



Offensive Odor Control Law

Calculation Method of Odor Index and Odor Intensity

Environment Agency Notification No.63 of 1995
Last Amendment by Environment Agency Notification No.18 of 1999

In stipulation of Ordinance of Offensive Odor Control Law (the Ordinance of Prime Minister's Office No.39 of 1972) Article 1, calculation method of odor index is defined as follows and this is applied from 1 April 1996. The test method of the odor judgement with smell function (Environment Agency Notification No.92 of 1992) shall be ineffective on 31 March 1996.

The calculation method of odor index and the odor intensity in stipulation of Ordinance of Offensive Odor Control Law, Article 1 is shown in the attached table

Attached table

Calculation method of odor index and odor intensity

I. Panel

Panel (a person who judges the odor with smell function) shall a person who is recognized to have normal smell function by selection method 2 with the standard odor liquid.

1. Standard odor liquid

Following 5 types of liquids are used;

Beta-phenyl ethyl alcohol	10-4.0
Methyl cycro pentenolon	10-4.5
Iso-Valeric acid	10-5.0
Gamma-Undecaracton	10-4.5
Scatol	10-5.0

Note : The right column represents ratio of weight to non-smell flow paraffin.

2. Selection method of panel

- (1) Five sheets of test paper (length of 14 cm, width of 7 cm, hereinafter referred to "odor paper") expressed number 1 through 5 are prepared. One centimeter of any edge of the odor paper is dipped into the standard odor liquid (one type only) for two sheets of odor paper and similarly dipped into non-smell flow paraffin.
- (2) Five sheets of odor paper are given to examinee (age over 18), examinee choose two of five sheets according to smell function.
- (3) Processes of (1) and (2) are conducted for 5 types of standard odor liquid, the examinee who made correct response is recognized person with normal smell function.
- (4) Above experiment is conducted in the period less than 5 years (3 years for age over 40) to confirm examinee's smell function.

II. Equipment and apparatus

Equipment and apparatus are as follows;

1. Sampling equipment

(1) Sampling equipment for environmental sample
It shall be one of equipment listed in i) through iv).

- i) Air tight glass sampling bottle with fluoride resin valve and ground glass part of 10 liter capacity.
- ii) An equipment with sampling bag in the sampling suction bottle with following condition.
 - (i) Gas sampler is visible for sampling bag and air tight of 10 liter capacity.
 - (ii) Sampling bag is made of non-smell and low odor absorbing polyester (compound name : poly-ethylene terephtharate) film or equivalent of 10 liter capacity with suitable shape for gas sampling injector.
- iii) Equipment that can deliver sample to the sampling bag through sampler pump that satisfies following requirement.
 - (i) Suction pump shall be able to air at 20 liter/minute, and made of non-smell material and low odor absorption is required.
 - (ii) Sampling bag shall be made of material 2-1-i)-(i) and capacity of 10 liter.
- iv) An equipment in which the sampling bag is equipped inside the suction case with suction pump and the following requirement shall be satisfied.
 - (i) The sampling bag inside of the suction case is visible and is with air tight structure.
 - (ii) Sampler pump with air suction power of over 10 liter per minute and the gas through portion is changeable.
 - (iii) Sampling bag shall be made of material 2-1-i)-(i) and capacity of 10 liters.

(2) Outlet sampler

An equipment that can collect sample in sampler bag through sampler pump or an equipment with sampler bag connected inside the suction case that the suction pump is mounted and that satisfy following requirement.

- (i) Sampler pump with air suction power of over 4 liter per minute and is made of non-smell material and low odor absorption is required.
- (ii) The sampling bag inside of the suction case is visible and is with air tight structure.
- (iii) Suction pump with air suction power of over 4 liter per minute.
- (iv) Sampling bag shall be made of material 2-1-i)-(i) and capacity of 3-20 liters.
- (v) Heat resistive sampler tube on outlet shall be used for high temperature gas.

Gas washer bottle of capacity of 25ml shall be used for condensed water trap in case of highly moist sample.

2. Judge test equipment and apparatus

(i) Air injection pump

Capable of air supply of 30 liter/min.

(ii) Non-smell air supply apparatus

Smell of supplied air and air injection pump is deodorized in case of injecting non-smell air to odor bag.

(iii) Injector

It is made of glass. Gas tight syringe shall be used for capacity less than 1 ml. Injector made of resin with similar air tightness as glass injector or gas tight syringe, or the injector made of low odor absorption and non-smell material can be used.

(iv) Odor bag

It is made of non-smell and polyester film of low odor absorption and low transmission with capacity of 3 liter or equivalent, attached glass tube of inner diameter 10 mm and length 6cm.

(v) Nose pad

Non-smell material and structure of direct nose covering and connected to the outlet of the odor bag.

(vi) Silicon rubber cap

Seals outlet of the odor bag.

Remarks

Tubes used for apparatus connect which the sample passes through shall be made of poly-fluoride vinyl of low odor absorption capability.

III. Measurement method

Measurement shall be conducted as follows. In case of measurement by panel, the measurement shall be managed by a person who is recognized to have proper smell function and to be the expert of the odor index measurement.

