most effective, and in reduction of Formaldehyde, *Aglaonema brevispathum* was effective.

Keywords: Plant, Indoor Air Quality, Volatile Organic Compounds(VOCs)

1. INTRODUCTION

Of late in Korea, as concern about well-being has risen, there has appeared a

movement to make clean air, and improve residential environment using already purified air. To reduce indoor air pollution, air is ventilated by an air-conditioner, and

contaminants are controlled by many means. This study made use of an air purifying plant for indoor setting to create pleasant air not by mechanical way, but natural way. The air purifying plant used for the experiment is of kind known as having the decrease effect of all kinds of VOCs and Formaldehyde, through which the study aims to explore the best VOCs decrease effect in autumn.

2. METHODS

The effect was confirmed with that experiment, on which three plants (*Aglaonema*, *Pachira aquatica*, *Ficus benjamiana*) having good effect were selected. The initial experiment to the three kinds of plants was conducted in order to reduce the concentration reduction of VOCs produced in autumn. The concentration of Benzene, Toluene, Ethylbenzene, Xylene, Styrene, Formaldehyde were monitored, since they were known as most toxic materials. In the experiment regarding planting and growing amount, the plants were divided by 10% and 5% of the experiment space, and that to the placement of planting and growing, sunny spot placement, and scattered placement were measured respectively. The measurement was made on the apartment measuring method at three in the afternoon for three days in a row after 5 hour closed state for 5 hours after ventilation for 30 minutes in the morning. A full-scale mock-up space was prepared to perform experiments. The dimension of the space was 3.5m (W) by 3.5m (D) by 2.4m (H).

The layout of the space and monitoring points are shown in Fig.1 and Data monitoring is shown in Fig. 2.

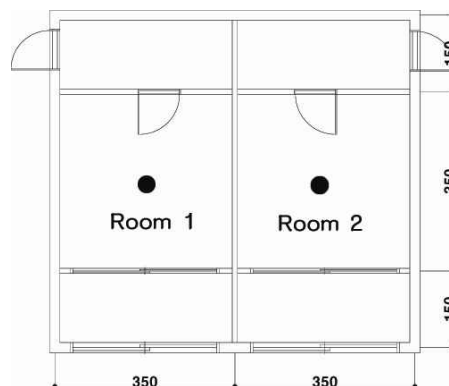


Figure 1: The layout of the space and monitoring points.



Figure 2: Data monitoring(*Pachira*).

3. RESULTS

Figure 3 indicates the volume of all kinds of VOCs in case of 10% arrangement of 3 kinds of plants. The figure indicates that the decrease volume of Toluene was the most, where the decrease effect was the largest at *Pachira aquatica* set-up. Figure 4 shows the effect of 5% planting, and the decrease volume is less than 10% set-up, where the effect of *Pachira aquatica* is the most remarkable. Figure 5 showing the decrease effect of Formaldehyde, indicates the largest decrease volume, where the effect was the largest at *Aglaonema* planting differently from other VOCs. In case of Formaldehyde, the decrease volume was the largest as $361.7 \mu\text{g}/\text{m}^3$ at *Aglaonema* set-up, and the decrease effect was largely indicated

as 290.1~295.3 $\mu\text{g}/\text{m}^3$ in other plant. Even at planting arrangement change experiment, in most cases, the effect of *Pachira aquatica* was the most excellently indicated. Figure 6 indicates VOCs decrease effect at a sunny-spot arrangement, where the decrease volume was largely indicated at Toluene and Ethylbenzene. In most cases including Toluene, the effect of *Pachira aquatica* and *Aglaonema* was largely indicated, and that of *Ficus benjamiana* was somewhat fallen behind. Figure 7 showing the effect of a scattered-spot arrangement indicated the best effect in *Pachira aquatica* set-up.

Figure 8 showing the concentration decrease effect of Formaldehyde, indicated that the effect of *Aglaonema* was most excellently displayed. As a result of grasping the concentration decrease effect of VOCs after setting up 3 kinds of plant, the effect was excellently indicated at *Pachira aquatica* set-up in Toluene and most VOCs set-up, but the effect was the largest at *Aglaonema* set-up only in Formaldehyde. To decrease VOCs in autumn, it is thought good to set up *Pachira aquatica* at large, but to decrease Formaldehyde, good to set up *Aglaonema*.

