

## Difference in the odor concentrations measured by the triangle odor bag method and dynamic olfactometry

3rd IWA International Conference on Odour and VOCs  
Oct 8<sup>th</sup>-10<sup>th</sup>, 2008 Barcelona

H. Ueno\*, S. Amano\*\*, B. Merecka\*\*\* and J. Kořmider\*\*\*\*  
\*Tokyo Metropolitan Research Institute for Environmental Protection  
\*\*Tokyo Metropolitan Government  
\*\*\*Odournet UK Ltd  
\*\*\*\* Szczecin University of Technology

## Table of Contents

- 1 Introduction
- 2 Introduction of Japanese olfactometry
- 3 Method
- 4 Result
- 5 Summary and remarks

## Introduction

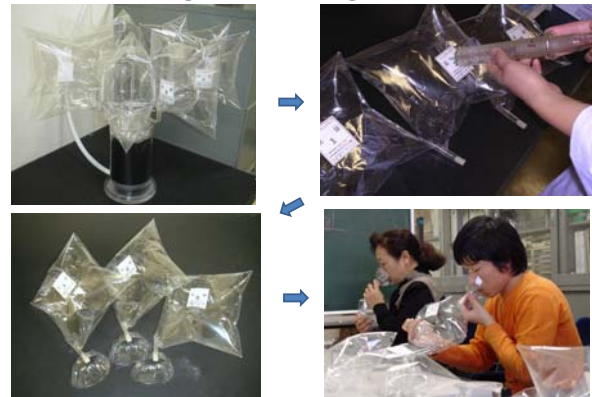
### Triangle odor bag method (Offensive odor control law in Japan) and The Dynamic olfactometry (EN 13725)

- Both methods are to determine odor concentration by sniffing diluted air samples.
- The dilution equipment, estimation methods of the threshold and panel selection procedures are different.

### Comparison in this study

- The odor thresholds
- Repeatability
- The panel selection criteria

## Triangle Odor Bag Method



## Triangle Odor Bag Method

### Calculation of odor concentration

Dilution Ratio	100	300	1000	3000	10000	discard
A	○	○	×			
B	○	○	×			
C	○	○	○	×		
D	○	○	○	○	×	×
E	○	×				×
F	○	○	×			

## Panel selection test (Japan)

### Standard Odor Solutions

- A β-Phenylethyl Alcohol
- B Metyl Cyclopentenolone
- C Isovaleric acid
- D γ-Undecalactone
- E Skatole  
and Odour-free solution



### Procedure : 5-2 method


Sniff 5 slips and select 2 slips that contain an odor




Measurements of Thresholds by Japanese and European Methods

**Method 1 Triangle odor bag method and dynamic olfactometry (Forced choice mode).**

Triangle odor bag method



Olfaktomat-n2



The panel members : 12 Japanese (Same panel in both methods)  
 Samples : 5 odorants  
 Measurement: 3-4 times by both methods on the same day to prevent the effect of variability in sensitivity of the individuals.

Measurements of Thresholds by Japanese and European Methods

**Method 2 Triangle odor bag method and Dynamic olfactometry (Yes/No mode).**

Triangle odor bag method



TO-7



The panel members : 12 Polish students. (Same panel in both methods)  
 Samples : 3 odorants

Consideration of Panel Selection Criteria

**Method 3: Distribution of threshold of n-Butanol**

- The thresholds of 51 Japanese assessors were measured by the dynamic olfactometer / forced choice mode.
- The thresholds of 22 Japanese assessors were measured by the triangle odor bag method.
- Measurements were made more than 10 times for each assessor.

Consideration of Panel Selection Criteria

**Method 4: Application of EN 13725 criterion to triangle odor bag method**

<p><b>Panel selection</b> By Triangle odor bag method</p>	<p><b>Panel selection</b> By dynamic olfactometer / forced choice mode</p>
n-Butanol thresold 20-80ppb	n-Butanol thresold 20-80ppb

- Samples : 6 odorants
- measurement 4-8 times for each odorant

**Result1 Odor Threshold values (Average)**

	Triangle odor Bag method	Dynamic Olfactometer forced choice mode
n-Butanol	4.2 (17ppb)	4.7 (53ppb)
Ethyl acetate	5.6 (0.36ppm)	6.1 (1.3ppm)
Hexanal	2.3 (0.20ppb)	3.0 (0.94ppb)
Hydrogen sulfide	2.5 (0.32ppb)	3.1 (1.3ppb)
Iso-butyric acid	3.6 (3.6ppb)	4.0 (11ppb)

