APPENDIX A

Calculation of the standard solution and conversion factor from percent concentration

1 Calculation of the concentration of toluene

1.1 Preparation of 1% v/v toluene in methanol

Toluene 1% v/v was prepared by pipetting 1 ml of toluene. After that, it was dissolved in enough methanol to give a final volume of 100 ml, The resulting toluene solution has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of toluene (0.8669 g/cm^3).

Method of calculation

1% v/v toluene solution means:

In solution 100 ml, the number of volume of toluene is 1 ml.

$$D = m/V$$

$$0.8626\ g/cm^3 = m/1\ ml$$

$$m = 0.87\ g$$

So in solution 100 ml, the mass of toluene is 0.87 g

In solution 1 ml, the number of gram of toluene is

$$= \quad \{(0.87\ g)(1\ ml)\}/100\ ml$$

$$= \quad 0.0087\ g$$

Therefore, 1% v/v toluene is equal to 0.0087 g/ml or 9 mg/ml.

1.2 Preparation of 2% v/v toluene in methanol

Toluene 2% v/v was prepared by pipetting 2 ml of toluene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting toluene solution has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of toluene (0.8669 g/cm^3).

Method of calculation

2% v/v toluene solution means:

In solution 100 ml, the number of volume of toluene is 2 ml.

$$D \quad = \quad m/V$$

$$0.8669\ g/cm^3 \quad = \quad m/2\ ml$$

$$m \quad = \quad 1.73\ g$$

So in solution 100 ml, the mass of toluene is 1.17 g

In solution 1 ml, the number of gram of toluene is

$$= \quad \{(1.73\ g)(1\ ml)\}/100\ ml$$

$$= \quad 0.0173\ g$$

Therefore, 2% v/v toluene is equal to 0.0173 g/ml or 17 mg/ml.

1.3 Preparation of 5% v/v toluene in methanol

Toluene 5% v/v was prepared by pipetting 5 ml of toluene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting toluene solution has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of toluene (0.8669 g/cm^3).

Method of calculation

5% v/v toluene solution meaning:

In solution 100 ml, the number of volume of toluene is 5 ml.

$$D = m/V$$

$$0.8626\ g/cm^3 = m/5\ ml$$

$$m = 4.31\ g$$

So in solution 100 ml, the mass of toluene is 4.31 g

In solution 1 ml, the number of gram of toluene is

$$= \{(4.31\ g)(1\ ml)\}/100\ ml$$

$$= 0.0431\ g$$

Therefore, 5% v/v toluene is equal to 0.0431 g/ml or 43 mg/ml.

1.4 Preparation of 7% v/v toluene in methanol

Toluene 7% v/v was prepared by pipetting 7 ml of toluene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting toluene solution has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of toluene (0.8669 g/cm^3).

Method of calculation

7% v/v toluene solution means:

In solution 100 ml, the number of volume of toluene is 7 ml.

$$D = m/V$$

$$0.8626 \text{ g/cm}^3 = m/7 \text{ ml}$$

$$m = 6.04 \text{ g}$$

So in solution 100 ml, the mass of toluene is 6.04 g

In solution 1 ml, the number of gram of toluene is

$$= \{(6.04 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0604 \text{ g}$$

Therefore, 7% v/v toluene is equal to 0.0604 g/ml or 60 mg/ml.

1.5 Preparation of 9% v/v toluene in methanol

Toluene 9% v/v was prepared by pipetting 9 ml of toluene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting toluene solution has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of toluene (0.8669 g/cm^3).

Method of calculation

9% v/v toluene solution means:

In solution 100 ml, the number of volume of toluene is 9 ml.

$$D = m/V$$

$$0.8626\ g/cm^3 = m/9\ ml$$

$$m = 7.76\ g$$

So in solution 100 ml, the mass of toluene is 7.76 g

In solution 1 ml, the number of gram of toluene is

$$= \{(7.76\ g)(1\ ml)\}/100\ ml$$

$$= 0.0776\ g$$

Therefore, 9% v/v toluene is equal to 0.0776 g/ml or 78 mg/ml.

2 Calculation of the concentration of xylene

2.1 Preparation of 1% v/v xylene in methanol

Xylene 1% v/v was prepared by pipetting 1 ml of xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting xylene solution has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of xylene (0.8600 g/cm^3).

Method of calculation

1% v/v toluene solution means:

In solution 100 ml, the number of volume of xylene is 1 ml.

$$D = m/V$$

$$0.8600\ g/cm^3 = m/1\ ml$$

$$m = 0.86\ g$$

So in solution 100 ml, the mass of xylene is 0.86 g

In solution 1 ml, the number of gram of xylene is

$$= \{(0.86\ g)(1\ ml)\}/100\ ml$$

$$= 0.0086\ g$$

Therefore, 1% v/v xylene is equal to 0.0086 g/ml or 9 mg/ml.

2.2 Preparation of 2% v/v xylene in methanol

Xylene 2% v/v was prepared by pipetting 2 ml of xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting xylene solution has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of xylene (0.8600 g/cm^3).

Method of calculation

2% v/v xylene solution means:

In solution 100 ml, the number of volume of xylene is 2 ml.

$$D = m/V$$

$$0.8600\ g/cm^3 = m/2\ ml$$

$$m = 1.72\ g$$

So in solution 100 ml, the mass of xylene is 1.72 g

In solution 1 ml, the number of gram of xylene is

$$= \{(1.72\ g)(1\ ml)\}/100\ ml$$

$$= 0.0172\ g$$

Therefore, 2% v/v xylene is equal to 0.0172 g/ml or 17 mg/ml.

2.3 Preparation of 5% v/v xylene in methanol

Xylene 5% v/v was prepared by pipetting 5 ml of xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting xylene solution has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of xylene (0.8600 g/cm^3).

Method of calculation

5% v/v xylene solution means:

In solution 100 ml, the number of volume of xylene is 5 ml.

$$D = m/V$$

$$0.8600\ g/cm^3 = m/5\ ml$$

$$m = 4.3\ g$$

So in solution 100 ml, the mass of xylene is 4.3 g

In solution 1 ml, the number of gram of xylene is

$$= \{(4.3\ g)(1\ ml)\}/100\ ml$$

$$= 0.043\ g$$

Therefore, 5% v/v xylene is equal to 0.043 g/ml or 43 mg/ml.

2.4 Preparation of 7% v/v xylene in methanol

Xylene 7% v/v was prepared by pipetting 7 ml of xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting xylene solution has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of xylene (0.8600 g/cm^3).

Method of calculation

7% v/v xylene solution means:

In solution 100 ml, the number of volume of xylene is 7 ml.

$$D = m/V$$

$$0.8600 \text{ g/cm}^3 = m/7 \text{ ml}$$

$$m = 6.02 \text{ g}$$

So in solution 100 ml, the mass of xylene is 6.02 g

In solution 1 ml, the number of gram of xylene is

$$= \{(6.02 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0602 \text{ g}$$

Therefore, 7% v/v xylene is equal to 0.0602 g/ml or 60 mg/ml.

2.5 Preparation of 9% v/v xylene in methanol

Xylene 9% v/v was prepared by pipetting 9 ml of xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting xylene solution has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of xylene (0.8600 g/cm^3).

Method of caculation

9% v/v xylene solution means:

In solution 100 ml, the number of volume of xylene is 9 ml.

$$D = m/V$$

$$0.8600 \text{ g/cm}^3 = m/9 \text{ ml}$$

$$m = 7.74 \text{ g}$$

So in solution 100 ml, the mass of xylene is 7.74 g

In solution 1 ml, the number of gram of xylene is

$$= \{(7.74 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0774 \text{ g}$$

Therefore, 9% v/v xylene is equal to 0.0774 g/ml or 77 mg/ml.

3 Calculation of the concentration of o-xylene

3.1 Preparation of 1% v/v o-xylene in methanol

o-Xylene 1% v/v was prepared by pipetting 1 ml of o-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting o-xylene solution has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of o-xylene (0.8802 g/cm^3).

Method of calculation

1% v/v o-xylene solution means:

In solution 100 ml, the number of volume of o-xylene is 1 ml.

$$D = m/V$$

$$0.8802\ g/cm^3 = m/1\ ml$$

$$m = 0.88\ g$$

So in solution 100 ml, the mass of o-xylene is 0.88 g

In solution 1 ml, the number of gram of o-xylene is

$$= \{(0.88\ g)(1\ ml)\}/100\ ml$$

$$= 0.0088\ g$$

Therefore, 1% v/v o-xylene is equal to 0.0088 g/ml or 9 mg/ml.

3.2 Preparation of 2% v/v o-xylene in methanol

o-Xylene 2% v/v was prepared by pipetting 2 ml of o-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting o-xylene solution has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of o-xylene (0.8802 g/cm^3).

Method of calculation

2% v/v o-xylene solution means:

In solution 100 ml, the number of volume of o-xylene is 2 ml.

$$D = m/V$$

$$0.8802 \text{ g/cm}^3 = m/2 \text{ ml}$$

$$m = 1.76 \text{ g}$$

So in solution 100 ml, the number of gram of o-xylene is 1.76 g

In solution 1 ml, the number of gram of o-xylene is

$$= \{(1.76 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0176 \text{ g}$$

Therefore, 2% v/v o-xylene is equal to 0.0176 g/ml or 18 mg/ml.

3.3 Preparation of 5% v/v o-xylene in methanol

o-Xylene 5% v/v was prepared by pipetting 5 ml of o-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting o-xylene solution has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of o-xylene (0.8802 g/cm^3).

Method of calculation

5% v/v o-xylene solution means:

In solution 100 ml, the number of volume of o-xylene is 5 ml.

$$D = m/V$$

$$0.8802 \text{ g/cm}^3 = m/5 \text{ ml}$$

$$m = 4.40 \text{ g}$$

So in solution 100 ml, the mass of o-xylene is 4.40 g

In solution 1 ml, the number of gram of o-xylene is

$$= \{(4.40 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0440 \text{ g}$$

Therefore, 5% v/v o-xylene is equal to 0.0440 g/ml or 44 mg/ml.