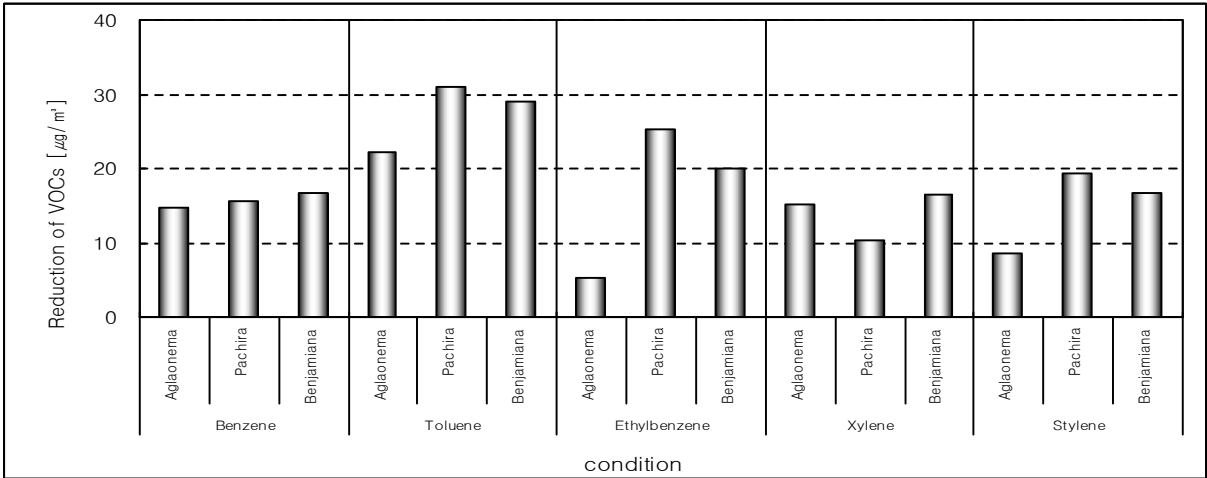


Figure 3: Reduction of Volatile Organic Compounds(VOCs) concentration(10%).

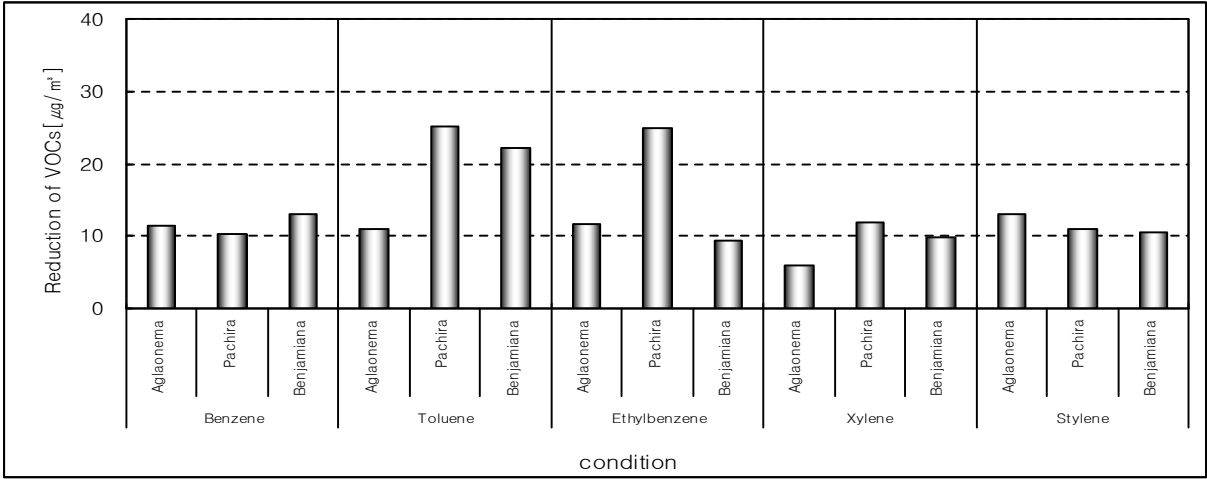


Figure 4: Reduction of Volatile Organic Compounds(VOCs) concentration(5%).

