(3) Performance of sensory test

The sensory test is conducted by at least 6 members of the panel. Each panel is given 3 bags; 1 with a sample in it and 2 without sample (odor-free air) and asked to choose the odorous bag.

If the panel can tell the correct bag, the odor is then diluted and the test is continued until it becomes impossible to identify the bag with odor.

In order to ensure the accuracy of the measurement, it is important to take psychological influences of panel members and olfactory fatigue into account.

Panel members are to identify the bag with odor among 3 bags in a composed environment without odor where they can concentrate on the test.

Fill a bag with odor-free air (filtered through activated charcoal).

When panel members detect intensive odors, their olfaction weakens (olfactory fatigue). Therefore, the test is started with a moderately diluted concentration.

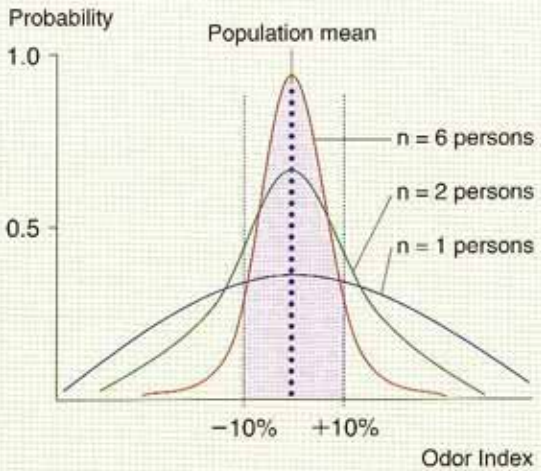
(4) Calculation

Test results should be calculated according to stipulated methods to determine the odor index.

Why are at least 6 members necessary for the panel ?

The indivisual sensitivity to smell differs even among those who passed the aptitude test. To examine the variation of test results, a series of sensory tests was conducted by changing the number of panel members. Sensory tests performed by 6 panel members yielded test results (odor index) which ranged within ± 10% of the population mean with a probability of 94%. When calculated with 4 members excluding maximum and minimum values, the probability of results being in a ± 10% range of the population mean was 91%, revealing a high reliability of results.

Therefore, the panel for the olfactory measurement should include 6 or more members. Moreover, in order to eliminate the influence of outliers, maximum and minimum values should be excluded.



Probability distribution of test results

Calculation of Odor Index

1) First, calculate the threshold of each panel member as follows;

$$X_i = \frac{(\log M_{1i} + \log M_{2i})}{2}$$

X_i : Threshold of panel i (expressed as common logarithm)
M_{1i} : Maximum dilution rate at which the answer of panel i is correct.
M_{0i} : Minimum dilution rate at which the answer of panel i is incorrect or indistinct.

2) Then, calculate the average threshold of panel, which is the average of X_i excluding maximum and minimum values.

$$X = \frac{X_1 + X_2 + \cdots + X_{n-2}}{n-2}$$

X : Average threshold of panel (expressed as common logarithm)
n : Number of panel members

3) Calculate the odor index by multiplying X by the factor 10.

$Y = 10X$

Y : Odor index

Example

An example of the test result is shown on the table below. Threshold of panel i (X_i) ranges from 2.24 to 3.74. Among these values, excluding the maximum (3.74) and minimum (2.24) values, average threshold of the panel (X) is determined by averaging X_i for the remaining 4 panel members. This value (X) multiplied by the factor 10 is the odor index (Y).

$$X = \frac{2.74 + 2.74 + 2.24 + 3.24}{4} = 2.74 \text{ (expressed as common logarithm)}$$

$Y = 10 \times 2.74 = 27.4 \rightarrow 27$ (round digits after decimal point)

Example of sensory test for sample collected at exhaust port

Dilution rate		30	100	300	1000	3000	10000	Threshold of each panel (X_i)	Exclude maximum/minimum values
Logarithm		1.48	2.00	2.48	3.00	3.48	4.00		
Panel	A	/	○	×				2.24	Excluded
	B	/	○	○	×			2.74	
	C	/	○	○	○	○	×	3.74	Excluded
	D	/	○	○	×			2.74	
	E	/	○	×				2.24	
	F	/	○	○	○	×		3.24	

Sensory tests for samples collected on site boundary

There is an established method that is suitable for measuring odors with low concentration. This method is applied to measure samples collected on site boundary of factories and workshops. First, when panel members select a bag with odor, the answers "correct," "incorrect" and "indistinct" are given a score of 1.00, 0.00 and 0.33, respectively. Then, the average correct answer rate is determined by averaging the scores of panel members. The odor index is calculated according to the following equation.

$$Y = 10 \log \left(M \times 10^{\frac{r_1 - 0.58}{r_1 - r_2}} \right)$$

Y : Odor Index
M : Initial dilution rate
r_1 : Average correct answer rate at the first operation
r_2 : Average correct answer rate at the second operation

Triangular Odor Flask Method

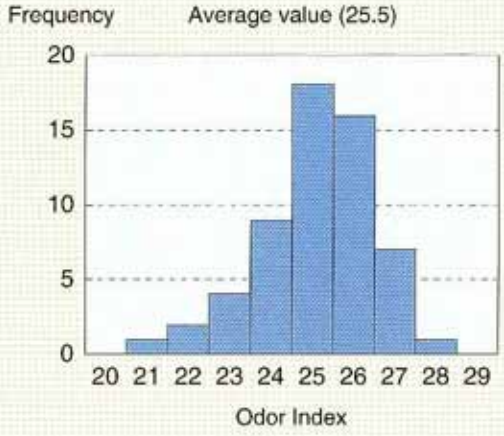
This is one of the methods to measure odors emitted from wastewater. This method is applied to measure samples collected at outlet of factories and workshops. Flasks are used instead of bags and at least 6 members of the panel identify the flask with odor among 3 flasks, repeatedly to determine the odor index. The procedures for the sensory test and the calculation of test results are almost the same as those in the triangular odor bag method.

Quality control

The quality control for the triangular odor bag method consists of two parts: external accuracy control and internal accuracy control.

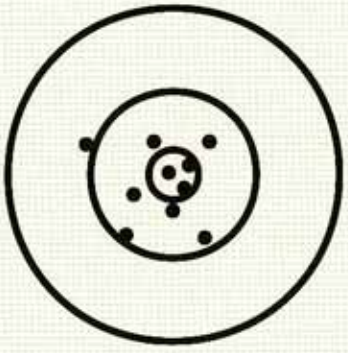
External accuracy control

In order to determine inter-laboratory errors, samples of unknown concentrations are distributed and measured simultaneously at multiple laboratories. The measurement accuracy of each laboratory is evaluated in comparison with the overall distribution of results.



Internal accuracy control

For intra-laboratory control, samples of known concentration are measured periodically at each laboratory and results are then compared with a standard value to evaluate the intra-laboratory errors.



Precision and trueness are evaluated for test results using ethyl acetate with a concentration of 2,000 ppm.

Contact address for inquiries or comments regarding this brochure

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