

# Determinations of trihalomethanes and haloacetic acids occurred from the processing in food industries



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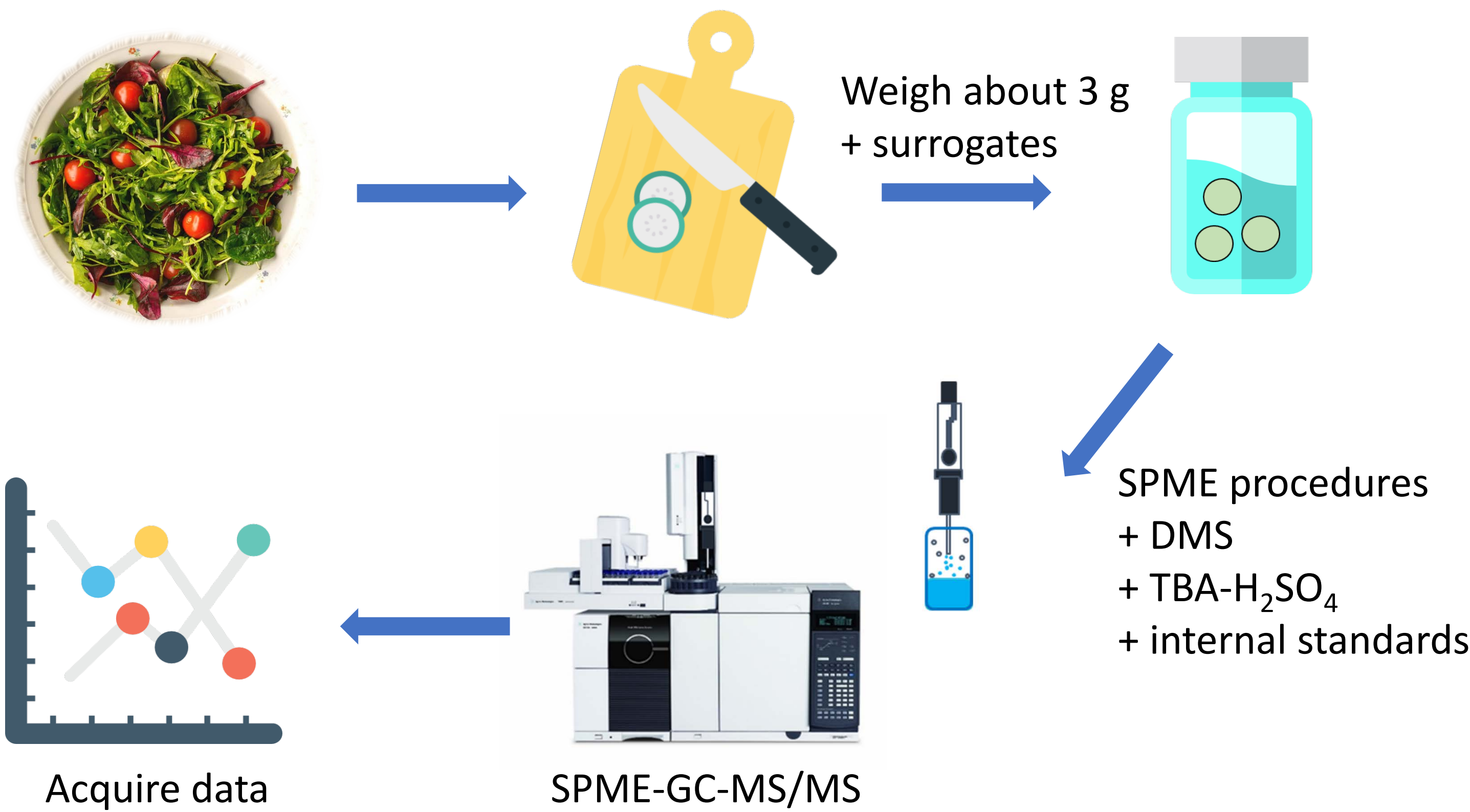
## Introduction

- Ready-to-eat (RTE) food are popular with people nowadays. Among them, RTE vegetables arouse our interest since they are under the threat of foodborne pathogens.
- Disinfectants are used to sanitize RTE vegetables during food processing. Among them, the chlorine-releasing compounds are most commonly used.
- The disinfection process will produce disinfection by-products (DBPs),while trihalomethanes (THMs) and haloacetic acids (HAAs) are the most popular types.
- Some of the THMs and HAAs have been evaluated by the IARC to be possible carcinogens (group B2) to humans.
- It has been reported elsewhere that the amounts of THMs and HAAs occurred from the processing in food industries are significant.
- For analysis, the solid-phase microextraction (SPME) coupled with gas chromatography-tandem mass spectrometers (GC-MS/MS) method that could analyze THMs and HAAs concurrently were established and performed.