The disagreement in the odor threshold

**Dynamic olfactometer /Forced choice mode**

Dilution Ratio	10000	5000	2400	1200	600	300
answer	Wrong Guess	Correct Guess	Wrong Inklng	Correct Inklng	Correct Certain	Correct Certain

**Triangle odor bag method**

Dilution Ratio	100	300	1000	3000	10000
answer	Correct	Correct	Correct	Wrong	-

**Result2 Odor Threshold values (Average)**

	Triangle odor bag method	Dynamic olfactometer Yes/No mode
n-Butanol	4.9 (88ppb)	5.1 (140ppb)
Ethyl acetate	6.2 (1.7ppm)	6.1 (1.2ppm)
Hexanal	2.8 (0.68ppb)	2.7 (0.48ppb)

The agreement in the odor threshold

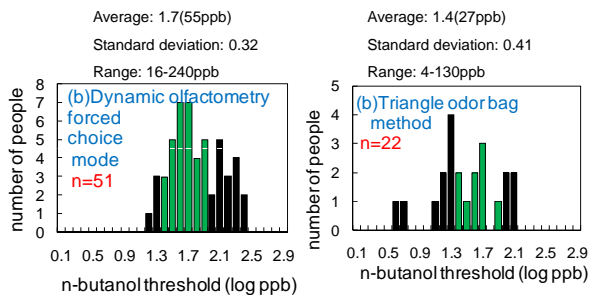
**Dynamic olfactometer / Yes/No mode**

Dilution Ratio	10000	5000	2400	1200	600	300
answer	No	No	No	Yes	Yes	Yes

**Triangle odor bag method**

Dilution Ratio	100	300	1000	3000	10000
answer	Correct	Correct	Correct	Wrong	-

**Result 3 Distribution of n-butanol threshold**

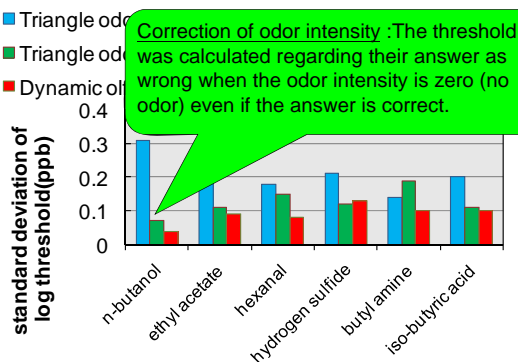


31 assessors (60%) comply with threshold criterion  
 20 assessors (40%) comply with both criteria

**Result 4 Application of EN criterion to triangle odor bag method**

	Triangle odor bag method	Dynamic olfactometer forced choice mode
n-butanol	4.4 (28ppb)	4.6 (37ppb)
Ethyl acetate	5.9 (0.77ppm)	5.7 (0.46ppm)
Hexanal	2.7 (0.42ppb)	2.6 (0.41ppb)
Hydrogen sulfide	2.9 (0.77ppb)	3.0 (0.96ppb)
Iso-butyric acid	3.5 (3.7ppb)	3.6 (3.8ppb)
Butyl amine	4.7 (45ppb)	4.9 (88ppb)

**Repeatability**



**Summary**

- The triangle odor bag method yield higher odor concentration than forced choice mode olfactometer, but the same level of yes/no mode olfactometer, if the panel is the same.
- The difference can be cancelled by applying the same panel selection criteria.
- The repeatability will also be the same by improving the methodology of determining the threshold of the triangle odor bag method.
- The panel selection criterion may be strict considering the distribution of the threshold of n-butanol.

### Remarks

	Triangle Odor Bag Method	Dynamic Olfactometry
Initial Cost	Low	High
Running Cost	High	Low
Calibration	Not need	Need
Operation	Hard work	Easy
Low concentration Sample	OK :Sample amount enough (static dilution)	High sample consumption rate (continuous dilution)

Both methods are useful. Availability is depend on the situation of the region/society.

Thank you for your kind attention