ISSN: 2586-6036 © 2021 KODISA & JWMAP.
http://www. welfareconvergence.or.kr
doi: http://dx.doi.org/10.13106/jwmap.2021.Vol4.no4.35

Measurement and Analysis of Odors Generated in Traditional Markets

Su-Hye KIM[1], Dong-Myung CHO[2], Lee-Seung KWON[3], Min-Jae JUNG[4]

1. First Author Researcher, Department of Environmental Health & Safety, Eulji University, Korea, Email: kagome00@naver.com
2. Second Author Researcher, SM Environment & Consulting.CO. LTD, Korea, Email: encvdm@naver.com
3. Third Author Professor, Department of Health Care Management, Catholic Kwandong University, Korea, Email: leokwon1@cku.ac.kr
4. Corresponding Author Researcher, Department of Environmental Health & Safety, Eulji University, Korea, Email: idrjqnrdl@naver.com

Received: December 17, 2021. Revised: December 24, 2021. Accepted: December 26, 2021.

Abstract

Purpose: The purpose of this study is to identify the causes of odors generated in traditional markets and to suggest appropriate application technologies to solve them**. Research design, data and methodology**: In order to achieve the purpose of this study, complex malodors, TVOC, and hydrogen sulfide were measured three times at each point in Wonju-city, Gangwon-do using direct-reading odor measuring equipment in Joong-ang Traditional Market's Korean beef Alley, Sundae Alley, and Joong-ang Citizens Traditional Market. Therefore, the average value was compared with the emission standard and analyzed. **Results:** As a result of the study, complex malodors exceeded the emission standards at all points, and hydrogen sulfide exceeded the emission standards at all except for one point. **Conclusions:** The odor generated in the traditional market has various causes and low concentration, so it is necessary to reduce the odor by using an appropriate technology.

Keywords : Traditional market, Odor, Odor reduction equipment, Ventilation, Measurement

JEL Classification Codes : I00, I10, I30, I31

1. Introduction

In the past, traditional markets in Korea were developed by various employment-related actors in functional areas where people and spaces, people and people, space and space, people and information, people and culture, and people and economy meet.

In addition, this market played a role in establishing a system that could interconnect and cooperate. In other words, the traditional market is a commercial space that represents the region, and functions as a complex space where you can experience culture, local customs, and community through various combinations of space, people, and functions (Korea Research Institute of Local Administration, 2013).

In the modern traditional market, you can shop for a variety of items such as vegetables, fruits, meat/eggs, aquatic products, ready-to-eat food, prepared side dishes,

* Acknowledgements: This work was supported by the research grant of the KODISA Scholarship Foundation in 2021.

and delivery food. However, the competitiveness of the traditional market has decreased due to the deterioration of convenience facilities such as narrow passageways, various odors, dirty shop signboards, insufficient parking space, and insufficient quality and country of compared to large discount stores (Nam, Ryu & Hong, 2010).

In particular, the stench generated in traditional markets is emerging as a major cause for modern people to turn away from traditional markets. It is known that 1) odors during the cooking process of restaurants, 2) sewer odors, and 3) odors from food waste account for the majority of complaints about odors generated in various traditional markets (The Seoul Institute, 2013).

Therefore, this study aims to identify the causes of odors occurring in traditional markets and suggest techniques that can be applied to solve them. It is judged that the proposed technology can have value as a basic data so that the optimized design can be applied.

2. Literature Review

Ahn and Kim (2016) studied the commercial space composition plan for the modernization of traditional markets, and especially mentioned smell (ventilation) in the psychological environmental element among the space elements. There were no results of actual measurement or cause identification, but it was mentioned that the occurrence of odor is one of the important factors in the construction of modernization and traditional markets.

Research to establish the 2nd anti-odor comprehensive measure studied by National Institute of Environmental Research(2018) suggests that sewage pipes, restaurants, and food waste, which are the main causes of odors in the market, are regarded as living odors, and reinforcement measures are suggested to manage them. Sewage odor was to be solved by preparing odor measurement methods and standards for wastewater transport and treatment facilities, and by promoting technology and odor improvement pilot project for effective liquid-derived odor management. The goal of restaurant odor was to clearly identify the problems with grilled meat restaurants and to present an effective and reasonable restaurant odor management plan. The goal of food waste is to improve waste management methods and introduce optimal odor reduction technology to minimize damage to the public due to odors generated in the process of collection, disposal and recycling. To solve the above three problems, this study analyzed the policy direction and priority tasks, applied the performance index, and established the criteria for evaluating the future application results.

