

APPENDICES

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APPENDIX A**The determination of the ascorbic acid content in vitamin C tablets by conventional method [17]**

Weigh and powder 20 tablets. Dissolve a quantity of the powder containing 0.15 g of ascorbic acid as completely as possible in a mixture of 30 mL of water and 20 ml of 1 M sulfuric acid and titrate with 0.1 M ammonium cerium (IV) sulphate using ferroin sulphate solution as indicator. Each mL of 0.1 M ammonium cerium (IV) sulphate is equivalent to 0.008806 g of $C_6H_8O_6$

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APPENDIX B**The determination of the acetic acid content of vinegar by conventional method [24]**

Vinegar usually contains 4-5 percent acetic acid. Weigh out about 20 g vinegar, and make up to 100 ml in graduated flask. Take 25 mL with a pipette, dilute this with an equal volume of water, add a few drops of phenolphthalein, and titrate with standard 0.1 M sodium hydroxide solution. As a result of the dilution of the vinegar, its natural color will be so reduced that it will not interfere with the color change of the indicator. Calculate the acetic acid content of the vinegar, and express the result in grams of acetic acid per 100 grams vinegar.

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APPENDIX C

AnalySIA program used for optimization of the determination of ascorbic acid system.

(1) "def_EX" AnalySIA program

```
;Filename : def_EX
```

```
*****Definition of devices*****
```

```
pump      = 'cavro.1'
pvalve    = 'cavro.101'
valve1    = 'cavro.3'
valve2    = 'cavro.4'
Sampler   = 'ni.1'
${Sampler}.Gain    = 5
${Sampler}.Cnt     = 200 ;total data points collected
${Sampler}.Interval = 100 ;ms between data point
```

```
*****
```

(2) "clean_system" AnalySIA program

```
;Filename : clean_system
```

```
-----
;*****Cleans all lines with solutions*****
```

```
-----
Include(def_EX)
```

```
Msg = "Please put the all tubings in a beaker of all your reagents "
```

```
MsgBox("$Msg")
```

```
Reps = 2
```

```
do while $Reps > 0
```

```
;------clean along tube-----
```

```

    ${pvalve}.pos      = 1
    ${pump}.speed      = 180
    ${pump}.pos        = 2500
    ${pvalve}.pos      = 2
    ${valve1}.pos      = 1
    ${valve2}.pos      = 2
    ${pump}.pos        = 0

```

```
;------clean valve1-----
```

```

    ${pvalve}.pos      = 2
    ${valve1}.pos      = 2
    ${pump}.pos        = 300
    ${valve1}.pos      = 3
    ${pump}.pos        = +300
    ${valve1}.pos      = 4
    ${pump}.pos        = +300
    ${valve1}.pos      = 5
    ${pump}.pos        = +300
    ${valve1}.pos      = 6
    ${pump}.pos        = +300
    ${valve1}.pos      = 1
    ${valve2}.pos      = 2
    ${pvalve}.pos      = 1
    ${pump}.pos        = 2000
    ${pvalve}.pos      = 2
    ${pump}.pos        = 0

```

```
;------clean valve2-----;
```

```

    ${pvalve}.pos      = 2
    ${valve1}.pos      = 1
    ${valve2}.pos      = 1
    ${pump}.pos        = 300
    ${valve2}.pos      = 3
    ${pump}.pos        = +300
    ${valve2}.pos      = 4
    ${pump}.pos        = +300
    ${valve2}.pos      = 5
    ${pump}.pos        = +300
    ${valve2}.pos      = 6
    ${pump}.pos        = +300
    ${valve2}.pos      = 2
    ${pvalve}.pos      = 1
    ${pump}.pos        = 2000
    ${pvalve}.pos      = 2
    ${pump}.pos        = 0

```

```
Reps = $Reps - 1
```

```
loop
```

```
;------clean along tube-----;
```

```

    ${pvalve}.pos      = 1
    ${pump}.pos        = 2500
    ${pvalve}.pos      = 2
    ${valve1}.pos      = 1
    ${valve2}.pos      = 2
    ${pump}.pos        = 0