3.4 Preparation of 7% v/v o-xylene in methanol

o-Xylene 7% v/v was prepared by pipetting 7 ml of o-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting o-xylene solution has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of o-xylene (0.8802 g/cm^3).

Method of calculation

7% v/v o-xylene solution means:

In solution 100 ml, the number of volume of o-xylene is 7 ml.

$$D = m/V$$

$$0.8802\ g/cm^3 = m/7\ ml$$

$$m = 6.16\ g$$

So in solution 100 ml, the mass of o-xylene is 6.16 g

In solution 1 ml, the number of gram of o-xylene is

$$= \{(6.16\ g)(1\ ml)\}/100\ ml$$

$$= 0.0616\ g$$

Therefore, 7% v/v o-xylene is equal to 0.0616 g/ml or 62 mg/ml.

3.5 Preparation of 9% v/v o-xylene in methanol

o-Xylene 9% v/v was prepared by pipetting 9 ml of o-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting o-xylene solution has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of o-xylene (0.8802 g/cm^3).

Method of calculation

9% v/v o-xylene solution means:

In solution 100 ml, the number of volume of o-xylene is 9 ml.

$$D = m/V$$

$$0.8802\ g/cm^3 = m/9\ ml$$

$$m = 7.92\ g$$

So in solution 100 ml, the mass of o-xylene is 7.92 g

In solution 1 ml, the number of gram of o-xylene is

$$= \{(7.92\ g)(1\ ml)\}/100\ ml$$

$$= 0.0792\ g$$

Therefore, 9% v/v o-xylene is equal to 0.0792 g/ml or 79 mg/ml.

4 Calculation of the concentration of p-xylene

4.1 Preparation of 1% v/v p-xylene in methanol

p-Xylene 1% v/v was prepared by pipetting 1 ml of p-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting p-xylene solution has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of p-xylene (0.8611 g/cm^3).

Method of calculation

1% v/v p-xylene solution means:

In solution 100 ml, the number of volume of p-xylene is 1 ml.

$$D = m/V$$

$$0.8611\ g/cm^3 = m/1\ ml$$

$$m = 0.86\ g$$

So in solution 100 ml, the mass of p-xylene is 0.86 g

In solution 1 ml, the number of gram of p-xylene is

$$= \{(0.86\ g)(1\ ml)\}/100\ ml$$

$$= 0.0086\ g$$

Therefore, 1% v/v p-xylene is equal to 0.0086 g/ml or 9 mg/ml.

4.2 Preparation of 2% v/v p-xylene in methanol

p-Xylene 2% v/v was prepared by pipetting 2 ml of p-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting p-xylene solution has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of p-xylene (0.8611 g/cm^3).

Method of calculation

2% v/v p-xylene solution means:

In solution 100 ml, the number of volume of p-xylene is 2 ml.

$$D = m/V$$

$$0.8611\ g/cm^3 = m/2\ ml$$

$$m = 1.72\ g$$

So in solution 100 ml, the mass of p-xylene is 1.72 g

In solution 1 ml, the number of gram of p-xylene is

$$= \{(1.72\ g)(1\ ml)\}/100\ ml$$

$$= 0.0172\ g$$

Therefore, 2% v/v p-xylene is equal to 0.0172 g/ml or 17 mg/ml.

4.3 Preparation of 5% v/v p-xylene in methanol

p-Xylene 5% v/v was prepared by pipetting 5 ml of p-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting p-xylene solution has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of p-xylene (0.8611 g/cm^3).

Method of calculation

5% v/v p-xylene solution means:

In solution 100 ml, the number of gram of p-xylene is 5 ml.

$$D = m/V$$

$$0.8611 \text{ g/cm}^3 = m/5 \text{ ml}$$

$$m = 4.31 \text{ g}$$

So in solution 100 ml, the mass of p-xylene is 4.31 g

In solution 1 ml, the number of gram of p-xylene is

$$= \{(4.31 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0431 \text{ g}$$

Therefore, 5% v/v p-xylene is equal to 0.0431 g/ml or 43 mg/ml.

4.4 Preparation of 7% v/v p-xylene in methanol

p-Xylene 7% v/v was prepared by pipetting 7 ml of p-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting p-xylene solution has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of p-xylene (0.8611 g/cm^3).

Method of calculation

7% v/v p-xylene solution means:

In solution 100 ml, the number of volume of p-xylene is 7 ml.

$$D = m/V$$

$$0.8611 \text{ g/cm}^3 = m/7 \text{ ml}$$

$$m = 6.03 \text{ g}$$

So in solution 100 ml, the mass of p-xylene is 6.03 g

In solution 1 ml, the number of gram of p-xylene is

$$= \{(6.03 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0603 \text{ g}$$

Therefore, 7% v/v p-xylene is equal to 0.0603 g/ml or 60 mg/ml.

4.5 Preparation of 9% v/v p-xylene in methanol

p-Xylene 9% v/v was prepared by pipetting 9 ml of p-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting p-xylene solution has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of p-xylene (0.8611 g/cm^3).

Method of calculation

9% v/v p-xylene solution means:

In solution 100 ml, the number of volume of p-xylene is 9 ml.

$$D = m/V$$

$$0.8611 \text{ g/cm}^3 = m/9 \text{ ml}$$

$$m = 7.75 \text{ g}$$

So in solution 100 ml, the mass of p-xylene is 7.75 g

In solution 1 ml, the number of gram of p-xylene is

$$= \{(7.75 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0775 \text{ g}$$

Therefore, 9% v/v p-xylene is equal to 0.0775 g/ml or 78 mg/ml.

5 Calculation of the concentration of m-xylene

5.1 Preparation of 1% v/v m-xylene in methanol

m-Xylene 1% v/v was prepared by pipetting 1 ml of m-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting m-xylene solution has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of m-xylene (0.8642 g/cm^3).

Method of calculation

1% v/v m-xylene solution means:

In solution 100 ml, the number of volume of m-xylene is 1 ml.

$$D = m/V$$

$$0.8642 \text{ g/cm}^3 = m/1 \text{ ml}$$

$$m = 0.86 \text{ g}$$

So in solution 100 ml, the mass of m-xylene is 0.86 g

In solution 1 ml, the number of gram of m-xylene is

$$= \{(0.86 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0086 \text{ g}$$

Therefore, 1% v/v m-xylene is equal to 0.0086 g/ml or 9 mg/ml.

5.2 Preparation of 2% v/v m-xylene in methanol

m-Xylene 2% v/v was prepared by pipetting 2 ml of m-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting m-xylene solution has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of m-xylene (0.8642 g/cm^3).

Method of calculation

2% v/v m-xylene solution meaning:

In solution 100 ml, the number of volume of m-xylene is 2 ml.

$$D = m/V$$

$$0.8642\ g/cm^3 = m/2\ ml$$

$$m = 1.73\ g$$

So in solution 100 ml, the mass of m-xylene is 1.73 g

In solution 1 ml, the number of gram of m-xylene is

$$= \{(1.736\ g)(1\ ml)\}/100\ ml$$

$$= 0.0173\ g$$

Therefore, 2% v/v m-xylene is equal to 0.0173 g/ml or 17 mg/ml.

5.3 Preparation of 5% v/v m-xylene in methanol

m-Xylene 5% v/v was prepared by pipetting 5 ml of m-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting m-xylene solution has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of m-xylene ($0.8642\ g/cm^3$).

Method of calculation

5% v/v m-xylene solution means:

In solution 100 ml, the number of volume of m-xylene is 5 ml.

$$D = m/V$$

$$0.8642\ g/cm^3 = m/5\ ml$$

$$m = 4.32\ g$$

So in solution 100 ml, the mass of m-xylene is 4.32 g

In solution 1 ml, the number of gram of m-xylene is

$$= \{(4.32\ g)(1\ ml)\}/100\ ml$$

$$= 0.0432\ g$$

Therefore, 5% v/v m-xylene is equal to 0.0432 g/ml or 43 mg/ml.

5.4 Preparation of 7% v/v m-xylene in methanol

m-Xylene 7% v/v was prepared by pipetting 7 ml of m-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting m-xylene solution has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of m-xylene (0.8642 g/cm^3).

Method of calculation

7% v/v m-xylene solution means:

In solution 100 ml, the number of volume of m-xylene is 7 ml.

$$D = m/V$$

$$0.8642\ g/cm^3 = m/7\ ml$$

$$m = 6.05\ g$$

So in solution 100 ml, the mass of m-xylene is 6.05 g

In solution 1 ml, the number of gram of m-xylene is

$$= \{(6.05\ g)(1\ ml)\}/100\ ml$$

$$= 0.0605\ g$$

Therefore, 7% v/v m-xylene is equal to 0.0605 g/ml or 61 mg/ml.

5.5 Preparation of 9% v/v m-xylene in methanol

m-Xylene 9% v/v was prepared by pipetting 9 ml of m-xylene. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting m-xylene solution has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of m-xylene (0.8642 g/cm^3).

Method of calculation

9% v/v m-xylene solution means:

In solution 100 ml, the number of volume of m-xylene is 9 ml.

$$D = m/V$$

$$0.8642\ g/cm^3 = m/9\ ml$$

$$m = 7.78\ g$$

So in solution 100 ml, the mass of m-xylene is 7.78 g

In solution 1 ml, the number of gram of m-xylene is

= {(7.78 g)(1 ml)}/100 ml

= 0.0778 g

Therefore, 9% v/v m-xylene is equal to 0.0778 g/ml or 78 mg/ml.

6 Calculation of the concentration of ethanol

6.1 Preparation of 1% v/v ethanol in methanol

Ethanol 1% v/v was prepared by pipetting 1 ml of ethanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml, the resulting ethanol solution has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethanol (0.7893 g/cm^3).