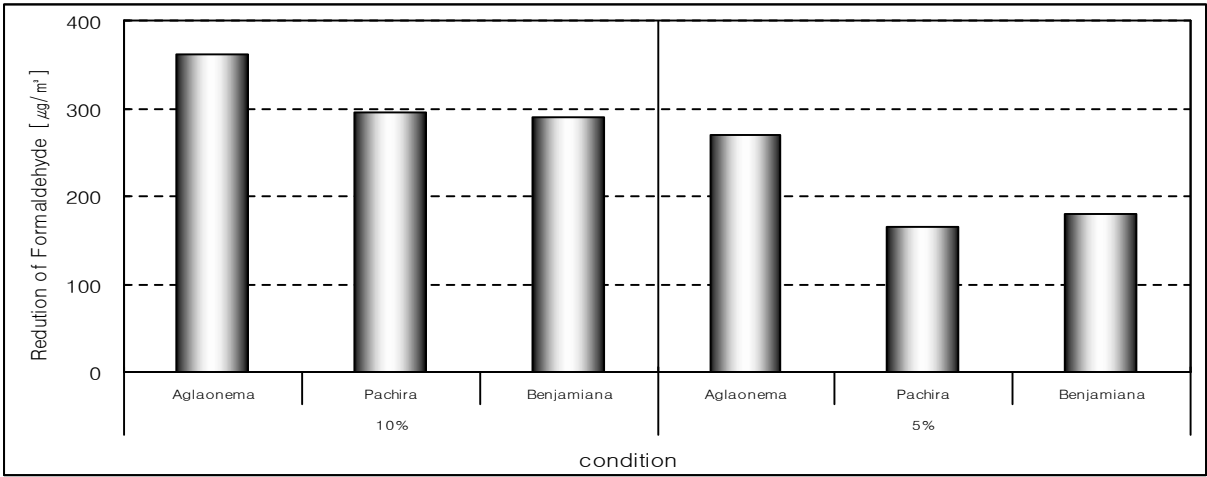


Figure 5: Reduction of Formaldehyde concentration(10%, 5%).

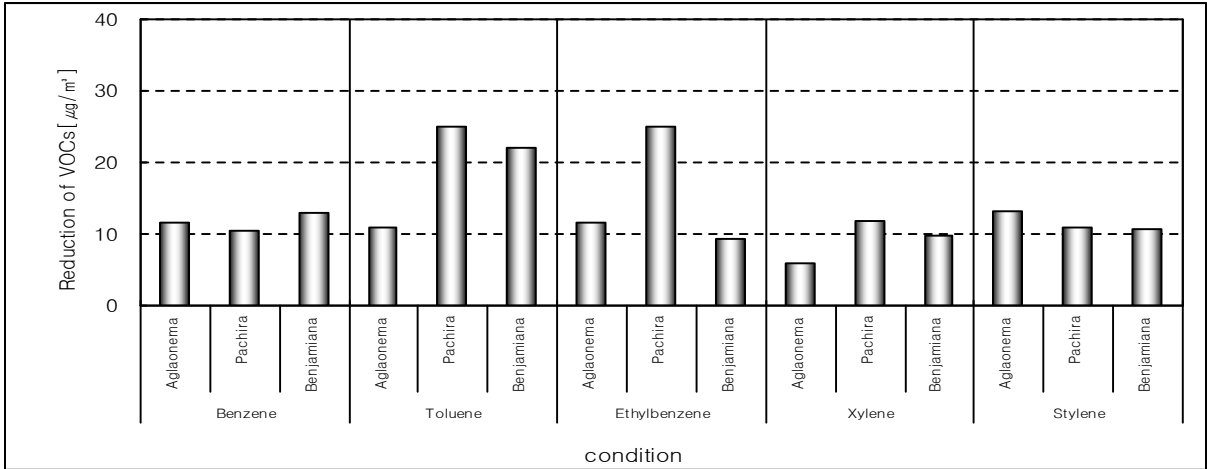


Figure 6: Reduction of Volatile Organic Compounds(VOCs) concentration(sunshine).