```

```
MsgBox("The system is Cleaned and Finished")
```

```
;------;
```

(3) "meas_as" AnalySIA program

```

;Filename : meas_as
;*****
;          Determination of Acetic Acid
;*****
Include(def_EX)
DsetName = InputBox("File Name :", "File Name")
ID = InputBox("Identification", $DsetName, Time())
CC = InputBox("Concentration/sample Code", $DsetName )
;-----
std = 2          ; assign port of valve 1
do while $std < 6
  Repeat = 2
  do while $Repeat > 0
    ${pvalve}.pos = 1
    ${pump}.speed = 200
    ${pump}.pos = 2000 ; aspiration of carrier
    ${pvalve}.pos = 2
    ${pump}.speed = 100
    ${valve2}.pos = 1 ; aspiration of sulfuric acid
    ${pump}.pos = +50
    ${valve1}.pos = $std ; aspiration of standard
                        ascorbic acid/sample
    ${pump}.pos = +80
    ${valve1}.pos = 6 ; aspiration of acidic KMnO4
    ${pump}.pos = +100
    ${valve1}.pos = 1
    ${valve2}.pos = 2
    ${pump}.speed = 150
    ${pump}.WaitForTrig = 1
  
```

```

    ${pump}.pos      = 0
    ${Sampler}.Sample() ;Samplig data
    do until $$${Sampler}.status = Ready
    loop
    Result = "$${Sampler}.result"
    RawSave(, "$DsetName", "$CC")
    Repeat = $Repeat - 1
    Loop
std = $std + 1
loop
;-----
Combine()
Median()
ApplyCursors()
Area(.1)
ReadCombined()
Polyfit(2)
SaveCalibration()
MsgBox("Success in Measuring Standard")
noise = 1
do while $noise < 3
    beep
    beep
    beep
    noise = $noise + 1
loop
MsgBox("Success in Measuring Standard")
return

```


APPENDIX D

AnalySIA program used for the determination of ascorbic acid system.

(1) "meas0_as" AnalySIA program

```

;Filename : meas0_as
;-----
Repeat = 2
do while $Repeat > 0
    ${pvalve}.pos      = 1
    ${pump}.speed      = 200
    ${pump}.pos        = 2000 ; aspiration of carrier
    ${pvalve}.pos      = 2
    ${pump}.speed      = 100
    ${valve2}.pos      = 1    ; aspiration of sulfuric acid
    ${pump}.pos        = +50
    ${valve1}.pos      = $std ; aspiration of standard
                           ascorbic acid/sample
    ${pump}.pos        = +80
    ${valve1}.pos      = 6    ; aspiration of acidic KMnO4
    ${pump}.pos        = +100
    ${valve1}.pos      = 1
    ${valve2}.pos      = 2
    ${pump}.speed      = 150
    ${pump}.WaitForTrig = 1
    ${pump}.pos        = 0
    ${Sampler}.Sample() ; Sampling data
do until $$ {Sampler}.status = Ready
loop
RawSave(, "$ID", "$CC")

```

```
RawSave(, "$DsetName", "$conc")
```

```
Result = "${Sampler}.result"
```

```
Repeat = $Repeat - 1
```

```
Loop
```

(2) "main_as" AnalySIA program

```
;Filename : main_as
```

```
;-----
```

```
;***** Main program*****
```

```
; Determiation of Ascorbic Acid
```

```
;*****
```

```
Include(def_EX)
```

```
conc = 0
```

```
FileList = ""
```

```
DsetName = InputBox("File Name :", "File Name")
```

```
ID = InputBox("Identification".DsetName.Time())
```

```
CC = InputBox("Concentration/sample Code", DsetName, "$conc" )
```

```
;clean_system()
```

```
;return
```

```
foreach std in "2 3 4 5 " do
```

```
    meas0_as()
```

```
    conc = $conc + 400
```

```
next std
```

```
noise = 1
```

```
do while $noise <20
```

```
    beep
```

```
    beep
```

```
    beep
```

```
noise = $noise + 1
```

```
loop
```

Combine()

Median()

ApplyCursors()

Area(1)

ReadCombined()

Polyfit(1)

SaveCalibration()

MsgBox("Success in Measuring Standard")

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APPENDIX E

AnalySIA program used for optimization of the determination of acetic acid system.