Method of calculation

1% v/v ethanol solution means:

In solution 100 ml, the number of volume of ethanol is 1 ml.

D = m/V

0.7893 g/cm^3 = m/1 ml

m = 0.79 g

So in solution 100 ml, the mass of ethanol is 0.79 g

In solution 1 ml, the number of gram of ethanol is

= {(0.79 g)(1 ml)}/100 ml

= 0.0079 g

Therefore, 1% v/v ethanol is equal to 0.0079 g/ml or 8 mg/ml.

6.2 Preparation of 2% v/v ethanol in methanol

Ethanol 2% v/v was prepared by pipetting 2 ml of ethanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting ethanol solution has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethanol (0.7893 g/cm^3).

Method of calculation

2% v/v ethanol solution means:

In solution 100 ml, the number of volume of ethanol is 2 ml.

$$D = m/V$$

$$0.7893\ g/cm^3 = m/2\ ml$$

$$m = 1.58\ g$$

So in solution 100 ml, the mass of ethanol is 1.58 g

In solution 1 ml, the number of gram of ethanol is

$$= \{(1.58\ g)(1\ ml)\}/100\ ml$$

$$= 0.0158\ g$$

Therefore, 2% v/v ethanol is equal to 0.0158 g/ml or 16 mg/ml.

6.3 Preparation of 5% v/v ethanol in methanol

Ethanol 5% v/v was prepared by pipetting 5 ml of ethanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting ethanol solution has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethanol (0.7893 g/cm^3).

Method of calculation

5% v/v ethanol solution means:

In solution 100 ml, the number of volume of ethanol is 5 ml.

$$D = m/V$$

$$0.7893 \text{ g/cm}^3 = m/5 \text{ ml}$$

$$m = 3.95 \text{ g}$$

So in solution 100 ml, the mass of ethanol is 3.95 g

In solution 1 ml, the number of gram of ethanol is

$$= \{(3.95 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0395 \text{ g}$$

Therefore, 5% v/v ethanol is equal to 0.0395 g/ml or 40 mg/ml.

6.4 Preparation of 7% v/v ethanol in methanol

Ethanol 7% v/v was prepared by pipetting 7 ml of ethanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting ethanol solution has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethanol (0.7893 g/cm^3).

Method of calculation

7% v/v ethanol solution means:

In solution 100 ml, the number of volume of ethanol is 7 ml.

$$D = m/V$$

$$0.7893\ g/cm^3 = m/7\ ml$$

$$m = 5.53\ g$$

So in solution 100 ml, the mass of ethanol is 5.53 g

In solution 1 ml, the number of gram of ethanol is

$$= \{(5.53\ g)(1\ ml)\}/100\ ml$$

$$= 0.0553\ g$$

Therefore, 7% v/v ethanol is equal to 0.0553 g/ml or 55 mg/ml.

6.5 Preparation of 9% v/v ethanol in methanol

Ethanol 9% v/v was prepared by pipetting 9 ml of ethanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting ethanol solution has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethanol ($0.7893\ g/cm^3$).

Method of calculation

9% v/v ethanol solution means:

In solution 100 ml, the number of volume of ethanol is 9 ml.

$$D = m/V$$

$$0.7893\ g/cm^3 = m/9\ ml$$

$$m = 7.10\ g$$

So in solution 100 ml, the mass of ethanol is 7.10 g

In solution 1 ml, the number of gram of ethanol is

$$= \{(7.10\ g)(1\ ml)\}/100\ ml$$

$$= 0.0710\ g$$

Therefore, 9% v/v ethanol is equal to 0.0710 g/ml or 71 mg/ml.

7 Calculation of the concentration of 1-propanol

7.1 Preparation of 1% v/v 1-propanol in methanol

1-Propanol 1% v/v was prepared by pipetting 1 ml of 1-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-propanol solution has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-propanol (0.8035 g/cm^3).

Method of calculation

1% v/v 1-propanol solution means:

In solution 100 ml, the number of volume of 1-propanol is 1 ml.

$$D = m/V$$

$$0.8035\ g/cm^3 = m/1\ ml$$

$$m = 0.80\ g$$

So in solution 100 ml, the mass of 1-propanol is 0.80 g

In solution 1 ml, the number of gram of 1-propanol is

= {(0.80 g)(1 ml)}/100 ml

= 0.0080 g

Therefore, 1% v/v 1-propanol is equal to 0.0080 g/ml or 8 mg/ml.

7.2 Preparation of 2% v/v 1-propanol in methanol

1-Propanol 2% v/v was prepared by pipetting 2 ml of 1-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-propanol solution has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-propanol (0.8035 g/cm^3).

Method of calculation

2% v/v 1-propanol solution means:

In solution 100 ml, the number of volume of 1-propanol is 2 ml.

D = m/V

0.8035 g/cm^3 = m/2 ml

m = 1.61 g

So in solution 100 ml, the mass of 1-propanol is 1.61 g

In solution 1 ml, the number of gram of 1-propanol is

= {(1.61 g)(1 ml)}/100 ml

= 0.0161 g

Therefore, 2% v/v 1-propanol is equal to 0.0161 g/ml or 16 mg/ml.

7.3 Preparation of 5% v/v 1-propanol in methanol

1-Propanol 5% v/v was prepared by pipetting 5 ml of 1-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-propanol solution has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-propanol (0.8035 g/cm^3).

Method of calculation

5% v/v 1-propanol solution means:

In solution 100 ml, the number of volume of 1-propanol is 5 ml.

$$D = m/V$$

$$0.8035\ g/cm^3 = m/5\ ml$$

$$m = 4.02\ g$$

So in solution 100 ml, the mass of 1-propanol is 4.02 g

In solution 1 ml, the number of gram of 1-propanol is

$$= \{(4.02\ g)(1\ ml)\}/100\ ml$$

$$= 0.0402\ g$$

Therefore, 5% v/v 1-propanol is equal to 0.0402 g/ml or 40 mg/ml.

7.4 Preparation of 7% v/v 1-propanol in methanol

1-Propanol 7% v/v was prepared by pipetting 7 ml of 1-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-propanol solution has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-propanol (0.8035 g/cm^3).

Method of calculation

7% v/v 1-propanol solution means:

In solution 100 ml, the number of volume of 1-propanol is 7 ml.

$$D = m/V$$

$$0.8035\ g/cm^3 = m/7\ ml$$

$$m = 5.62\ g$$

So in solution 100 ml, the mass of 1-propanol is 5.62 g

In solution 1 ml, the number of gram of 1-propanol is

$$= \{(5.62\ g)(1\ ml)\}/100\ ml$$

$$= 0.0562\ g$$

Therefore, 7% v/v 1-propanol is equal to 0.0562 g/ml or 56 mg/ml.

7.5 Preparation of 9% v/v 1-propanol in methanol

1-Propanol 9% v/v was prepared by pipetting 9 ml of 1-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-propanol solution has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-propanol (0.8035 g/cm^3).

Method of calculation

9% v/v 1-propanol solution means:

In solution 100 ml, the number of volume of 1-propanol is 9 ml.

$$D = m/V$$

$$0.8035\ g/cm^3 = m/9\ ml$$

$$m = 7.23\ g$$

So in solution 100 ml, the mass of 1-propanol is 7.23 g

In solution 1 ml, the number of gram of 1-propanol is

$$= \{(7.23\ g)(1\ ml)\}/100\ ml$$

$$= 0.0723\ g$$

Therefore, 9% v/v 1-propanol is equal to 0.0723 g/ml or 72 mg/ml.

8 Calculation of the concentration of 1-butanol

8.1 Preparation of 1% v/v 1-butanol in methanol

1-Butanol 1% v/v was prepared by pipetting 1 ml of 1-butanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-butanol solution has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-butanol (0.8098 g/cm^3).

Method of calculation

1% v/v 1-butanol solution means:

In solution 100 ml, the number of volume of 1-butanol is 1 ml.

$$D = m/V$$

$$0.8098\ g/cm^3 = m/1\ ml$$

$$m = 0.81\ g$$

So in solution 100 ml, the mass of 1-butanol is 0.81 g

In solution 1 ml, the number of gram of 1-butanol is

$$= \{(0.81\ g)(1\ ml)\}/100\ ml$$

$$= 0.0081\ g$$

Therefore, 1% v/v 1-butanol is equal to 0.0081 g/ml or 8 mg/ml.

8.2 Preparation of 2% v/v 1-butanol in methanol

1-Butanol 2% v/v was prepared by pipetting 2 ml of 1-butanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-butanol solution has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-butanol (0.8098 g/cm^3).

Method of caculation

2% v/v 1-butanol solution means:

In solution 100 ml, the number of volume of 1-butanol is 2 ml.

$$D = m/V$$

$$0.8098\ g/cm^3 = m/2\ ml$$

$$m = 1.62\ g$$

So in solution 100 ml, the mass of 1-butanol is 1.62 g

In solution 1 ml, the number of gram of 1-butanol is

$$= \{(1.62\ g)(1\ ml)\}/100\ ml$$

$$= 0.0162\ g$$

Therefore, 2% v/v 1-butanol is equal to 0.0162 g/ml or 16 mg/ml.

8.3 Preparation of 5% v/v 1-butanol in methanol

1-Butanol 5% v/v was prepared by pipetting 5 ml of 1-butanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-butanol solution has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-butanol ($0.8098\ g/cm^3$).

Method of calculation

5% v/v 1-butanol solution means:

In solution 100 ml, the number of volume of 1-butanol is 5 ml.

$$D = m/V$$

$$0.8098\ g/cm^3 = m/5\ ml$$

$$m = 4.05\ g$$

So in solution 100 ml, the mass of 1-butanol is 4.05 g

In solution 1 ml, the number of gram of 1-butanol is

$$= \{(4.05\ g)(1\ ml)\}/100\ ml$$

$$= 0.0405\ g$$

Therefore, 5% v/v 1-butanol is equal to 0.0405 g/ml or 40 mg/ml.

