

Thesis Title	Removal of ethylbenzene in air by <i>Zamioculcas zamiifolia</i> and Epiphytic Bacteria
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Abstract

Ethylbenzene (C_8H_{10}) is a volatile organic compound (VOC) in the 'BTEX' (benzene, toluene, ethylbenzene, and xylene) substance group naturally found in petroleum, paints, inks, insecticides, carpet glues, and tobacco products. Ethylbenzene can be detected in air, water, and soil that have adversely effects on human health, damages animal kidney, and causes cancer from long-term exposure. The biological process known as bioremediation is regarded as a clean and environmental friendly technology compared to other methods especially phytoremediation was proposed as a possible technique to treat air pollutants by various plants.

Therefore, in this research was studied the efficiency of three plant species (*Zamioculcas zamiifolia*, *Sansevieria trifasciata*, and *Sansevieria kirkii*) for ethylbenzene removal in the air. The results showed that *Z. zamiifolia* has the highest potential to reduce the concentration of ethylbenzene from contaminated indoor air ($13.39 \mu\text{mole/m}^2$ leaf area) compared to *Sansevieria trifasciata* and *Sansevieria kirkii* (3.83 and $2.23 \mu\text{mole/m}^2$ leaf area), respectively in 24 hours. In 12 hours, *Z. zamiifolia* leaf and stem can remove 5 ppm ethylbenzene accounted for 26% and 16%, respectively. In 24 hours, leaf and stem remove ethylbenzene increasing to 45% and 20%, respectively. Moreover, the degradation of ethylbenzene in *Z. zamiifolia* was studied by HPLC and GC-MS technique, showed that 1-phenylethanol and acetophenone only found in all parts of treated *Z. zamiifolia* (leaf, stems and roots), which may be the metabolites degraded from ethylbenzene.

Enhancing ethylbenzene removal by bacteria isolated from *Z. zamiifolia* leaf and soil was studied. The result showed that sterile *Z. zamiifolia* by 5% of $NaClO_2$ solution has the potential to remove 5 ppm of ethylbenzene within 60 hours, which no significantly difference compared with natural *Z. zamiifolia*. In addition, after inoculation of these microorganisms (OD 0.5) on leaf of *Z. zamiifolia* such as *Pseudomonas putida* TISTR1522, *Bacillus cereus* E33L, *Bacillus* sp. N6, and *Bacillus* sp. 6B254-3L enhanced the removal efficiency of ethylbenzene of *Z. zamiifolia* completely in 48 hours. *Pseudomonas aeruginosa* and *Bacillus cereus* strain ZQN5 can remove ethylbenzene completely in 36 hours. Accordingly, sterile plant inoculated with epiphytic bacteria or soil microorganisms could remove ethylbenzene in a shorter time and continuously. *P. aeruginosa* and *B. cereus* ZQN5 were confirmed their removal efficiency by inoculated in nutrient both during 0 to 12 hours. It clearly showed that *P. aeruginosa* had higher removal rate (26.09 ppm/hour) than *B. cereus* ZQN5 (19.1 ppm/hour) at initial ethylbenzene of 520 ppm. Therefore, *P. aeruginosa* is the best microorganism that can enhance *Z. zamiifolia* for treatment of ethylbenzene contaminated air effectively.

Keywords: *B. cereus* ZQN5/ Epiphytic bacteria/ Ethylbenzene/ *P. aeruginosa*/ Soil bacteria/ *Zamioculcas zamiifolia*