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Development of an electrolysis for Oi Sobaegi fermentation and analysis of volatile compound changes with Gas-chromatography-mass spectrometry

Sorrawit Songsathitmetha[1], Isaya Thaveesangsakulthai[2], Chadin Kulsing[2]

Department of Pathology, Faculty of Veterinary Science, Chulalongkorn University, Thailand[1]

Department of Chemistry, Faculty of Science, Chulalongkorn University, Thailand[2]

INTRODUCTION & AIM

This research introduces a method for modifying, enhancing fermentation process and aroma of cucumber kimchi (Oi Sobaegi) based on an electrolysis mechanism using spring coil electrodes. The electrodes are immersed into kimchi, allowing electrochemical reactions of volatile compounds, leading to odor compound changes in composition, smell and concentration of the cucumber kimchi. Additionally, the potential of the approach to expedite the fermentation time was explored.

The cucumber kimchi samples, treated with electrolysis at 30 and 60 min were compared with untreated control samples collected at specified fermentation times. Samples were further analyzed using headspace solid-phase microextraction (HS-SPME) and coupled with gas chromatography-mass spectrometry (GC-MS) for volatile compound identification.

Results indicated that after 30 minutes of electrolysis treatment, there was an enhancement in the amounts of Citronellol (fresh, floral, clean rose), Trisulfide, di-2-propenyl (sulfurous garlic onion), (E)-β-Famesene (woody citrus herbal sweet), Terpinen-4-ol (mild earthy and woody odor), α-Terpineol (pine terpene lilac woody resinous cooling lemon citrus floral).

With a new compound, 3H-1,2-Dithiole with the odor of garlic asparagus, was also observed.

METHOD

Figure 1. Oi Sobaegi sample preparation and electrolysis reaction on spring coil electrodes by applied voltage and current at 9V 1A condition.

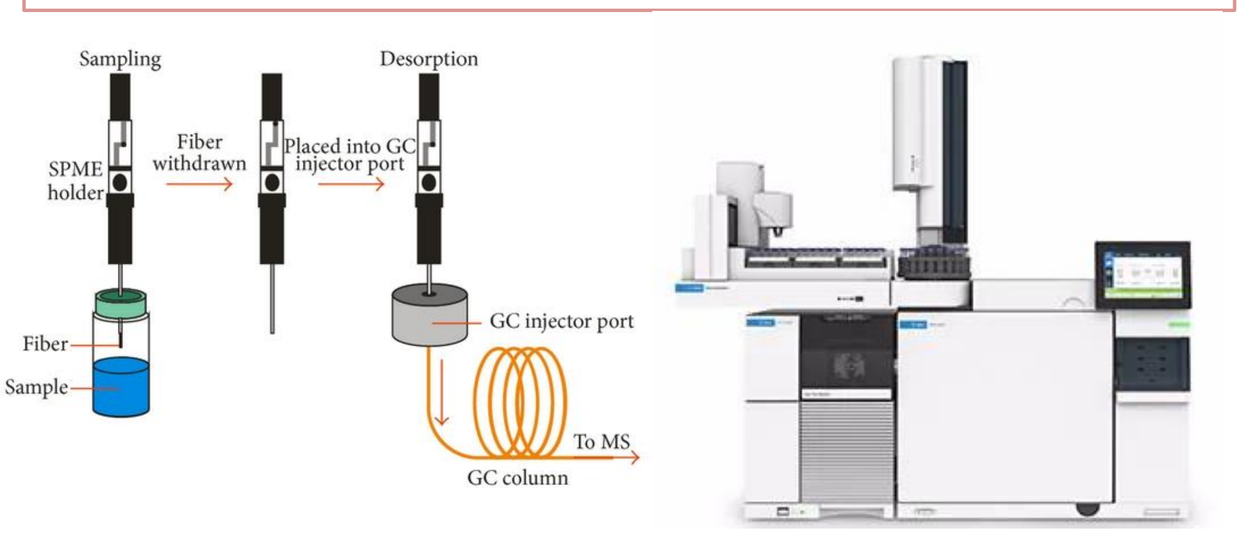

Figure 2. Qualitative analysis of volatile organic compounds profile of Oi Sobaegi by HS-SPME-GC-MS technique