8.4 Preparation of 7% v/v 1-butanol in methanol

1-Butanol 7% v/v was prepared by pipetting 7 ml of 1-butanol. After that. It was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-butanol solution has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-butanol (0.8098 g/cm^3).

Method of calculation

7% v/v 1-butanol solution means:

In solution 100 ml, the number of volume of 1-butanol is 7 ml.

$$D = m/V$$

$$0.8098\ g/cm^3 = m/7\ ml$$

$$m = 5.67\ g$$

So in solution 100 ml, the mass of 1-butanol is 5.67 g

In solution 1 ml, the number of gram of 1-butanol is

$$= \{(5.67\ g)(1\ ml)\}/100\ ml$$

$$= 0.0567\ g$$

Therefore, 7% v/v 1-butanol is equal to 0.0567 g/ml or 57 mg/ml.

8.5 Preparation of 9% v/v 1-butanol in methanol

1-Butanol 9% v/v was prepared by pipetting 9 ml of 1-butanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 1-butanol solution has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 1-butanol (0.8098 g/cm^3).

Method of calculation

9% v/v 1-butanol solution means:

In solution 100 ml, the number of volume of 1-butanol is 9 ml.

$$D = m/V$$

$$0.8098\ g/cm^3 = m/9\ ml$$

$$m = 7.29\ g$$

So in solution 100 ml, the mass of 1-butanol is 7.29 g

In solution 1 ml, the number of gram of 1-butanol is

$$= \{(7.29\ g)(1\ ml)\}/100\ ml$$

$$= 0.0729\ g$$

Therefore, 9 % v/v 1-butanol is equal to 0.0729 g/ml or 73 mg/ml.

9 Calculation of the concentration of 2-propanol

9.1 Preparation of 1% v/v 2-propanol in methanol

2-Propanol 1% v/v was prepared by pipetting 1 ml of 2-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 2-propanol solution has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 2-propanol (0.7855 g/cm^3).

Method of calculation

1% v/v 2-propanol solution means:

In solution 100 ml, the number of volume of 2-propanol is 1 ml.

$$D = m/V$$

$$0.7855\ g/cm^3 = m/1\ ml$$

$$m = 0.78\ g$$

So in solution 100 ml, the mass of 2-propanol is 0.78 g

In solution 1 ml, the number of gram of 2-propanol is

$$= \{(0.78\ g)(1\ ml)\}/100\ ml$$

$$= 0.0078\ g$$

Therefore, 1% v/v 2-propanol is equal to 0.0078 g/ml or 8 mg/ml.

9.2 Preparation of 2% v/v 2-propanol in methanol

2-Propanol 2% v/v was prepared by pipetting 2 ml of 2-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 2-propanol solution has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 2-propanol (0.7855 g/cm^3).

Method of calcultion

2% v/v 2-propanol solution means:

In solution 100 ml, the number of volume of 2-propanol is 2 ml.

$$D = m/V$$

$$0.7855\ g/cm^3 = m/2\ ml$$

$$m = 1.57\ g$$

So in solution 100 ml, the mass of 2-propanol is 1.57 g

In solution 1 ml, the number of gram of 2-propanol is

$$= \{(1.57\ g)(1\ ml)\}/100\ ml$$

$$= 0.0157\ g$$

Therefore, 2% v/v 2-propanol is equal to 0.0157 g/ml or 16 mg/ml.

9.3 Preparation of 5% v/v 2-propanol in methanol

2-Propanol 5% v/v was prepared by pipetting 5 ml of 2-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 2-propanol solution has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 2-propanol (0.7855 g/cm^3).

Method of calculation

5% v/v 2-propanol solution means:

In solution 100 ml, the number of volume of 2-propanol is 5 ml.

$$D = m/V$$

$$0.7855 \text{ g/cm}^3 = m/5 \text{ ml}$$

$$m = 3.93 \text{ g}$$

So in solution 100 ml, the mass of 2-propanol is 3.93 g

In solution 1 ml, the number of gram of 2-propanol is

$$= \{(3.93 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0393 \text{ g}$$

Therefore, 5% v/v 2-propanol is equal to 0.0393 g/ml or 39 mg/ml.

9.4 Preparation of 7% v/v 2-propanol in methanol

2-Propanol 7% v/v was prepared by pipetting 7 ml of 2-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 2-propanol solution has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 2-propanol (0.7855 g/cm^3).

Method of calculation

7% v/v 2-propanol solution means:

In solution 100 ml, the number of volume of 2-propanol is 7 ml.

$$D = m/V$$

$$0.7855\ g/cm^3 = m/7\ ml$$

$$m = 5.50\ g$$

So in solution 100 ml, the mass of 2-propanol is 5.50 g

In solution 1 ml, the number of gram of 2-propanol is

$$= \{(5.50\ g)(1\ ml)\}/100\ ml$$

$$= 0.0550\ g$$

Therefore, 7% v/v 2-propanol is equal to 0.0550 g/ml or 55 mg/ml.

9.5 Preparation of 9% v/v 2-propanol in methanol

2-Propanol 9% v/v was prepared by pipetting 9 ml of 2-propanol. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting 2-propanol solution has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of 2-propanol (0.7855 g/cm^3).

Method of calculation

9% v/v 2-propanol solution means:

In solution 100 ml, the number of volume of 2-propanol is 9 ml.

$$D = m/V$$

$$0.7855\ g/cm^3 = m/9\ ml$$

$$m = 7.07\ g$$

So in solution 100 ml, the mass of 2-propanol is 7.07 g

In solution 1 ml, the number of gram of 2-propanol is

$$= \{(7.07\ g)(1\ ml)\}/100\ ml$$

$$= 0.0707\ g$$

Therefore, 9% v/v 2-propanol is equal to 0.0707 g/ml or 71 mg/ml.

10 Calculation of the concentration of n-butyl acetate

10.1 Preparation of 1% v/v n-butyl acetate in methanol

n-Butyl acetate 1% v/v was prepared by pipetting 1 ml of n-butyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting n-butyl acetate has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of n-butyl acetate (0.8825 g/cm^3).

Method of calculation

1% v/v n-butyl acetate solution means:

In solution 100 ml, the number of volume of n-butyl acetate is 1 ml.

$$D = m/V$$

$$0.8825\ g/cm^3 = m/1\ ml$$

$$m = 0.88\ g$$

So in solution 100 ml, the mass of n-butyl acetate is 0.88 g

In solution 1 ml, the number of gram of n-butyl acetate is

$$= \{(0.88\ g)(1\ ml)\}/100\ ml$$

$$= 0.0088\ g$$

Therefore, 1% v/v n-butyl acetate is equal to 0.0088 g/ml or 9 mg/ml.

10.2 Preparation of 2% v/v n-butyl acetate in methanol

n-Butyl acetate 2% v/v was prepared by pipetting 2 ml of n-butyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting n-butyl acetate has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of n-butyl acetate (0.8825 g/cm^3).

Method of calculation

2% v/v n-butyl acetate solution means:

In solution 100 ml, the number of volume of n-butyl acetate is 2 ml.

$$D = m/V$$

$$0.8825\ g/cm^3 = m/2\ ml$$

$$m = 1.76\ g$$

So in solution 100 ml, the mass of n-butyl acetate is 1.76 g

In solution 1 ml, the number of gram of n-butyl acetate is

$$= \{(1.76\ g)(1\ ml)\}/100\ ml$$

$$= 0.0176\ g$$

Therefore, 2% v/v n-butyl acetate is equal to 0.0176 g/ml or 18 mg/ml.

10.3 Preparation of 5% v/v n-butyl acetate in methanol

n-Butyl acetate 5% v/v was prepared by pipetting 5 ml of n-butyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting n-butyl acetate has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of n-butyl acetate (0.8825 g/cm^3).

Method of calcution

5% v/v n-butyl acetate solution means:

In solution 100 ml, the number of volume of n-butyl acetate is 5 ml.

$$D = m/V$$

$$0.8825\ g/cm^3 = m/5\ ml$$

$$m = 4.41\ g$$

So in solution 100 ml, the mass of n-butyl acetate is 4.41 g

In solution 1 ml, the number of gram of n-butyl acetate is

$$= \{(4.41\ g)(1\ ml)\}/100\ ml$$

$$= 0.0441\ g$$

Therefore, 5% v/v n-butyl acetate is equal to 0.0441 g/ml or 44 mg/ml.

10.4 Preparation of 7% v/v n-butyl acetate in methanol

n-Butyl acetate 7% v/v was prepared by pipetting 7 ml of n-butyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting n-butyl acetate has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of n-butyl acetate (0.8825 g/cm^3).

Method of calculation

7% v/v n-butyl acetate solution means:

In solution 100 ml, the number of volume of n-butyl acetate is 7 ml.

$$D = m/V$$

$$0.8825\ g/cm^3 = m/7\ ml$$

$$m = 6.18\ g$$

So in solution 100 ml, the mass of n-butyl acetate is 6.18 g

In solution 1 ml, the number of gram of n-butyl acetate is

$$= \{(6.18\ g)(1\ ml)\}/100\ ml$$

$$= 0.0618\ g$$

Therefore, 7% v/v n-butyl acetate is equal to 0.0618 g/ml or 62 mg/ml.

10.5 Preparation of 9% v/v n-butyl acetate in methanol

n-Butyl acetate 9% v/v was prepared by pipetting 9 ml of n-butyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting n-butyl acetate has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of n-butyl acetate (0.8825 g/cm^3).

Method of calculation

9% v/v n-butyl acetate solution means:

In solution 100 ml, the number of volume of n-butyl acetate is 9 ml.

$$D = m/V$$

$$0.8825 \text{ g/cm}^3 = m/9 \text{ ml}$$

$$m = 7.94 \text{ g}$$

So in solution 100 ml, the mass of n-butyl acetate is 7.94 g

In solution 1 ml, the number of gram of n-butyl acetate is

$$= \{(7.94 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0794 \text{ g}$$

Therefore, 9% v/v n-butyl acetate is equal to 0.0794 g/ml or 79 mg/ml.