1. Sampling and flow rate measurement

(1) Environment sample

According to type of sampling equipment, sample is introduced to sampling container or sampling bag by one of following methods.

i) A method of sampling by opening a valve of sampling container depressurized below 1.3 kPa for 6 to 30 seconds, in case of equipment listed in II-1-(1)-(i)

ii) A method of sampling a quantity of sample corresponding to sampling bag by using sampling bottle for 6 to 30 seconds in case of equipment listed in II-1-(1)-(ii)

iii) A method if bay calculate sample for 6 to 30 seconds in case of equipment listed

in II-1(1)-(iii).

(2) Outlet sample

A method of collecting 3 to 10 liter sample for one to 3 minutes in case of equipment listed in II-1-(2).

(3) Flow rate measurement

Gas flow rate at the emission point of the gas (unit : cubic meter per second at 0 degree Celsius and 1 atm.) is a value that measured by method specified in JIS Z8808 and by using unit of flow per second.

2. Judgement test

(1) When to perform judgment test

Judgement test (A test made by panel to judge existence of odor in odor bag. Hereinafter referred in the same manner.) shall be conducted as soon as possible on the day of sampling or the next day.

(2) Number of panel

More than 6 panels who are previously selected by I-(2) are employed for the test.

(3) Place to perform judgment test

The test is performed in a place where the ventilation or window is equipped and no odor shall be existed and the panels can relax in the facility.

(4) Procedure of the judgment test

i) Environmental sample

Sample is prepared in one of three odor bags filled with non smell air and sealed with silicon rubber, by introducing sampling gas with injector and diluted to the dilution ratio for the first test (Hereinafter referred to "First dilution ratio") (note 1). Prepared odor bag (hereinafter referred to "smell odor bag") and two odor bag with non-smell air (hereinafter referred to "non-smell odor bag") are given to the panel. Panel selects on odor bag that he/she suspects that odor substance is injected. (It is called "selecting operation". Hereinafter referred in the same manner.) The selecting operation is repeated three times by each panel.

For selecting operation performed by each panel, correct answer point, 1.00 is given to the panel in case of selecting smell odor bag, 0.00 is given to the panel in case of selecting non-smell odor bag and 0.33 is given in case where selection is disabled. The summation of correct answer points is divided by number of selection made by panels. The average correct point is less than 0.58, the judgement test is finished. In case where the average correct point equals to or is greater than 0.58, the dilution ratio is set 10 times greater than original value and perform the same operation above, then the judgment test is finished.

(note 1) The first dilution ratio shall normally be 10. However, in case where the average correct answer point can be estimated to equal to or be greater than 0.58, the first dilution ratio is decided to value greater than 10 for the value of average correct point to be lower than 0.58.

ii) Emission point sample

Selecting operation is conducted by each panel for one smell odor bag

and two non-smell odor bag that are prepared at the first dilution ratio (note 2) in the same manner as III-2-4-i). In this selecting operation, the test is finished for the panel who selected non-smell odor bag or could not select. The test is further performed by using sample diluted by three times for the panel who selected smell odor bag, then the test is finished in case where the panel selects non-smell odor bag or is unable to select.

(note 2) The first dilution ratio shall be the value that the panel is able to make decision of existence of odor and to avoid the effect of exhausted smell function.

3. Calculation of odor index

(1) Environment sample

The odor index is calculated by following equation;

$$Y = 10 \log \left(M \times 10^{\frac{r_1 - 0.58}{r_1 - r_0}} \right)$$

where Y is odor index, M is the first dilution ratio, r_1 is the average correct answer point and r_0 is the average correct answer for the first dilution ratio multiplied by 10.

However in case where the average correct answer point for the first dilution ratio is 0.58, the value of the odor index is indicated the value less than $10 \log M$. In case where the value Y has fractional number less than 1, the odor index is rounded value of Y .

(2) Emission point sample

i) Threshold of each panel is calculated for the dilution ratio of the sample odor by following equation.

$$X_1 = \frac{\log M_{11} + \log M_{01}}{2}$$

where X_1 is a threshold of a panel for the dilution ratio of sample odor, M_{11} is the maximum of the dilution ratio for odor bag in case where the panel selects the smell odor bag, M_{01} is the dilution ratio for odor bag in case where the panel selects the non-smell odor bag or could not select the bag.

ii) After eliminating minimum and maximum of calculated X_1 for panel, all the values except eliminated values were added and the summation is divide by number that is two less than number of panels.

iii) Calculation made by using following equation. However, in case where the value Y has fraction number less than 1, the odor index is rounded value of Y .

$$Y = 10X$$

where Y is the odor index and X is the value that is calculated by ii) shown above.

4. Calculation method of odor intensity

(1) Odor concentration of the sample odor is calculated by the following equation;

$$C = 10^{\frac{Y}{10}}$$

where Y is the odor index that is calculated by method of previous paragraph.

(2) Odor concentration of the sample odor is calculated by the following equation;

$$q_d = 60 \times C \times Q_0$$

where q_d is odor intensity (unit : cubic meter per second at 0 degree Celsius and 1 atm.), C is the value calculated in (1) and Q_0 is flow rate of the exhaust gas (unit : cubic meter per second at 0 degree Celsius and 1 atm.).



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