

CHROMATOMEMBRANE METHOD APPLIED IN PHARMACEUTICALS ANALYSIS

**Dissertation zur Erlangung des akademischen Grades des
Doktors der Naturwissenschaften (Dr. rer. nat.)**

**eingereicht im Fachbereich Biologie, Chemie, Pharmazie
der Freien Universität Berlin**

vorgelegt von

Ganden Supriyanto

aus Indonesien

2005

- 1. Gutachter: Prof. Dr. Jürgen Simon**
2. Gutachter: Prof. Dr. Peter Surmann

Disputation am: 25. Januar 2005

ABBREVIATIONS

FIA	Flow Injection Analysis
CMC	ChromatoMembrane Cell
PAN	1-(2-pyridilazo-2-naphtol)
ETE	Ethinylestradiol
LEV	Levonorgestrel
US	United States
HPLC	High Performance Liquid Chromatography
FI	Flow Injection
RSD	Relative Standard Deviation
LC	Liquid Chromatography
ICP	Inductively Couple Plasma
AES	Atomic Emission Spectroscopy
MS	Mass Spectroscopy
NMR	Nuclear Magnetic Resonance
UV	Ultraviolet
LLE	Liquid Liquid Extraction
SPE	Solid Phase Extraction
SPME	Solid Phase Micro Extraction
LPME	Liquid Phase Micro Extraction
SBSE	Stir Bar Sorptive Extraction
GC	Gas Chromatography
PDMS	Polydimethylsiloxane
PTFE	Polytetrafluoroethylene
P	Pressure
MSTFA	N-methyl-N-(trimethylsilyl)-trifluoroacetamide
TMSI	Trimethylsilylimidazole
DTE	Dithioerytrol
DAD	Diode Array Detection
ESI	Electrospray Ionisation
DCM	Dichloromethane
PAH	Poly Aromatic Hydrocarbons
USP	United States Pharmacopeia
TEA	Triethanolamine
LED	Light Emitting Diode
NAA	Neutron Activation Analysis
AAS	Atomic Absorption Spectrometry
KR	Knotted Reactor
5-Br-PADAP	2-(5-bromo-2-pyridylazo)-5-diethylamino-phenol
PAR	4-(2-pyridylazo) resorcinol
MSFA	Monosegmented Flow Analysis
DDTC	Diethyldithiocarbamate
PC	Personal Computer
M	Molar
MC	Mixing Coil

SYMBOL

C_o	the original concentration of the constituent in the solution before dispersion
C_{max}	the highest concentration of that fluid element of the dispersed fluid zone
D	dispersion coefficient
P_c	capillary pressure
σ	surface tension
θ	contact angle of the porous material
r	pore radius
U_i	the rate of the shift of the i th component zone
U_o	the rate of supply of the solution
K_{D1}	the distribution coefficient at the extraction stage
V_1/V_2	the ratio of the volumes occupied by the micro- and macropores
l	the length of the rectangular biporous PTFE block
U_{ex}	the flow rate of the non polar phase
h	the height of the rectangular biporous PTFE block/ the direction of the non polar phase
M	divalent metal
R	recovery (%)
C_e	the peak of the analyte after extraction with CMC
C_s	the peak of standard solution with the same concentration
EF_{th}	theoretical enrichment factor
EF_{tr}	true enrichment factor
V_s	the volume of the sample before extraction
V_e	the volume of the sample after extraction/end volume

ACKNOWLEDGMENTS

The author is deeply indebted to his principal advisor, Prof. Dr. Jürgen Simon (Department of Inorganic and Analytical Chemistry, Free University of Berlin), who provided not only scientific and moral support, but also guidance and ideas that will positively influence the author's academic life. Special thanks go to Prof. Dr. Ulrich Abram (Department of Inorganic and Analytical Chemistry, Free University of Berlin) who wrote a strong reference for DAAD. Special thanks also go to Prof. Dr. Peter Surmann (Institute of Pharmacy, Free University of Berlin) for reviewing the dissertation.

Thanks is truly due to Mr. Hygo Behrens (Department of Inorganic and Analytical Chemistry, Free University of Berlin) for his technical assistance with computing.

Special thanks also to Mrs. Regina Reinke for providing tridest for this research in the analytical chemistry laboratory at the Free University of Berlin.

Thanks are also grateful to Mr. Nidhu Lal Banik and Ms. Titin Muljati for their help in collecting experimental data in the laboratory.

The faculty staff and friends of the Department of Inorganic and Analytical Chemistry at the Free University of Berlin have been very cooperative. Their friendship and assistance are truly appreciated.

Appreciation is sincerely expressed to DAAD and the Indonesian Government for supporting this research financially.

Special appreciation goes to my wife, Masrutji Handajani, for her patience and willingness to accompany me to Berlin. Much love also to our children, Bagus Aryan Delftando and Nimas Sekar Ayu Citraningsukma. To them, the author can only offer himself and his endless love.