11 Calculation of the concentration of ethyl acetate

11.1 Preparation of 1% v/v ethyl acetate in methanol

Ethyl acetate 1% v/v was prepared by pipetting 1 ml of ethyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting ethyl acetate has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethyl acetate (0.9003 g/cm^3).

Method of calculation

1% v/v ethyl acetate solution means:

In solution 100 ml, the number of volume of ethyl acetate is 1 ml.

$$D = m/V$$

$$0.9003 \text{ g/cm}^3 = m/1 \text{ ml}$$

$$m = 0.90 \text{ g}$$

So in solution 100 ml, the mass of ethyl acetate is 0.90 g

In solution 1 ml, the number of gram of ethyl acetate is

$$= \{(0.90 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0090 \text{ g}$$

Therefore, 1% v/v ethyl acetate is equal to 0.0090 g/ml or 9 mg/ml.

11.2 Preparation of 2% v/v ethyl acetate in methanol

Ethyl acetate 2% v/v was prepared by pipetting 2 ml of ethyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting ethyl acetate has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethyl acetate (0.9003 g/cm^3).

Method of calculation

2% v/v ethyl acetate solution means:

In solution 100 ml, the number of volume of ethyl acetate is 2 ml.

$$D = m/V$$

$$0.9003\ g/cm^3 = m/2\ ml$$

$$m = 1.80\ g$$

So in solution 100 ml, the mass of ethyl acetate is 1.80 g

In solution 1 ml, the number of gram of ethyl acetate is

$$= \{(1.80\ g)(1\ ml)\}/100\ ml$$

$$= 0.0180\ g$$

Therefore, 2% v/v ethyl acetate is equal to 0.0180 g/ml or 18 mg/ml.

11.3 Preparation of 5% v/v ethyl acetate in methanol

Ethyl acetate 5% v/v was prepared by pipetting 5 ml of ethyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting ethyl acetate has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethyl acetate (0.9003 g/cm^3).

Method of calculation

5% v/v ethyl acetate solution means:

In solution 100 ml, the number of volume of ethyl acetate is 5 ml.

$$D = m/V$$

$$0.9003\ g/cm^3 = m/5\ ml$$

$$m = 4.50\ g$$

So in solution 100 ml, the mass of ethyl acetate is 4.50 g

In solution 1 ml, the number of gram of ethyl acetate is

$$= \{(4.50\ g)(1\ ml)\}/100\ ml$$

$$= 0.0450\ g$$

Therefore, 5% v/v ethyl acetate is equal to 0.0450 g/ml or 45 mg/ml.

11.4 Preparation of 7% v/v ethyl acetate in methanol

Ethyl acetate 7% v/v was prepared by pipetting 7 ml of ethyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting ethyl acetate has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethyl acetate (0.9003 g/cm^3).

Method of calculation

7% v/v ethyl acetate solution means:

In solution 100 ml, the number of volume of ethyl acetate is 7 ml.

$$D = m/V$$

$$0.9003\ g/cm^3 = m/7\ ml$$

$$m = 6.30\ g$$

So in solution 100 ml, the mass of ethyl acetate is 6.30 g

In solution 1 ml, the number of gram of ethyl acetate is

= {(6.30 g)(1 ml)}/100 ml

= 0.0630 g

Therefore, 7% v/v ethyl acetate is equal to 0.0630 g/ml or 63 mg/ml.

11.5 Preparation of 9% v/v ethyl acetate in methanol

Ethyl acetate 9% v/v was prepared by pipetting 9 ml of ethyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting ethyl acetate has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of ethyl acetate (0.9003 g/cm^3).

Method of calculation

9% v/v ethyl acetate solution means:

In solution 100 ml, the number of volume of ethyl acetate is 9 ml.

D = m/V

0.9003 g/cm^3 = m/9 ml

m = 8.10 g

So in solution 100 ml, the mass of ethyl acetate is 8.10 g

In solution 1 ml, the number of gram of ethyl acetate is

= {(8.10 g)(1 ml)}/100 ml

= 0.0810 g

Therefore, 9% v/v ethyl acetate is equal to 0.0810 g/ml or 81 mg/ml.

12 Calculation of the concentration of propyl acetate

12.1 Preparation of 1% v/v propyl acetate in methanol

Propyl acetate 1% v/v was prepared by pipetting 1 ml of propyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting propyl acetate has the concentration of 1% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of propyl acetate (0.8878 g/cm^3).

Method of calculation

1% v/v propyl acetate solution means:

In solution 100 ml, the number of volume of propyl acetate is 1 ml.

$$D = m/V$$

$$0.8878\ g/cm^3 = m/1\ ml$$

$$m = 0.89\ g$$

So in solution 100 ml, the mass of propyl acetate is 0.89 g

In solution 1 ml, the number of gram of propyl acetate is

$$= \{(0.89\ g)(1\ ml)\}/100\ ml$$

$$= 0.0089\ g$$

Therefore, 1% v/v propyl acetate is equal to 0.0089 g/ml or 9 mg/ml.

12.2 Preparation of 2% v/v propyl acetate in methanol

Propyl acetate 2% v/v was prepared by pipetting 2 ml of propyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting propyl acetate has the concentration of 2% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of propyl acetate (0.8878 g/cm^3).

Method of calculation

2% v/v propyl acetate solution means:

In solution 100 ml, the number of volume of propyl acetate is 2 ml.

$$D = m/V$$

$$0.8878 \text{ g/cm}^3 = m/2 \text{ ml}$$

$$m = 1.78 \text{ g}$$

So in solution 100 ml, the mass of propyl acetate is 1.78 g

In solution 1 ml, the number of gram of propyl acetate is

$$= \{(1.78 \text{ g})(1 \text{ ml})\}/100 \text{ ml}$$

$$= 0.0178 \text{ g}$$

Therefore, 2% v/v propyl acetate is equal to 0.0178 g/ml or 18 mg/ml.

12.3 Preparation of 5% v/v propyl acetate in methanol

Propyl acetate 5% v/v was prepared by pipetting 5 ml of propyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting propyl acetate has the concentration of 5% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of propyl acetate (0.8878 g/cm^3).

Method of caculation

5% v/v propyl acetate solution means:

In solution 100 ml, the number of volume of propyl acetate is 5 ml.

$$D = m/V$$

$$0.8878\ g/cm^3 = m/5\ ml$$

$$m = 4.44\ g$$

So in solution 100 ml, the mass of propyl acetate is 4.44 g

In solution 1 ml, the number of gram of propyl acetate is

$$= \{(4.44\ g)(1\ ml)\}/100\ ml$$

$$= 0.0444\ g$$

Therefore, 5% v/v propyl acetate is equal to 0.0444 g/ml or 44 mg/ml.

12.4 Preparation of 7% v/v propyl acetate in methanol

Propyl acetate 7% v/v was prepared by pipetting 7 ml of propyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting propyl acetate has the concentration of 7% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of propyl acetate (0.8878 g/cm^3).

Method of calculation

7% v/v propyl acetate solution means:

In solution 100 ml, the number of volume of propyl acetate is 7 ml.

$$D = m/V$$

$$0.8878\ g/cm^3 = m/7\ ml$$

$$m = 6.21\ g$$

So in solution 100 ml, the mass of propyl acetate is 6.21 g

In solution 1 ml, the number of gram of propyl acetate is

$$= \{(6.21\ g)(1\ ml)\}/100\ ml$$

$$= 0.0621\ g$$

Therefore, 7% v/v propyl acetate is equal to 0.0621 g/ml or 62 mg/ml.

12.5 Preparation of 9% v/v propyl acetate in methanol

Propyl acetate 9% v/v was prepared by pipetting 9 ml of propyl acetate. After that, it was dissolved in enough methanol to give a final volume of 100 ml. The resulting propyl acetate has the concentration of 9% (v/v).

Conversion factor from percent concentration

Due to the fact that the evaporation rate is measured in unit of weight (mg) per unit of time, the concentration in the unit of percent by volume, % (v/v) can be converted to mg/ml unit by using the density of propyl acetate ($0.8878\ g/cm^3$).

Method of calculation

9% v/v propyl acetate solution means:

In solution 100 ml, the number of volume of propyl acetate is 9 ml.

$$D = m/V$$

$$0.8878\ g/cm^3 = m/9\ ml$$

$$m = 7.99\ g$$

So in solution 100 ml, the mass of propyl acetate is 7.99 g

In solution 1 ml, the number of gram of propyl acetate is

$$= \{(7.99\ g)(1\ ml)\}/100\ ml$$

$$= 0.0799\ g$$

Therefore, 9% v/v propyl acetate is equal to 0.0799 g/ml or 80 mg/ml.

APPENDIX B

Standard curves of toluene, xylene, o-xylene, p-xylene, m-xylene, ethanol, 1-propanol, 1-butanol, 2-propanol, n-butyl acetate, ethyl acetate, and propyl acetate

The chromatogram of headspace volatiles of each solvent are shown in Figure 1.