The Seoul Institute (2013) studied policies for minimizing living odors in Seoul. In particular, they suggested policies to improve sewage pipes, waste neglect, backflow of sewage pipes connected to rain gutter, and insufficient ventilation systems in building-type markets, among the odors generated in traditional markets.

As above, as a result of previous studies, there have been studies that the problem of odors in traditional markets is related to modernization, civil complaints, and market revitalization. Although not mentioned directly in these studies, it was judged that it was necessary to introduce ventilation or reduction devices and to support them through policies to solve the odor problem.

There was no study to present an appropriate solution through the measurement of odor-causing substances in the same form as this study.

3. Research Methods and Materials

3.1. Research Location and Period

This study conducted a total of three measurements (three times per point) from September to October 2021 targeting the Joong-ang Traditional Market's Korean Beef Alley, Sundae Alley, and Joong-ang Citizens Traditional Market in Wonju-city, Gangwon-do.

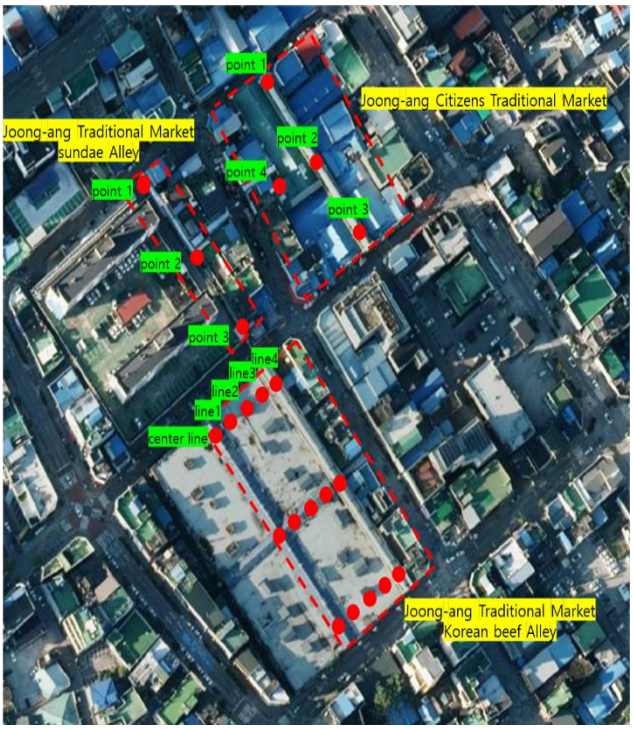

Figure 1: Map of Traditional Markets

3.2. Measuring Equipment

Figure 2: Odor Measuring Equipment AOMS-1000

In this study, measurements were made continuously for 5 minutes at 1-minute intervals using a direct-reading odor measurement device, and the results were averaged and presented.

AOMS-1000, a portable and automatic odor sample collection device, is a miniaturized device that can be installed and used in an area where it is difficult for users to directly operate it. This device can collect standby samples remotely through the standby sample collection function and remote (SMS command) control using CDMA wireless communication.

Table 1: Measuring Equipment Specifications

Model	AOMS-1000
Fluid	Air
Sampling method	Forced suction method
Sensor array module	Basic 4 types, up to 8 types
Field data display	Built-in LCD
Screen size	8″ touch-operated (Tablet PC)
Display contents	Quantitative measurement value for each substance, dilution factor, complex malodors
Appropriate operating temperature	-20℃ ~ 65℃

4. Results

4.1. Measurement Results

The results measured in this study were divided into 1st, 2nd, and 3rd rounds and presented in a table, respectively.