(1) "meas_aa" AnalySIA program

```

;Filename : meas_aa
;*****
;
;               Determination of Acetic Acid
;*****
Include(def_EX)
DsetName = InputBox("File Name :", "File Name")
ID = InputBox("Identification", $DsetName, Time())
CC = InputBox("Concentration/sample Code", $DsetName )
;-----

std = 2                               : assign port of valve 1
do while $std < 7
  Repeat = 2
  do while $Repeat > 0
    ${pump}.speed      = 100
    ${pvalve}.pos      = 2
    ${valve1}.pos      = 1
    ${valve2}.pos      = 1    ; aspiration of phenolphthalein
    ${pump}.pos        = +50
    ${valve2}.pos      = 3    ; aspiration of NaOH
    ${pump}.pos        = +70
    ${valve1}.pos      = $std ; aspiration of standard
                           acetic acid / sample
    ${pump}.pos        = +50
  
```

```

    ${valve1}.pos          = 1
    ${valve2}.pos          = 2
    ${pvalve}.pos         = 1
    ${pump}.speed          = 200
    ${pump}.pos            = 2500 ; aspiration of carrier
    ${pump}.speed          = 150
    ${pvalve}.pos         = 2
    ${pump}.WaitForTrig   = 1
    ${pump}.pos            = 0
    ${Sampler}.Sample()   ;Sampling data
do until $$${Sampler}.status = Ready
loop
Result = "$${Sampler}.result"
RawSave(, "$DsetName", "$CC")
Repeat = $Repeat - 1
Loop
std = $std + 1
loop
;-----
Combine()
Median()
ApplyCursors()
Area(,1)
ReadCombined()
Polyfit(2)
SaveCalibration()
MsgBox("Success in Measuring Standard")
;-----
noise = 1
do while $noise <10
    beep

```

```
    beep
    beep
    noise = $noise + 1
loop
MsgBox("Success in Measuring Standard")
Return
```

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APPENDIX F

AnalySIA program used for the determination of acetic acid system.

(1) "meas0_aa" AnalySIA program.

```

;Filename : meas0_aa
;-----
Repeat = 2
do while $Repeat > 0
    ${pump}.speed      = 100
    ${pvalve}.pos      = 2
    ${valve1}.pos      = 1
    ${valve2}.pos      = 1 ; aspiration of phenolphthalein
    ${pump}.pos        = +50
    ${valve2}.pos      = 3 ; aspiration of NaOH
    ${pump}.pos        = +70
    ${valve1}.pos      = $std ; aspiration of standard
                           acetic acid / sample
    ${pump}.pos        = +50
    ${valve1}.pos      = 1
    ${valve2}.pos      = 2
    ${pvalve}.pos      = 1
    ${pump}.speed      = 200
    ${pump}.pos        = 2500 ; aspiration of carrier
    ${pump}.speed      = 150
    ${pvalve}.pos      = 2
    ${pump}.WaitForTrig = 1
    ${pump}.pos        = 0
    ${Sampler}.Sample() ; Sampling data

```

```

do until $$ {Sampler}.status = Ready
loop
RawSave(, "$ID", "$CC")
RawSave(, "$DsetName", "$conc")
Result = "$$ {Sampler}.result"
Repeat = $Repeat - 1
Loop
;-----

```

(2) "main_aa" AnalySIA program.

```

;Filename : main_aa
;***** Main program*****
:
:           Determination of Acetic Acid
;*****
Include(def_EX)
conc = 0
FileList = ""
DsetName = InputBox("File Name :", "File Name")
ID = InputBox("Identification", $DsetName, Time())
CC = InputBox("Concentration/sample Code", $DsetName, "$conc" )
clean_system()
;return
foreach std in "2 3 4 5 6 " do
    meas0_aa()
    conc = $conc + 2
next std
noise = 1
do while $noise <20
    beep

```



```
    beep
    beep
' noise = $noise + 1
loop
Combine()
Median()
ApplyCursors()
Area(,1)
ReadCombined()
Polyfit(1)
SaveCalibration()
MsgBox("Success in Measuring Standard")
return
```

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APPENDIX G

Detail of vitamin C tablet samples used in the experiment.