## Study Aims

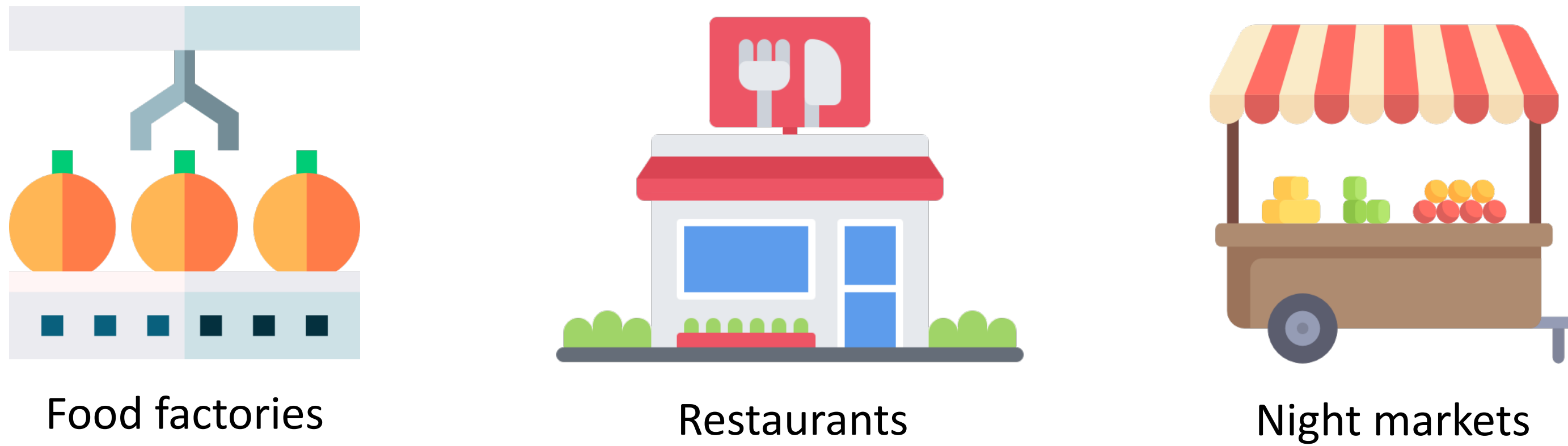
- Develop a method that can detect THMs and HAAs concurrently with SPME-GC-MS/MS.
- Determine the THMs and HAAs that might present in RTE food.
- Investigate the mechanisms about the formation of DBPs in RTE food.
- Figure out possible solutions to lower the amounts of DBPs in RTE food.

## Materials and Methods



## Sampling Methods

Collecting RTE food from:



## Preliminary Results

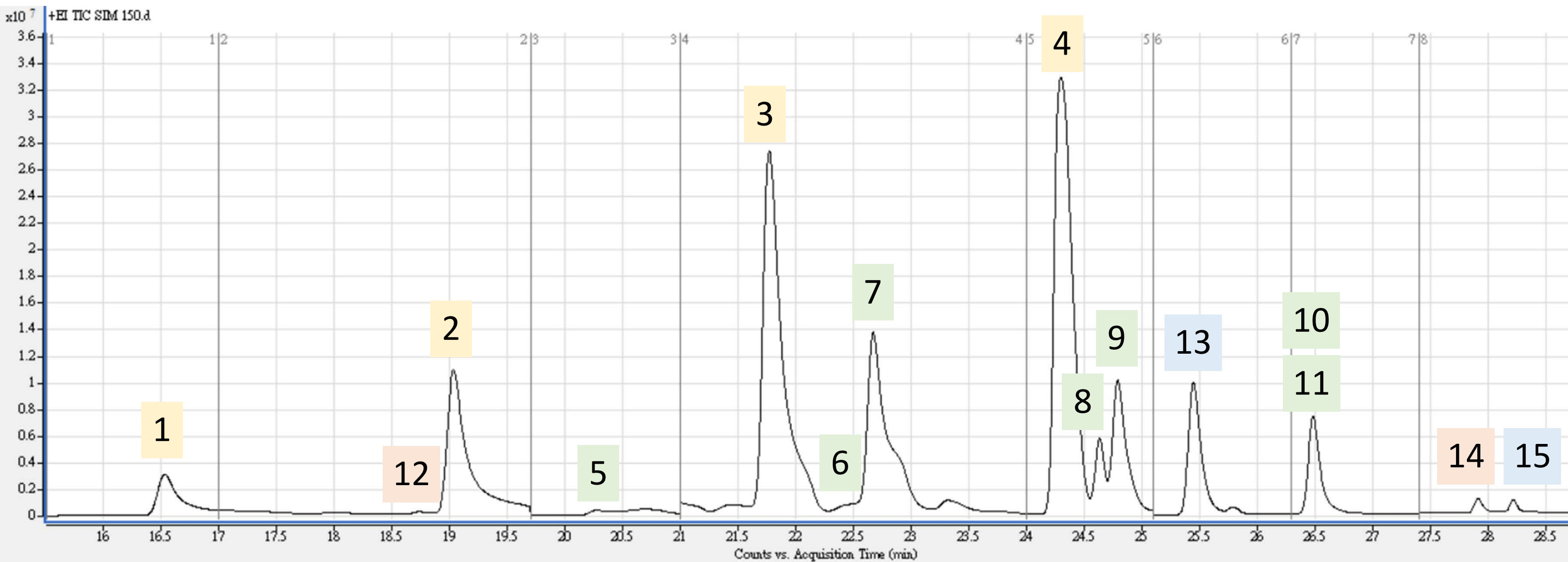


Fig1. Chromatogram of THMs and HAAs

Peak identification:

(1)Cl, (2)DCBM, (3)DBCM, (4)Bromoform, (5)MCAA, (6)MBAA, (7)DCAA, (8)TCAA, (9)BCAA, (10)BDCAA, (11)DBAA, (12)1,2-Dichloropropane(IS), (13) 2,3-Dichloropropionic acid(SUR), (14)Decafluorobiphenyl(SUR), (15) 2,3-Dibromopropionic acid(IS)