Table 2: 1st Measurement Results

Measurement points		Complex malodors (OU)	TVOC(ppb)	H_2S(ppb)
Joong-ang Traditional Market Korean Beef Alley	Line 1	107.06	230.91	782.33
	Line 2	78.06	171.80	481.61
	Line 3	68.94	155.02	402.86
	Line 4	59.48	138.49	322.78
Joong-ang Traditional Market Sundae Alley	Point 1	73.27	214.25	466.47
	Point 2	50.59	105.81	249.54
	Point 3	46.74	72.56	220.79
Joong-ang Citizens Traditional Market	Point 1	70.44	63.92	409.23
	Point 2	71.62	103.18	437.07
	Point 3	55.71	103.83	289.68
	Point 4	67.66	168.27	411.39

Table 3: 2nd Measurement Results

Measurement points		Complex malodors (OU)	TVOC(ppb)	H_2S(ppb)
Joong-ang Traditional Market Korean Beef Alley	Line 1	36.18	191.06	158.79
	Line 2	22.22	116.39	74.33
	Line 3	18.62	177.77	56.90
	Line 4	14.23	78.51	37.91
Joong-ang Traditional Market Sundae Alley	Point 1	58.71	171.76	320.14
	Point 2	52.93	174.24	287.70
	Point 3	40.95	164.66	185.73
Joong-ang Citizens Traditional Market	Point 1	2.95	533.38	0.00
	Point 2	0.28	259.61	0.00
	Point 3	114.21	275.58	963.73
	Point 4	104.12	248.95	748.33

Table 4: 3rd Measurement Results

Measurement points		Complex malodors (OU)	TVOC(ppb)	H_2S(ppb)
Joong-ang Traditional Market Korean Beef Alley	Line 1	71.62	210.98	470.56
	Line 2	50.19	144.09	277.97
	Line 3	43.78	166.56	229.88
	Line 4	36.85	108.50	180.35
Joong-ang Traditional Market Sundae Alley	Point 1	65.99	193.00	393.31
	Point 2	51.76	140.02	268.62
	Point 3	43.85	118.61	203.26
Joong-ang Citizens Traditional Market	Point 1	0.23	238.49	0.00
	Point 2	136.85	190.92	1,161.26
	Point 3	82.24	160.11	522.47
	Point 4	63.15	143.33	350.58

Table 5 shows the emission standards for complex malodors and hydrogen sulfide.

Table 5: Complex Malodors and Hydrogen Sulfide Emission Standards

Type	Emission standards	
	Industrial area	Other areas
Complex malodors site boundary line (OU)	≤ 20	≤ 15
H_2S(ppm)	≤ 0.06	≤ 0.02

Table 6 shows the average of three measurements per point for comparison with the emission limit.

Looking at the average value, the complex odor exceeded the emission limit of 15 times at all points, and the hydrogen sulfide exceeded the emission limit of 0.02 ppm at all other points except for the Line 4 of the Joong-ang Traditional Market Korean Beef Alley.

The place with the highest complex odor is Sundae Alley Point 3 of the Joong-ang Traditional Market, which seems to come out with the smell of livestock by-products from Sundae Alley and the smell of cooking food from the Jayou Market and Joong-ang Traditional Market adjacent to Sundae Alley.

Hydrogen sulfide was the highest in the Joong-ang Traditional Market Korean Beef Alley Line 1 and the Joong-ang Citizens Traditional Market Point 2. This seems to be high due to the combination of the sewage odor from the drains arranged at regular intervals in the market and the smell from cooking food.

Since this study was conducted outdoors, TVOC was not compared with indoor air quality standards.

Table 6: Average of 3 Measurements

Measurement points		Complex malodors (OU)	TVOC(ppb)	H_2S(ppb)
Joong-ang Traditional Market Korean Beef Alley	Line 1	71.62	210.98	470.56
	Line 2	50.19	144.09	277.97
	Line 3	43.78	166.56	229.88
	Line 4	36.85	108.50	180.35
Joong-ang Traditional Market Sundae Alley	Point 1	46.74	72.56	220.79
	Point 2	50.59	105.81	249.54
	Point 3	73.27	214.25	366.47
Joong-ang Citizens Traditional Market	Point 1	70.44	63.92	409.23
	Point 2	71.62	103.18	437.07
	Point 3	55.71	103.83	289.68
	Point 4	67.66	168.27	411.39