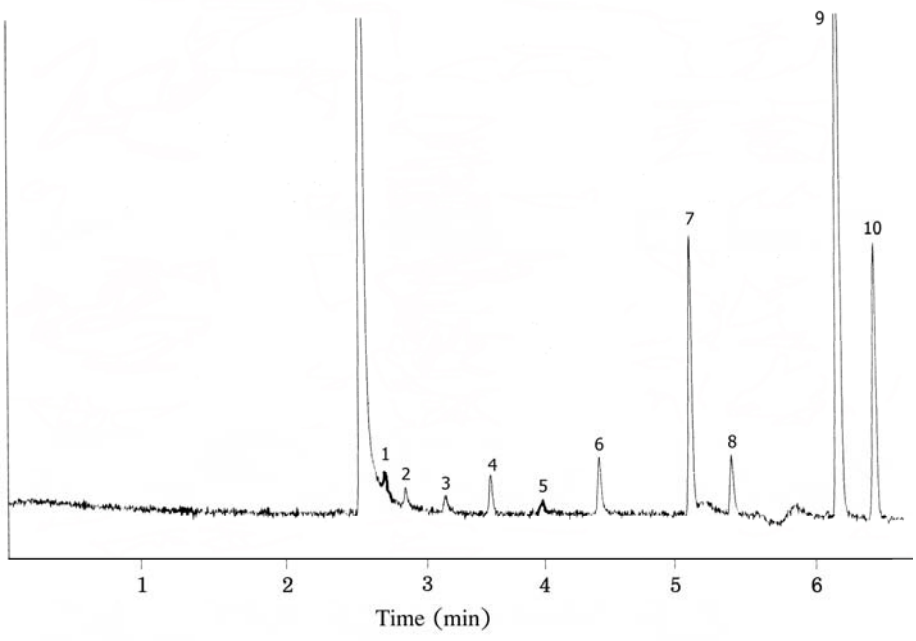


Figure 1 Chromatogram of headspace volatiles of each solvent for standard solution. Identified peaks: (1) ethanol, (2) 2-propanol, (3) 1-propanol, (4) ethyl acetate, (5) 1-butanol, (6) propyl acetate, (7) toluene, (8) n-butyl acetate, (9) xylene, p-xylene, and m-xylene (10) o-xylene.

In this work, the quantity of solvent in mixture was analyzed. The GC headspace technique provided the standard curves for toluene, xylene, o-xylene, p-xylene, m-xylene, ethanol, 1-propanol, 1-butanol, 2-propanol, n-butyl acetate, ethyl acetate, and propyl acetate. Standard solutions were prepared in the concentration of 9, 17, 43, 61, and 78 mg/ml for toluene and m-xylene; 9, 17, 43, 60, and 77 mg/ml for xylene; 9, 18, 44, 62, and 79 mg/ml for o-xylene and n-butyl acetate; 9, 17, 43, 60, and 78 mg/ml for p-xylene; 8, 16, 40, 55, and 71 mg/ml for ethanol; 8, 16, 40, 56, and 72 mg/ml for 1-propanol; 8, 16, 40, 57, and 73 mg/ml for 1-butanol; 8, 16, 39, 55, and 71 mg/ml for 2-propanol; 9, 18, 45, 63, and 81 mg/ml for ethyl acetate; and, 9, 18, 44, 62, and 80 mg/ml for propyl acetate. The results are shown in Figure 2 to 13.

