Negative Temperature Programming using Microwave Gas Chromatography

by

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(ABSTRACT)

The microwave region of the electromagnetic spectrum lies between the infrared radiation and radio frequency region and corresponds to wavelengths of 1 cm to 1 m (frequencies of 30 GHz to 300 MHz respectively). Gaisford and Walters developed the microwave GC oven in 2000, which operated at 919 MHz. The microwave GC oven has been engineered to generate a uniform microwave field around an open tubular capillary column with elimination of cold spots which are common in a domestic microwave oven. Only the column is heated in a microwave GC oven. In microwave GC, ramp rates in excess of 6 ºC/sec, isotherms as high as 450ºC, and 1-min cool-down times from 300 to 50℃ can be achieved. In conventional GC, only positive temperature programming is used because the oven cools down slowly due to the great thermal mass of the oven. Short cool-down time in microwave-heating GC makes it possible to employ negative temperature programming for the separation of compounds during the process.

The theory and feasibility of negative temperature programming in microwave GC were investigated in this research. Negative temperature programming was employed to analyze and quantitate four different critical pairs of non-volatile and volatile compounds. The influence of cooling rate, holding time, and reheating rate in negative temperature programs for enhanced resolution were investigated. The results obtained from negative temperature programming were compared to those from positive temperature programming. Negative temperature programming afforded greater resolution of critical pairs of analytes.

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Table of Contents

	Page
Abstract	ii
Acknowledgements	iv
Table of Contents	v
List of Figures	vi
List of Tables	viii
I. Introduction	
1. Microwave Technology Review	1
1.1 Microwave-assisted Extraction	4
1.2 Microwave Liquid Chromatography	6
2. Microwave Gas Chromatography	7
3. Alternative Approaches for Improving Resolution	12
4. Polycyclic Aromatic Hydrocarbons	23
4.1 Properties, Nomenclature, and Toxicity	23
4.2 PAH Analysis	24
II. Quantitative Analysis and Application of Negative Temperature Programming	
1. Introduction	29
2. Experimental	29
3. Results and Discussion	39
4.Conclusions	64
References	65
Vita	70

List of Figures

Figure	Description	Page
1	Alignment and randomization of polar molecules resulting from dielectric polarization	2
2	The actual microwave GC instrument in laboratory	10
3	GC×GC system	17
4	The combination of GC and MS for optimization of speed	19
5	Mass transfer of the solute in negative temperature programming	22
6	Structure and classification of selected PAHs	25
7	Structure of xylene and ethylbenzene	28
8	Microwave GC oven control system	30
9a	Van Deemter curve (plate height vs. inlet pressure) of microwave methyl silicone column at 160℃ using naphthalene	35
9b	Van Deemter curve (plate height vs. average linear velocity) of microwave methyl silicone column at 160℃ using naphthalene	36
10a	Van Deemter curve (plate height vs. inlet pressure) of microwave methyl silicone column at 280℃ using acenaphthene	37
10b	Van Deemter curve (plate height vs. average linear velocity) of microwave methyl silicone column at 280℃ using acenaphthene	38
11	Chromatogram of ten PAHs using positive temperature program 1	43
12	Chromatogram of three PAHs using negative temperature program 2	45
13	Chromatogram of three PAHs using negative temperature program 3	46

14	Chromatogram of three PAHs using negative temperature program 4	47
15	Chromatogram of ten PAHs using negative temperature program 3	49
16	Calibration curves using negative temperature program 3	52
17	Chromatogram of three PAHs using positive temperature program 5	54
18	Chromatogram of three PAHs using negative temperature program 6	55
19	Chromatogram of ethylbenzene and m-xylene using positive temperature program 7	57
20	Chromatogram of ethylbenzene and m-xylene using positive temperature program 8	58
21	Graphs of three negative temperature programs	59
22	Chromatogram of xylene mixture using positive temperature program 11	62
23	Chromatogram of xylene mixture using negative temperature programs	63

List of Tables

Table	Description	Page
1	Physical properties of analytes	32
2	Reproducibility data for positive temperature program 1	40
3	Reproducibility data of negative temperature programs	41
4	Comparison of chromatographic parameters via a positive temperature program versus a negative temperature program	48
5	Peak area ratio for calibration curves	51
6	Comparison of chromatographic parameters via a positive temperature program versus three negative temperature programs	60