Evaluating the Emission of "Musty" Smells

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Introduction

You may have experienced "mustiness" when you have smelled particular foods or entered certain buildings. According to my experience, it never seems to be a memory on the "comfort" side. At the Railway Technical Research Institute (RTRI), our group is now carrying out research to establish a technique for evaluating the air quality in railway facilities which includes, among other things, the identification of smells stemming from mould. In surveys carried out in the past to determine the awareness of mustiness among railway users, a number of respondents replied that they were conscious of the atmospheric environment and of smells at stations. They often cited "mould smell" as an example of unpleasant smells 1). Thus, our group decided to keep an eye on the mould floating in the air as a factor for the evaluation of air quality.

High correlation between subjective evaluation and quantity of mould suspended in the air

Figure 1 shows the replies of railway users to a question asking whether they noticed a smell at particular locations when they were guided around the station premises. The X-axis stands for the quantity of the mould floating in the air at the survey points. This Figure shows that the number of respondents who noticed a smell correlates very well with the quantity of mould floating in the air.

Emitters of smell - volatile substances

Next, we collected the mould floating in the air within the station premises, cultured it in our laboratory and examined what substances the mould emits to cause smells. As a result, we found that Cladosporium spp. that is frequently detected (in bathrooms, for example) does not emit smell-related substances much, while Penicillium spp. and Aspergillus spp. do emit smell-related substances in some quantity. Before implementing a series of analyses, we thought that particular substances related to "mould smell" would exist in the environment. On the contrary, our analysis revealed that there were no specific mould smell substances but



that unpleasant smells were caused synergistically by a set of substances existing in nature. It is rather interesting that these substances include "limonene" and similar substances contained in lemons, mandarin oranges and other citrus fruits.

A smell sampling device and instrumental analysis

Indeed, smell is complicated enough to deal with, in that human sensory reaction against a mouldy substance changes from "comfort" to "discomfort" when its concentration becomes high. Even at an extraordinarily low concentration, some substances are offensive to human beings. To analyze smells, therefore, we now perform sensory evaluation with our nose by using a smell sampling device installed on a gas chromatograph (GCMS) (Fig. 2) in addition to instrumental evaluation with the GCMS equipment. If we are allowed to give the conclusion of these analyses first, we found that the human nose is really an excellent sensory organ. Nevertheless, we are now discussing whether it isn't possible to somehow find a way of evaluating smells in qualitative and quantitative terms.

We carried out this study partly with a subsidy by the Ministry of Land, Infrastructure, Transport and Tourism.

Reference

1) Hiroaki Suzuki et al., RTRI Report Vol. 19, No. 1, pp 15 - 20, 2005 (in Japanese)



Fig. 1 Correlation between the ratio of reply "mouldiness noticed" and the quantity of mould floating in the air



Fig. 2 A smell sampling device and GCMS equipment