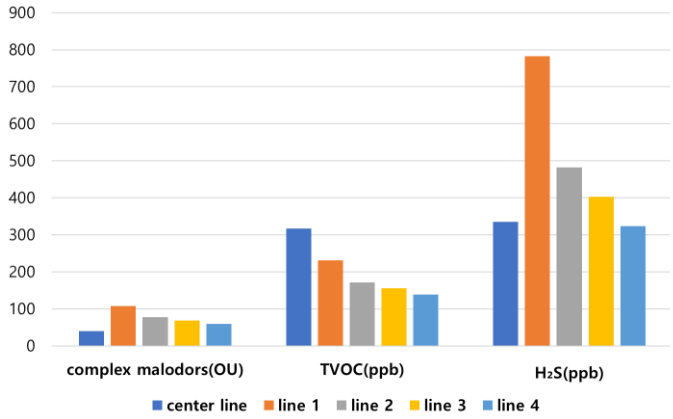

Figure 3: Joong-ang Traditional Market Korean Beef Alley's Odor Results

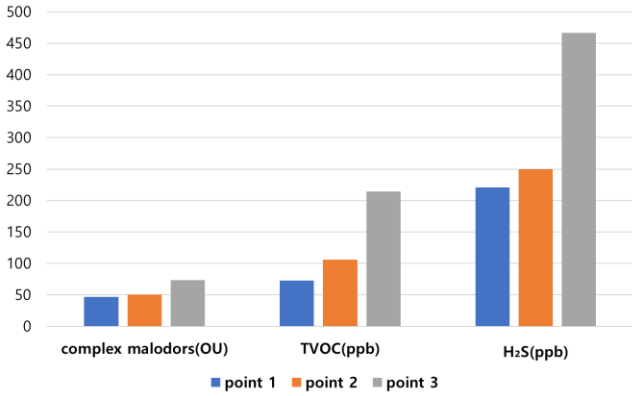

Figure 4: Joong-ang Traditional Market Sundae Alley's Odor Results

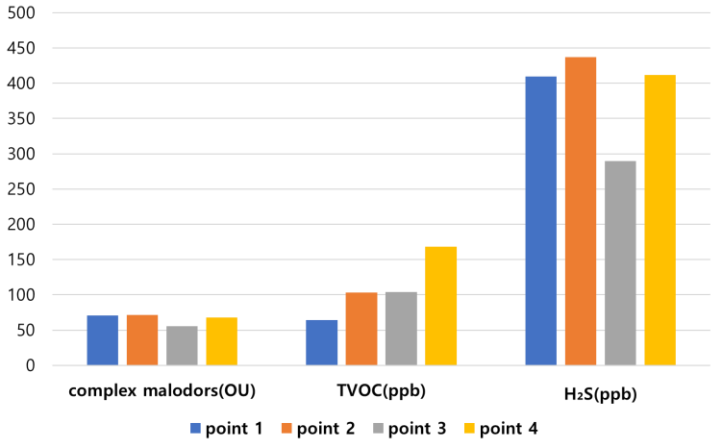

Figure 5: Joong-ang Citizens Traditional Market's Odor Results

5. Discussion and Conclusions

Since consumption in large stores and Internet shopping malls has increased, the number of traditional markets has decreased due to sanitation problems and aging convenience facilities.

Looking at the studies on the revitalization plan of the traditional market, to solve the above problems, the traditional market was modernized and measures such as the installation of arcade-type ceilings and ventilation fans were applied.

However, despite these attempts, due to the nature of the traditional market, a smell of food, garbage, and sewage, which causes a negative experience for market visitors is inevitable. This study measured the complex malodors, TVOC, and hydrogen sulfide concentrations in the Joong-ang Traditional Market and the Joong-ang Citizens Traditional Market in Wonju-city, Gangwon-do from September to October 2021.

As a result of the measurement, the complex malodors and hydrogen sulfide were found to exceed the emission standards in other areas. Due to the nature of the market's odor generation, it is not a point source, but rather it is generated within the area, so it is somewhat difficult to apply the emission standards. However, since there is no separate limit value applicable to the area unit, the measurement results were compared and analyzed by referring to the emission limit.

. In particular, in the case of Korean Beef Alley and Sundae Alley, livestock products and their by-products are handled, so it can become a more unpleasant odor for people to take. In addition, since the market has an arcade-type ceilings, ventilation is not good in the humid and hot summer, and odors can be generated with high intensity.