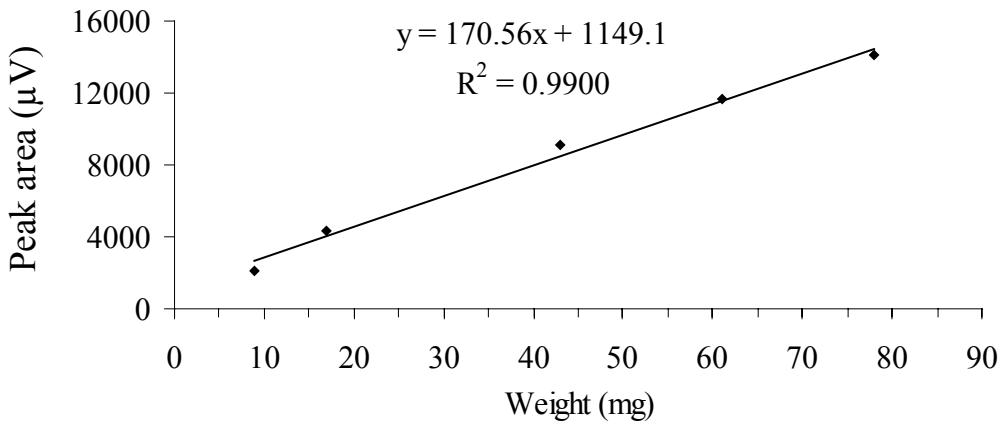


Figure 2 The standard curve of toluene

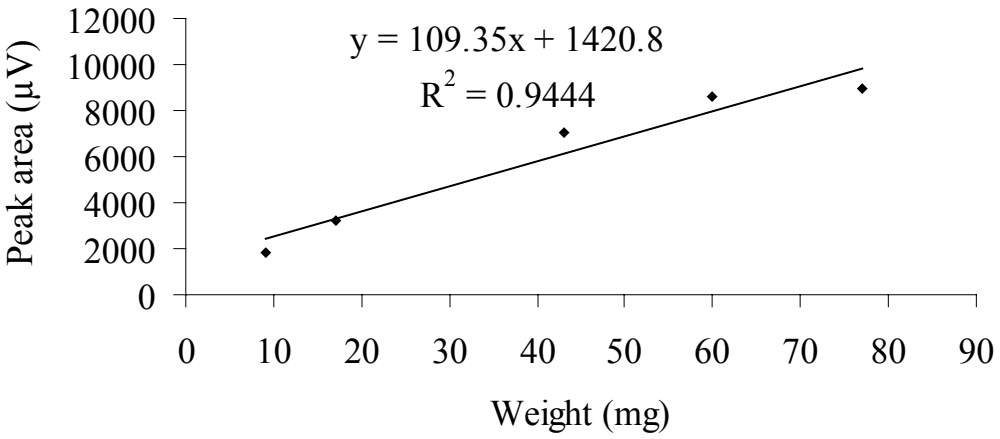


Figure 3 The standard curve of xylene

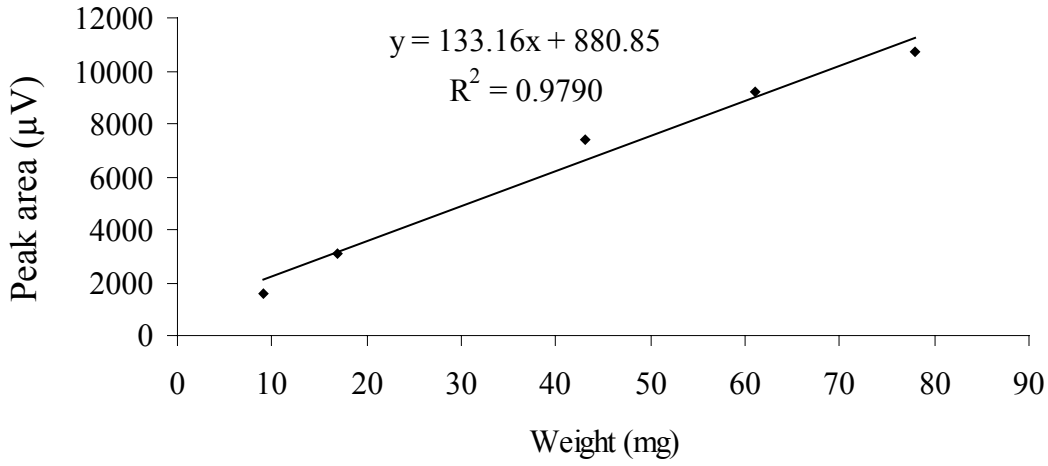


Figure 4 The standard curve of m-xylene

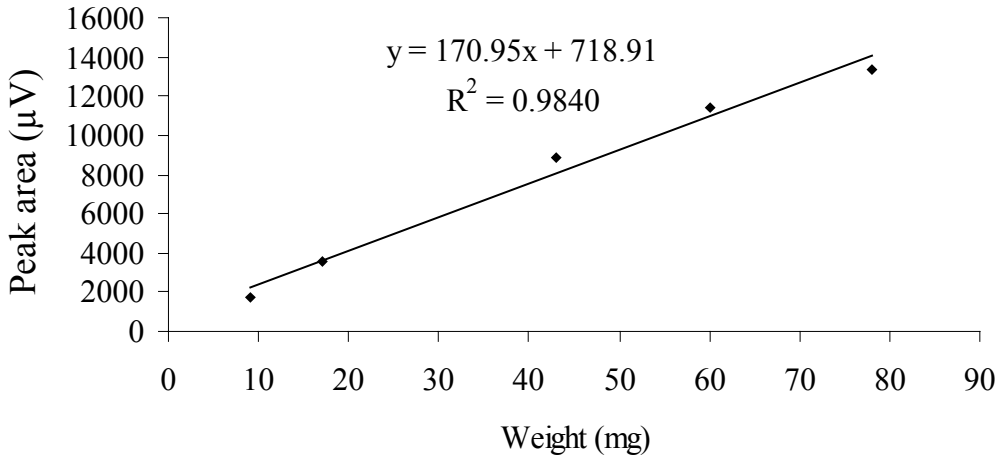


Figure 5 The standard curve of p-xylene

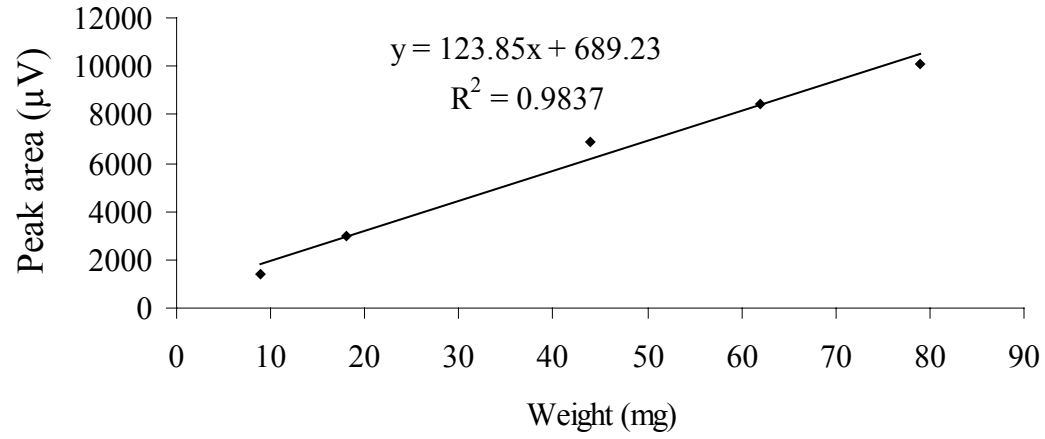


Figure 6 The standard curve of o-xylene

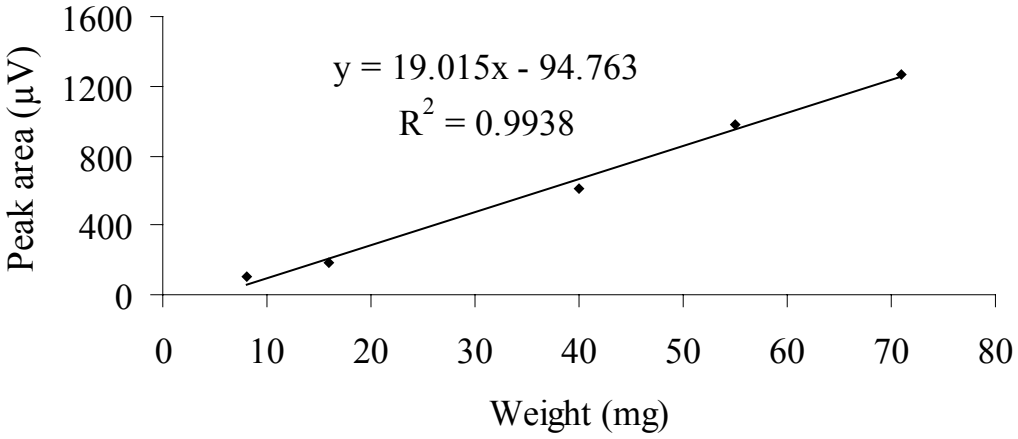


Figure 7 The standard curve of ethanol

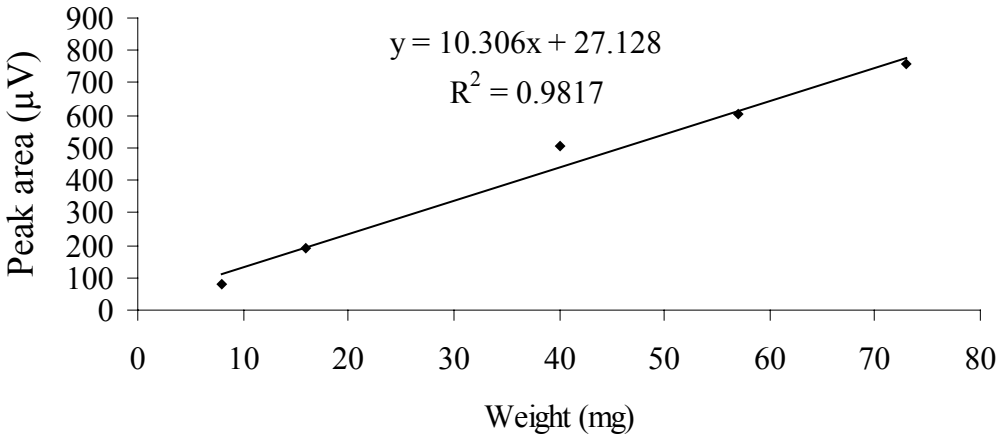


Figure 8 The standard curve of 1-butanol

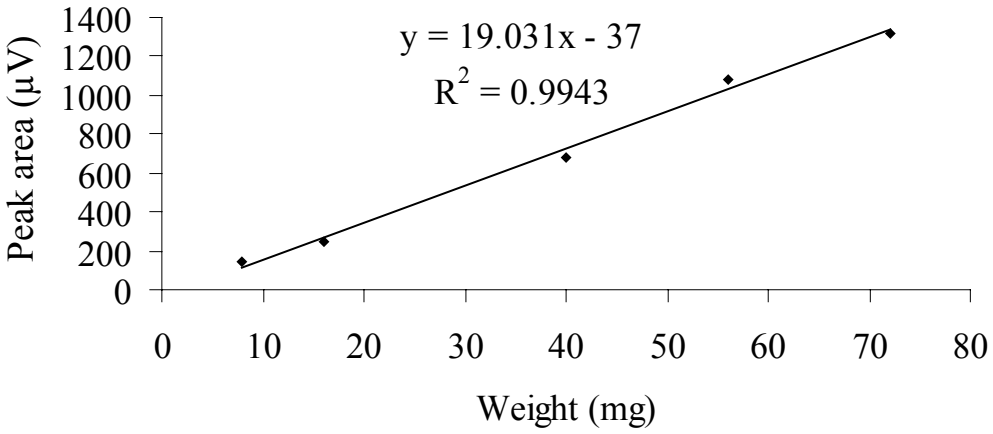


Figure 9 The standard curve of 1-propanol

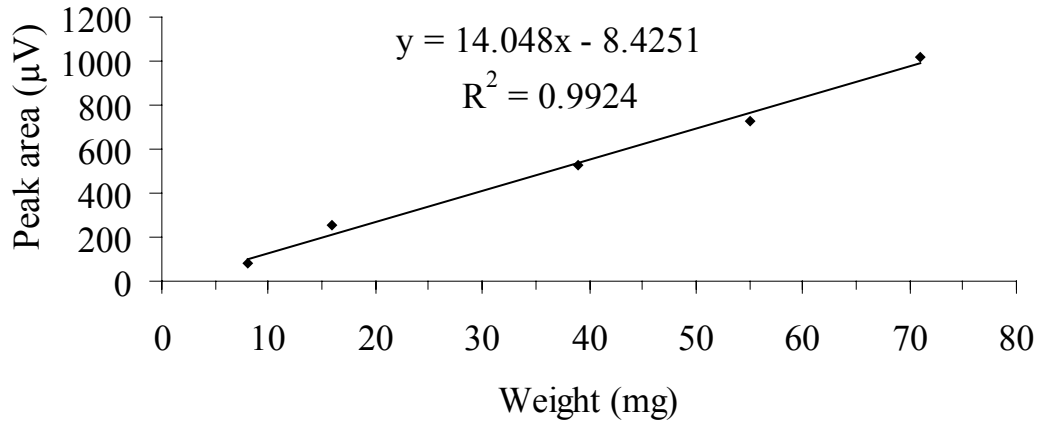


Figure 10 The standard curve of 2-propanol

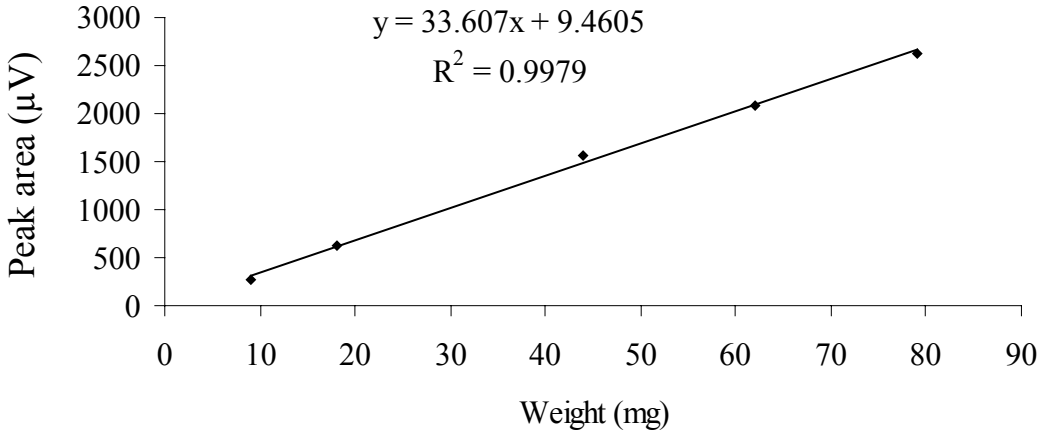


Figure 11 The standard curve of n-butyl acetate

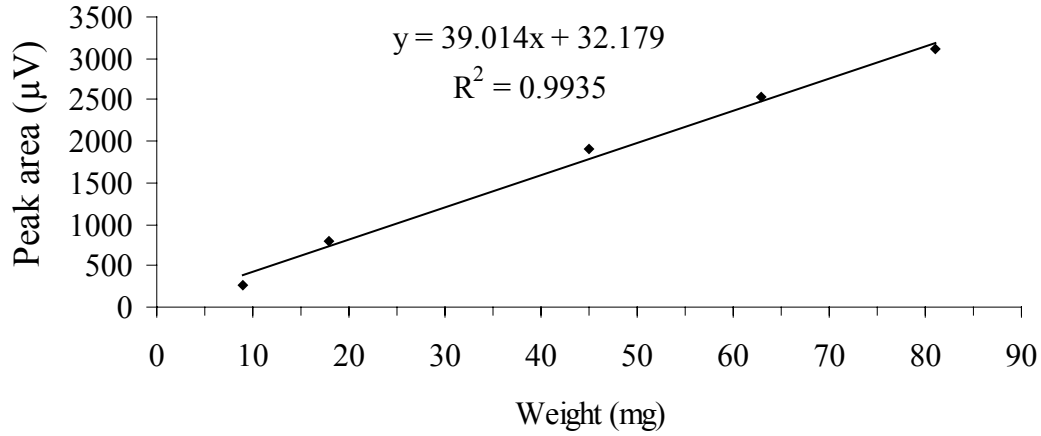


Figure 12 The standard curve of ethyl acetate

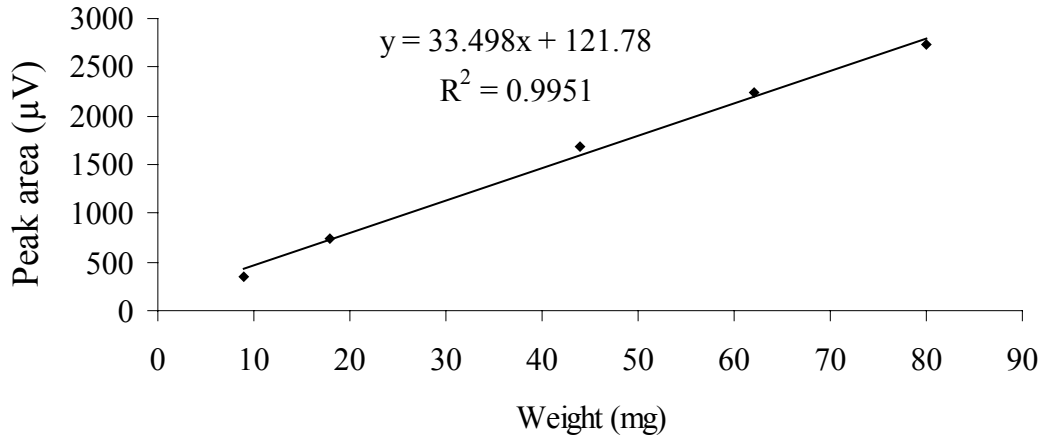


Figure 13 The standard curve of propyl acetate

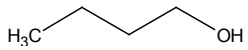
APPENDIX C

The structure and physical properties of solvents

All information was taken from Richard, J.L. 1993. Hewley's Condensed Chemistry Dictionary (12^{th} ed.), 275 pp. New York: Van Nostrand Reinhold.