RESULTS & DISCUSSION

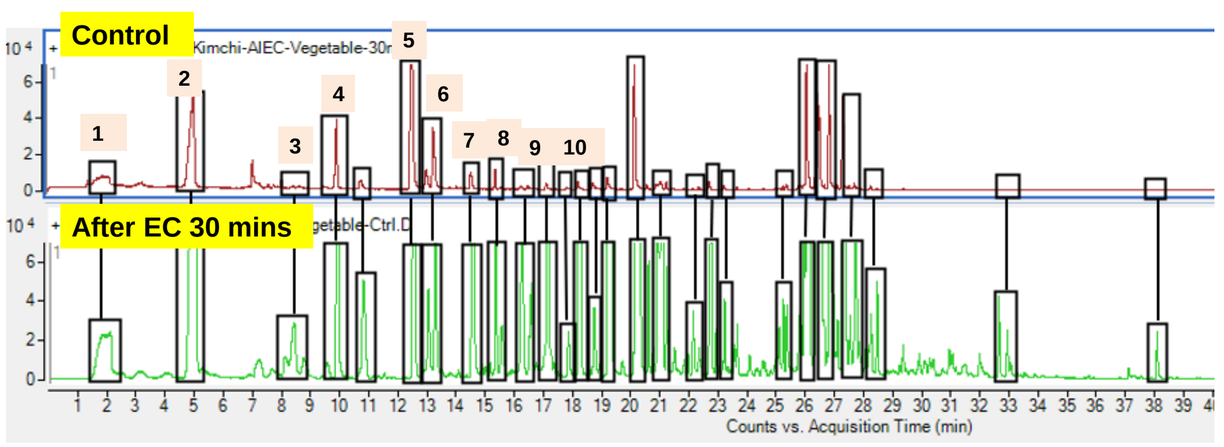

Figure 3. Chromatogram results of VOCs Oi Sobaegi before and after electrolysis at 9V1A condition

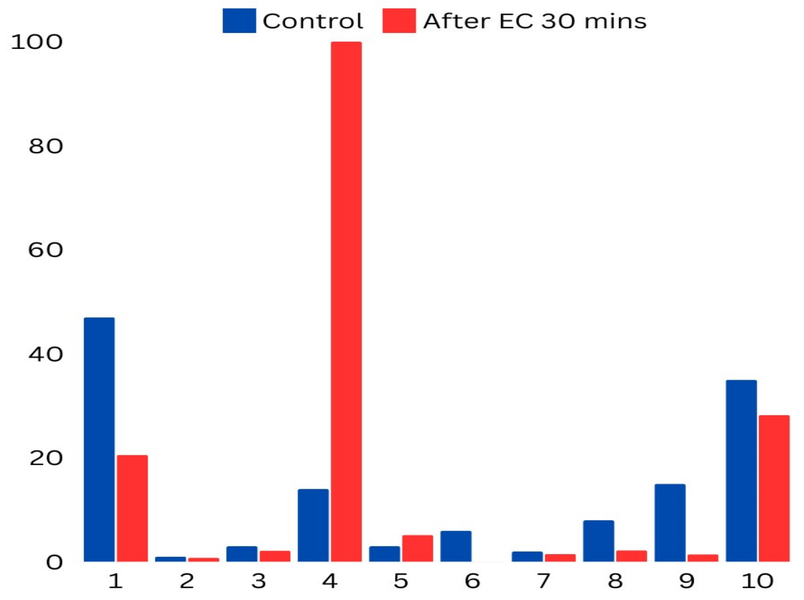

Figure 4. Comparison of the main volatile peak in Oi Sobaegi before and after electrolysis at 9V1A treatment condition.

Order	Control		After EC 30 mins	
	Compound	Odor Description	Compound	Odor Description
1	2-Undecanone 2,4-dinitrophenylhydrazone	Fruity	Ethylenediamine	Ammonia-like
2	β-Myrcene	Spicy	3H-1,2-Dithiole	cooked asparagus
3	Eucalyptol	herbal	Eucalyptol	herbal
4	Cyclohexanone, oxime	minty acetone	Cyclohexanone, oxime	minty acetone
5	(E)-1-Allyl-2-(prop-1-en-1-yl)-disulfane	Sulfurous alliaceous	Diallyl disulphide	garlic oil
6	Trisulfide, methyl 2-propenyl	alliaceous creamy garlic onion	Camphor	strong mothball-like
7	trans-Verbenol	balsamic	cis-Chrysanthemum	spicy
8	Cyclohexanol, 2-methyl-5-(1-methylethenyl), (1α,2β,5α)	-	α-Terpineol	pine terpene lilac citrus woody floral
9	2-Vinyl-4H-1,3-dithiine	soft-necked garlic	2-Vinyl-4H-1,3-dithiine	soft-necked garlic
10	Bicyclo-[3.1.1]hept-2-en-6-ol, 2,7,7-trimethyl-, acetate, [1S-(1α,5α,6β)]	-	Neral	citrus

Table 1. Qualitative analysis of VOCs main odor active compounds of Oi Sobaegi before and after electrolysis at 9V1A treatment condition.

CONCLUSION

The established approach demonstrates the capability to adjust the fermentation enrichment and aroma of the cucumber kimchi, potentially serving as a tool for customizable food quality in the future.

FUTURE WORK / REFERENCES

[1] P. Seong-Eun, Y. Seon-A, S. Seung-Ho, L. Kyoung-In, N. Chang-Su, S. Hong-Seok, GC–MS based metabolomics approach of Kimchi for the understanding of Lactobacillus plantarum fermentation characteristics, LWT - Food Science and Technology, 2016, 68, 313-321.

[2] WD Hur, Volatile flavor components in kimchi, Bull Food Tech, 1994, 7, 3-12.