In order to solve the odor problem in traditional markets, ventilation facilities are installed, Effective Microorganisms are sprayed, and periodic cleaning is implemented. Since odors generated in traditional markets are not concentrated

in any one place and occur widely at low concentrations, it seems that comprehensive and diverse methods are needed to reduce odors.

In order to reduce the odor in traditional markets, this study proposes three methods.

To remove odors, remains, and fine dust generated during the cooking process of food, an Electrostatic Precipitator must be installed and a technology to prevent the spread of harmful air must be applied by improving hood and duct facilities. To remove the sewage odor, the hydrogen sulfide in the sewage pipe must be removed using a chemical deodorant and a microorganism carrier. In particular, hydrogen sulfide is a dangerous substance that can cause suffocation, so it is necessary to manage it. To remove the odor of food waste, it is necessary to develop and apply an exclusive container for sealing and vacuum packaging food waste. And it would be desirable to develop the technology in a form capable of automatic control and remote control by grafting sensor technology and AIOT to these technologies.

This study is meaningful in that it presents measurement data for substances that cause odors in traditional markets and analyzes the causes. In the future, it is expected that basic data will be provided for building odor reduction facilities in traditional markets.

However, there is a limit to applying the odor to the entire traditional market because the odor was measured by alleys rather than the entire market, and the measurement period was as short as 2 months. Based on this, if research on odor reduction in traditional markets is conducted in the future, it will be possible to create a more competitive traditional market.

References

An, Y. W., & Kim, D. H. (2016). The Spatial Configuration Space Plan for the Modernization of Traditional Markets - Focusing on the Modernization of Garak Market. *Korean Institute of Interior Design,* 90-95.

Full, J., Baumgarten, Y., Delbrück, L., Sauer, A., & Miehe, R. (2021). Market Perspectives and Future Fields of Application of Odor Detection Biosensors within the Biological Transformation—A Systematic Analysis. *Biosensors, 11*(3), 93-94.

Jun, S. K., & Sunh, J. Y. (2009). A Case Study of Suyu Mart`s Revitalization Strategy. *Korea Business Review, 12*(3), 51-82.

Jung, M. J., Kim, Y. D., Kwon, L. S., Lee, W. S., & Kwon, W. T. (2018). A Study on Cost-effective Treatment of Wastewater and Odor Reduction for Southeast Asian Market Entry. *The Journal of Industrial Distribution & Business, 9*(12), 23-29. doi: https://doi.org/10.13106/ijidb.2018.vol9.no12.23.

Kim, D. H. (2013). Strategies for the Promotion of Traditional Markets to Revitalize. *Regions*, 1-155.

Kim, M. J., & Ryu, S. M. (2016). Qualitative Analysis of Traditional Market Vitalization - Focused on traditional market in Korea -. *Journal of channel and retailing, 21*(4), 157-177.

Korea Research Institute for Local Administration. (2013). Strategies for the Promotion of Traditional Markets to Revitalize*, Regions*, 1-141.

Lee, J. H., Kim, Y., & Kim, K. H. (2013). Analysis of the Influence of Traditional Market Vitalization of Facility Modernization Project on Traditional Markets - Focused on Jung-ang Yudeung Market in Jinju -. *Journal of The Korean Regional Development Association, 25*(1), 233-249.

Lee, S. J., Song, J. H., & Lee, J. S. (2010). A Regeneration Scheme based on the Classification for Traditional Market - Focused on the Traditional Markets in Chung-Nam Province. *Journal of the Urban Design Institute of Korea Urban Design, 11*(3), 113-128.

Nam, Y. H., Ryu, T. C., & Hong, G. G. (2010). Explore ways to revitalize traditional markets and shopping malls. *Urban Information Service,* (345), 3-18.

National Institute of Environmental Research. (2018). Research to establish the second anti-odor comprehensive measure. 1-334. doi: https://doi.org/10.23000/TRKO201900002638.

Park, S. J., & Kwon, S. Y. (2020). Experimental Study on Hydrogen Sulfide Abatement in Sewage Odor Using Microbial Deodorants on the Market. *Journal of Environmental Health Sciences, 46*(2), 170-183. doi: https://doi.org/10.5668/JEHS.2020.46.2.170

The Seoul Institute. (2013). A Study on the Management of Odor Emission in Seoul – Towards Seoul without Odor -. ISBN: 979-11-5700-024-1 93530, 1-164.