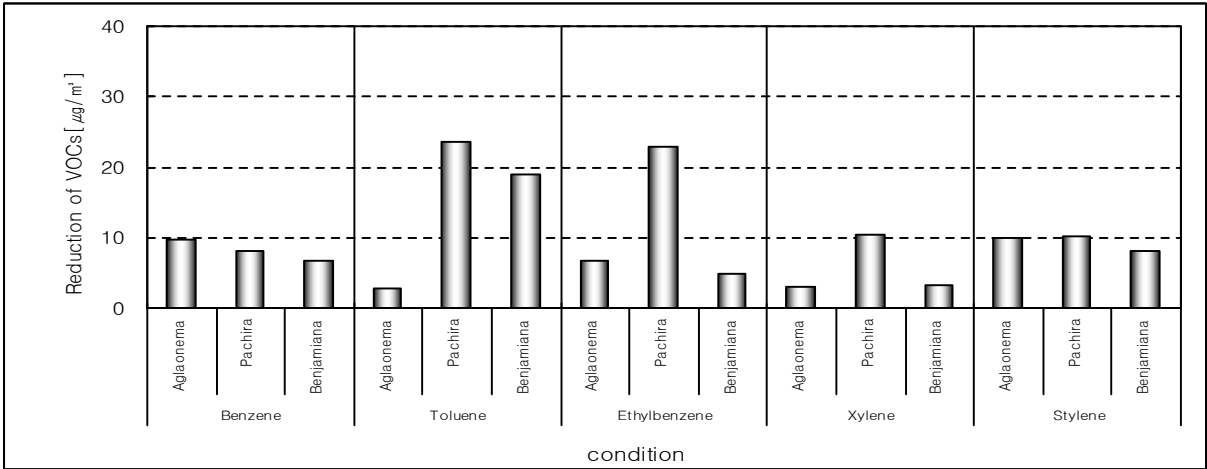


Figure 7: Reduction of Volatile Organic Compounds(VOCs) concentration(scatter).

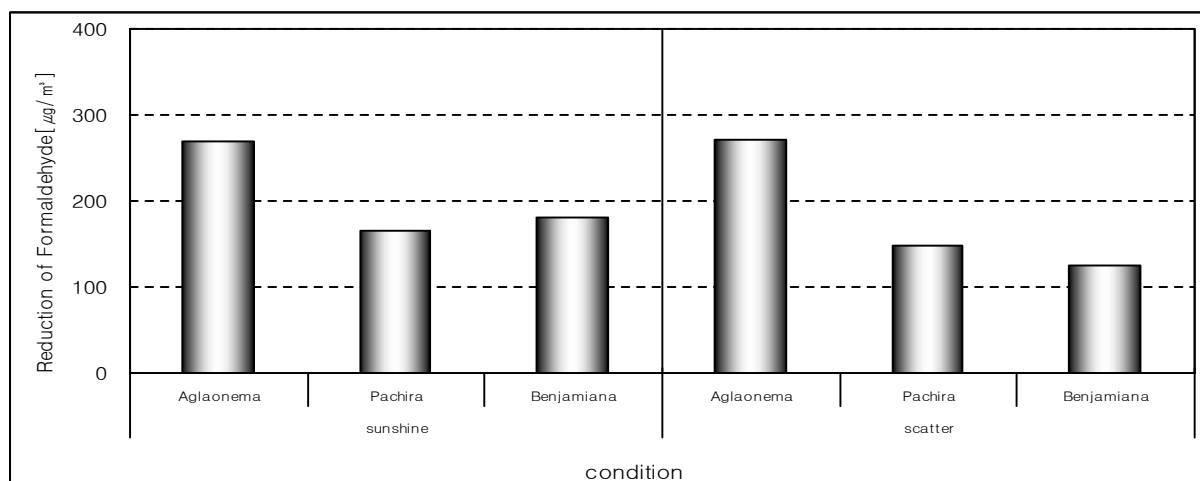


Figure 8: Reduction of Formaldehyde concentration(sunshine, scatter).

4. CONCLUSION

This research explored in what type placement was effective to the three kinds of air purifying plants in autumn. The experiment findings are as follows.

- (1) In decrease of Formaldehyde, the effect was the best at set-up in the change of planting volume and arrangement, and in decrease of Toluene, the decrease effect was excellent at *Pachira aquatica* set-up.
- (2) The plating and growing amount experiment was most effective with *Pachira aquatica* set up by 10% of the experiment room space.
- (3) In the plating and growing placement experiment, the sunny-spot placement of *Pachira aquatica* was most effective, and in reduction of Formaldehyde, *Aglaonema brevispathum* was effective.

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