Derivation of Quantitative Evaluation Method for Plant Air-Purification Capability

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Recently, sick-building syndrome is occurring frequently in an indoor environment due to adopting airtight structures to general domiciles and buildings, the use of synthetic materials which emit air-pollutants and the increase of the polluting chemicals generated from furniture and carpets. Plants possess the capability to remedy environment. Wolverton et al. have reported that plants have high capability to decompose indoor air-pollutants. They evaluated the plant capability using a removing ratio for air-pollutants, where the removing ratio depends on the initial concentration of air-pollutants. However, the purification capability must be specific one for the plant. In the previous studies, measurements for the purification effect were done using gas chromatography and detecting tube. They can not measure the concentration of air-pollutants continuously.

The aim of this study is to derive quantitative evaluation indicator for the specific purification capability of the plant. In this study, a system feasible for continuous measurement was made using a tin oxide gas sensor in order to comprehend the purification process. The purification capabilities of golden pothos and peace lily were examined for formaldehyde. The sensor responding characteristic indicated the first order system. The time constant was employed to evaluate the plant capability. Their capabilities stayed nearly constant in the measurement range even when the formaldehyde concentration was changed. It was confirmed that the time constant did not depend on the initial concentration. Environmental factors, which affected the purification capability, were discussed. Kind of soil, room temperature and light intensity had significant effects on the capability. It was cleared that the measurement should be performed under the same conditions about these factors.

The purification capabilities of ten kinds of common plants were investigated. All purification characteristics indicated the first order system. There was about 3.8 times

difference in the time constant. The purification capabilities of three different-size golden pothoses were examined. The purification capability became higher as leaf area was bigger and young leaves had the high capability per unit area. The purification capabilities of golden pothos and peace lily were examined for toluene and xylene. The purification characteristics for these chemicals also indicated the first order system. Their capabilities stayed nearly constant in the measurement range.

As for the results, the time constant was effective for the evaluation of the purification capability of different kind and size of plant and for various air-pollutants. The validity of the time constant as quantitative evaluation indicator for the specific purification capability of the plant was confirmed.