

海洋性発光バクテリアの生物発光阻害を利用した 室内微粒子汚染のバイオモニタリング

池田四郎, 及川雅史, 関根嘉香

東海大学大学院理学研究科 〒259-1292 神奈川県平塚市北金目1117

Biomonitoring of indoor particulate contamination by detecting bioluminescence reduction of marine bacterium *Vibrio fischeri*

Shiro IKEDA, Masafumi OIKAWA and Yoshika SEKINE

Graduate School of Science, Tokai University, 1117 Kitakaname, Hiratsuka, Kanagawa, 259-1292 Japan

要 旨

バイオアッセイは生物応答を利用した有害性評価法であるが、室内環境汚染物質の一般毒性に着目した適用例は少ない。そこで、海洋性バクテリア*Vibrio fischeri*(*V. fischeri*)の生物発光性を利用した室内環境の簡易毒性評価法の開発を目的に、*V. fischeri*の生物発光量に及ぼす浮遊粒子状物質およびハウスダストの影響を検討した。神奈川県内の一般住宅においてローボリュームエアサンプラーを用い、7日間連続で室内外の総浮遊粒子状物質を石英繊維製フィルター上に捕集した。また、首都圏の4軒の家庭から掃除機ごみを提供してもらいハウスダストを収集し、ふるいを用いて粒径分画した。試料を滅菌蒸留水で振とう抽出し、抽出液を孔径0.45 μm のフィルターでろ過し、ろ液を*V. fischeri*に作用させ、ルミノメーターで生物発光強度を測定した。その結果、*V. fischeri*の生物発光は室内および室外の浮遊粒子状物質の水抽出物に阻害され、発光阻害度はTSP(Total Suspended Particles)濃度の増加に伴い増加した。また、室内では換気回数が増えるほど単位質量あたりの発光阻害度が増大し、エアロゾル中の毒性成分の割合が高くなる現象が認められた。一方、ハウスダストの水抽出物も生物発光量を減少させ、微小な粒子ほど高い毒性をもつことがわかった。またハウスダストの発光阻害度は、抽出液中の硝酸イオンおよび硫酸イオンの濃度と相関が認められた。

Abstract

Bioassay, which detects biohazardous property of environmental contaminants, is still being an unexplored field of air quality monitoring. This study aims to develop a simple testing system of toxicity of the indoor particulate matter by detecting bioluminescence reduction of marine bacterium *Vibrio fischeri*. Suspended particulate matter in indoor and outdoor air was collected on a quartz fiber filter at a flow rate of 23.5 L/min by a low volume air sampler for 7-day duration, at the terrace and living room of an apartment house in Kanagawa, Japan. Collected materials were extracted with sterilized distilled water by mild shaking. After filtration with 0.45 μm pore size filter, the extracts were subsequently mixed with a bacterium solution in a well of 24-well plate and time courses of bioluminescence intensity were measured by a luminometer. Meanwhile, House dust samples were collected from filter bags of household cleaners of 4 houses in metropolitan area. House dust samples were size-fractionated by stainless steel sieves and then served for bioassay as well. As a result, the water extracts of indoor and outdoor aerosol samples significantly reduced the bioluminescence of *Vibrio fischeri* and the inhibition per sampling volume increased with increasing of TSP (Total Suspended Particles) concentrations. The inhibition per unit mass of the indoor aerosols became greater than that of outdoor aerosols, when increasing in air change rate. On the other hand, the water extracts of house dust also showed the inhibition of bioluminescence especially in fine mode. The inhibition tended to correlate with nitrate and sulfate concentrations in the extracts. This study showed possible application of bioassay to the monitoring of indoor particle contamination.

Key words: バイオアッセイ (Bioassay), ビブリオフィッシェリ (*Vibrio fischeri*), 浮遊粒子状物質 (Suspended particulate matter), ハウスダスト (House dust), 生物発光性 (Bioluminescence)