Sample code	Brand name	Each tablet contain	Manufacture by
A	Calcium-D-Redoxon	Vitamin C 1000 mg Calcium carbonate 625 mg Vitamin D ₃ 300 I.U. Vitamin B ₆ 15 mg	P.T. Roche Indonesia
B	Ca-C 1000 Sandoz	Vitamin C 1000 mg Calcium carbonate 327 mg Calcium lactate-gluconate 1000 mg	Hoechst Marion Roussel (Thailand) Ltd.
C	No label	Vitamin C 500 mg	-
D	Vitacimin	Vitamin C 1000 mg	Takeda (Thailand) Ltd.
E	Chewable Zinc and Vitamin C	Calcium carbonate 70.7% Maltodextrin 7.7% Ascorbic acid 5.6% (60 mg) Sodium ascorbate 6.3% Zinc oxide 3.5%	Boots contact manufacturing Ltd., England.
F	Redoxon	Vitamin C 1000 mg	P.T. Roche Indonesia
G	Ascorbic acid tablets	Vitamin C 100 mg	Osoth inter laboratory co., Ltd.
H	No label	Vitamin C 500 mg (sodium ascorbate)	-
I	Hicce	Vitamin C 250 mg (500mg/tablet) Sodium ascorbate 281.25 mg (equivalent to vitamin C 250 mg)	Takeda (Thailand) Ltd.
J	Vit C	Vitamin C 100 mg	Takeda (Thailand) Ltd.

APPENDIX H

Detail of vinegar samples used in the experiment.

Sample code	Brand name	Concentration of acetic acid labeled (%w/v)	Type of vinegar
1	Golden mountain	5%	Distilled vinegar
2	Heinz	5%	Distilled vinegar
3	White vinegar	5%	Distilled white vinegar
4	Kewpie brand	5%	Distilled vinegar
5	Mae barn brand	5%	Distilled vinegar
6	Gold label	5%	Distilled vinegar
7	Rice brand	5%	Distilled vinegar
8	Double lion	5%	Distilled vinegar
9	5% distilled vinegar	5%	Distilled vinegar
10	No label	4%	Artificial vinegar
11	No label	5%	Artificial vinegar

CURRICULUM VITAE

Name: Mr. Narong Lenghor

Date of Birth: December 4, 1975

Academic status:

- Diploma (Laboratory Chemistry – Petrochemistry), Bangkok Technical Campus, Rajamangala Institute of Technology, 1996
- B.Sc. (Analytical Chemistry), Bangkok Technical Campus, Rajamangala Institute of Technology, 1998
- M.S. student in analytical chemistry, Chaing Mai University. 1999-2001

Practical Experiences:

- Laboratory Technician in Hitech Lab Co., Ltd., 1994-1999

Awards/Scholarships:

- The “Dr. Bruno Werdelmann Foundation”
- The “Postgraduate Education and Research in Chemistry Program (PERCH)”

List of Publications:

International Conferences

1. K. Grudpan, J. Jakmune, N. Lenghor, M. Vilen and R. Sara, “Sequential Injection System for the Determination of Ascorbic Acid or Acetic Acid”, 8th International Conferences on Flow Analysis, Wasaw, Poland, 2000

National Conferences

1. W. Oungpipat and N. Lenghor, "Ahybrid Arginine Biosensor based on Bovine Liver, *Cajanus Cajan* and Stainless Steel Electrode", 25th Congress on Science and Technology of Thailand, Pitsanuloke, 1999
2. N. Lenghor, B. Prazen, R.E. Synovec and K. Grudpan, "A Novel Dynamic Surface Tension Detector for Flow Injection Analysis of Surfactants", 26th Congress on Science and Technology of Thailand, Pitsanuloke, 2000
3. K. Sa-nguanwong, N. Lenghor and S. Liawruangrath, "Development of Flow Injection Turbidimetric Method for the Determination of Chromium (III) in Thron-Smitt Metal", 26th Congress on Science and Technology of Thailand, Pitsanuloke, 2000
4. N. Lenghor, J. Jakmunee and K. Grudpan, "Sequential Injection Spectrophotometric Determination of Ascorbic Acid in a Vitamin C Tablet using Permanganate", RGJ Seminar Series II-Analytical Chemistry and Chemistry in the North, Chiang Mai, 2000