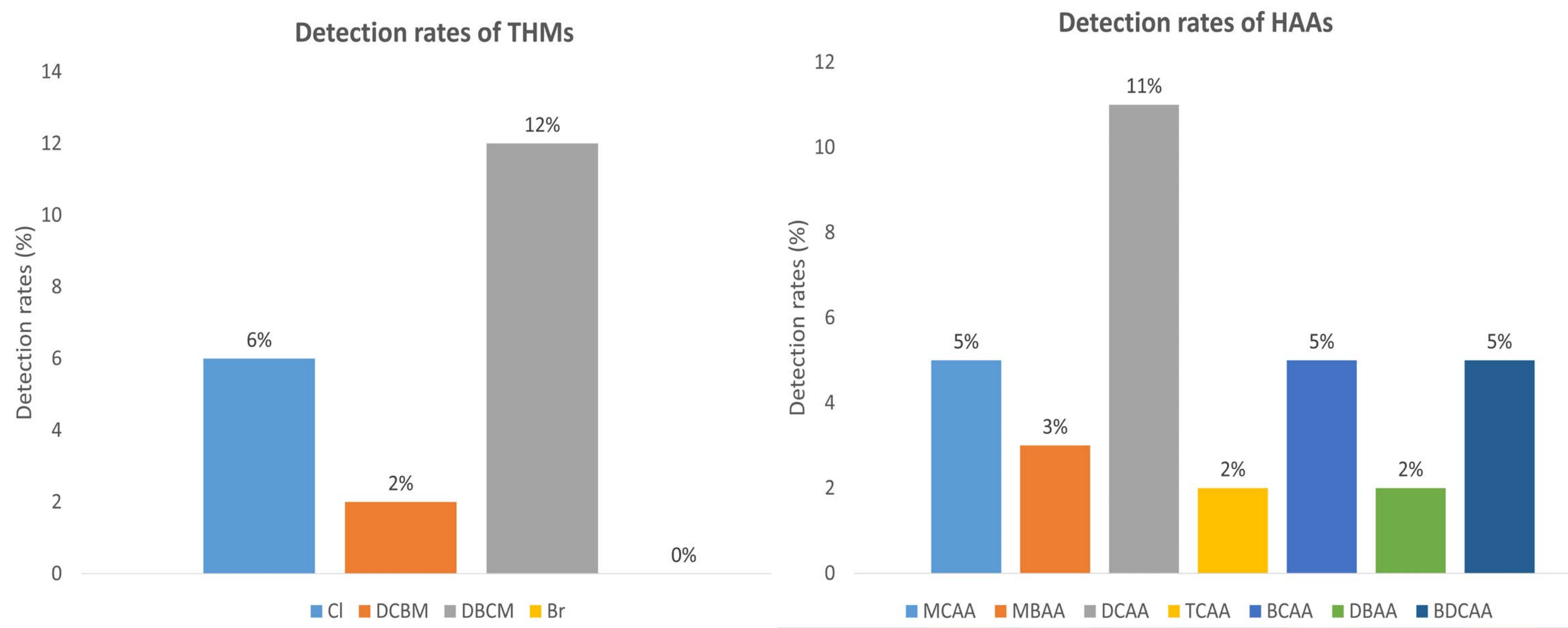
## Preliminary Results

Table1. THMs and HAAs concentrations (ng/g) in RTE samples

Samples	Cl	DCBM	MCAA	MBAA	DCAA	BCAA	TCAA	DBAA	BDCAA
Yellow Carrot 1	ND	ND	ND	ND	ND	5.5	ND	ND	ND
Iceburg Lettuce 1	10.03	ND	70.99	ND	30.03	ND	ND	ND	ND
Yellow Carrot 3	ND	ND	ND	139.8	25.74	ND	ND	ND	ND
Purple Onion 4	11.91	ND	ND	78.66	ND	ND	29.35	12.72	ND
Purple Cabbage 6	ND	ND	ND	ND	25.71	ND	ND	ND	ND
Tomato 10	ND	13.03	ND	ND	ND	ND	ND	ND	28.58
Watermelon 11	ND	ND	ND	ND	ND	ND	ND	ND	27.07
Iceburg Lettuce 15	ND	26.28	ND	ND	ND	ND	ND	ND	ND
Kiwi 17	ND	16.56	ND	ND	ND	ND	ND	ND	ND
Pineapple 19	20.9	ND	ND	ND	ND	ND	ND	ND	ND
Mango 20	ND	46.05	ND	ND	ND	ND	ND	ND	ND

- The number of samples refers to different types of products.
- The results show part of the sample that was analyzed with positive data.
- THMs includes Cl, Br, DCBM and DBCM.
- HAAs includes MCAA, DCAA, TCAA, MBAA, DBAA, BCAA, BDCAA.

Fig2. Detection rates of THMs and HAAs in 65 samples



## Conclusions

- Successfully developed a method that could analyze THMs and HAAs *in situ* by SPME-GC-MS/MS.
- The intakes from salad would be as high as 18.83 µg and 5.87 µg for HAAs and THMs, respectively.
- Ingestion is the significant route of exposure to THMs and HAAs.
- For THMs, DBCM (12%) was the most frequently found compounds, while for HAAs was DCAA (11%).
- It is necessary to continue analyzing the samples from food factories, restaurants and night markets to determine the distributions of THMs and HAAs in RTE vegetables.

## References

1. Maria Jose Cardador and Mercedes Gallego (2012) Effect of the Chlorinated Washing of Minimally Processed Vegetables on the Generation of Haloacetic Acids. Journal of Agricultural and Food Chemistry 60 (29), 7326-7332
2. Valentina Coroneo, Valentina Carraro, Barbara Marras, Alessandro Marrucci, Sara Succa, Barbara Meloni, Antonella Pinna, Alberto Angioni, Adriana Sanna & Marco Schintu (2017) Presence of Trihalomethanes in ready-to-eat vegetables disinfected with chlorine, Food Additives & Contaminants: Part A, 34:12, 2111-2117
3. Taiwan Food and Drug Administration (2017) RTE vegetables Hygiene Reference Manual for Vendors
4. Icon made by Freepik, Nikita Golubevfrom and wanicon from www.flaticon.com