1. 1-Butanol

Structural formula:



Other names: n-butyl alcohol, butyric alcohol, butan-1-ol

Properties: colorless liquid

Odor: strong odor

Boiling point: 117.7 ^{o}C

Melting point: -89 ^{o}C

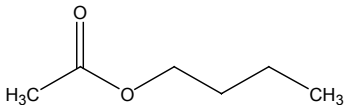
Density: 0.8109 g/cm^{3}

Solubility: soluble in water

Hazard: Toxic on prolonged inhalation, irritant to eyes, absorbed by skin. Flammable, moderate fire risk.

2. n-Butyl acetate

Structural formula:



Others name: butyl ethanoate, 1-butyl acetate, acetic acid n-butyl ester

Properties: colorless liquid

Odor: fruity odor

Boiling point: 126.3 ^{o}C

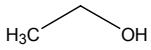
Melting point: -75 ^{o}C

Density: 0.8826 g/cm^{3}

Solubility: soluble in alcohol ether and hydrocarbons; slightly soluble in water Hazard: Skin irritant, toxic. Flammable, moderate fire risk.

3. Ethanol

Structural formula:



Others name: alcohol, grain alcohol, ethyl alcohol

Properties: Colorless, limpid, volatile liquid

Odor: ethereal vinous odor

Boiling point: 78 ^{o}C

Melting point: -117.3 ^{o}C

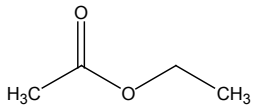
Density: 0.7893 g/cm^{3}

Solubility: miscible with water, methanol, ether, chloroform and acetone

Hazard: Is classified as a depressant drug. Though it is rapidly oxidized in the body and is therefore noncumulative, ingestion of even moderate amounts causes lowering of inhibitions, often succeeded by dizziness, headache, or nausea. Larger intake causes loss of motor nerve control, shallow respiration, and in extreme cases unconsciousness and even death. Degree of intoxication is determined by concentration of alcohol in the brain of primary importance is the fact that intake of even moderate amounts together with barbiturates or similar drugs is extremely dangerous and may even be fatal. Flammable, dangerous fire risk.

4. Ethyl acetate

Structural formula:



Other names: acetic ether, acetic ester, vinegar naphtha

Properties: colorless, fragrant liquid

Odor: -

Boiling point: 77 ^{o}C

Melting point: -83.6 ^{o}C

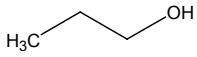
Density: 0.9003 g/cm^{3}

Solubility: solubility in chloroform, ether, alcohol; slightly soluble in water

Hazard: Toxic by inhalation and skin absorption; irritant to eyes and skin. Flammable, dangerous fire and explosion.

5. 1-Propanol

Structural formula:



Other names: propyl alcohol, *n*-propyl alcohol, propan-1-ol

Properties: colorless liquid

Odor: similar to ethanol

Boiling point: 97.2 ^{o}C

Melting point: -126.5 ^{o}C

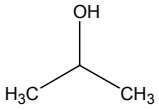
Density: 0.8035 g/cm^{3}

Solubility: soluble in water, alcohol and ether

Hazard: Flammable, dangerous fire risk.

6. 2-Propanol

Structural formula:



Other names: dimethylcarbinol, sec-propyl alcohol, isopropanol, isopropyl alcohol

Properties: colorless liquid

Odor: pleasant odor

Boiling point: 82 ^{o}C

Melting point: -89 ^{o}C

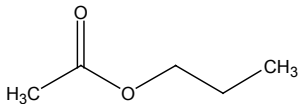
Density: 0.7855 g/cm^{3}

Solubility: solubility in water, alcohol and ether

Hazard: Flammable, dangerous fire risk.

7. Propyl acetate

Structural formula:



Other names: 1-acetoxypropane, n-propyl acetate, acetic acid propyl ester

Properties: colorless liquid

Odor: pleasant odor

Boiling point: 100-102 ^{o}C

Melting point: -95 ^{o}C

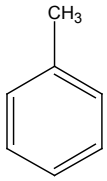
Density: 0.8878 g/cm^{3}

Solubility: slightly soluble in water

Hazard: Flammable, dangerous fire risk.

8. Toluene

Structural formula:



Other names: methylbenzene, phenylmethane, methylbenzol

Properties: colorless liquid

Odor: benzene-like odor

Boiling point: 111 ^{o}C

Melting point: -95 ^{o}C

Density: 0.8669 g/cm^{3}

Solubility: soluble in alcohol, benzene and ether

Hazard: Flammable, dangerous fire risk. Toxic by ingestion, inhalation and skin absorption.

9. Xylene

A commercial mixture of the three isomers, o-, m- and p-xylene (60% m-xylene, 9% o-xylene, 14% p-xylene, and 17% ethyl benzene)

Other names: dimethylbenzene, xylol

Properties: color liquid

Odor: -

Boiling point: ~137-143 ^{o}C

Melting point: > -34 ^{o}C

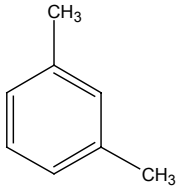
Density: 0.86 g/cm^{3}

Solubility: soluble in alcohol and ether

Hazard: Flammable, moderate fire risk. Toxic ingestion and in halation.

10. m-Xylene

Structural formula:



Other names: 1,3-dimethylbenzene, m-dimethylbenzene, 1,3-xylene

Properties: clear, colorless liquid

Odor: -

Boiling point: 139 ^{o}C

Melting point: -48 ^{o}C

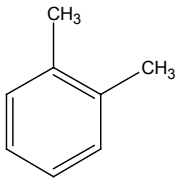
Density: 0.8642 g/cm^{3}

Solubility: soluble in alcohol and ether

Hazard: Flammable, moderate fire risk.

11. o-Xylene

Structural formula:



Other names: 1,2-dimethylbenzene, o-methyltoluene, 1,2-xylene

Properties: clear, colorless liquid

Odor: -

Boiling point: 144 ^{o}C

Melting point: -25 ^{o}C

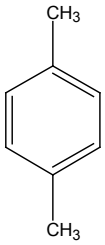
Density: 0.8802 g/cm^{3}

Solubility: soluble in alcohol and ether

Hazard: Moderate fire risk.

12. p-Xylene

Structural formula:



Other names: 1,4-dimethylbenzene, p-methyltoluene, 1,4-xylene

Properties: colorless liquid

Odor: -

Boiling point: 138 ^{o}C

Melting point: 13 ^{o}C

Density: 0.8611 g/cm^{3}

Solubility: soluble in alcohol and ether

Hazard: Flammable, dangerous fire risk.

APPENDIX D

Toxicity

All information were adapted from U.S. National Library of Medicine, 2004; National Center for Manufacturing Sciences, 2006; and Chemical data bank, 2001.

1 Lethal Dose fifty (LD_{50})

The LD_{50} value is the amount of a solid or liquid material that it takes to kill 50% of test animals in one dose. The LD_{50} is one way to measure the short-term poisoning potential (acute toxicity) of a material. Toxicologists can use many kinds of animals but most often testing is done with rats and mice. It is usually expressed as the amount of chemical administered (e.g., milligrams) per 100 grams (for smaller animals) or per kilogram (for bigger test subjects) of the body weight of the test animal.

Table 1 The toxicity classes of LD_{50}.

LD_{50} values		Toxicity rating
Oral (single dose to rats) mg/kg	Dermal (single application to skin of rabbits) mg/kg	
$LD_{50} < 1$	$LD_{50} \leq 5$	Extremely Toxic
$1 < LD_{50} \leq 50$	$5 < LD_{50} \leq 43$	Highly Toxic
$50 < LD_{50} \leq 500$	$44 < LD_{50} \leq 340$	Moderate Toxic
$500 < LD_{50} \leq 5{,}000$	$350 < LD_{50} \leq 2{,}810$	Slightly Toxic
$5{,}000 < LD_{50} \leq 15{,}000$	$2{,}810 < LD_{50} \leq 22{,}590$	Practical non-Toxic

Table 2 The LD_{50} value of each solvent when swallowed in the rat.

Solvents	LD_{50} value (mg/kg)
1-Butanol	790
n-Butyl acetate	13,100
Ethanol	7,060
Ethyl acetate	5,620
1-Propanol	1,870
2-propanol	5045
Propyl acetate	9,370
Toluene	636
o-Xylene	5,000
p-Xylene	5,000
m-Xylene	5,000
Xylene	4,300

2 Lethal Concentration fifty (LC_{50})

The LC_{50} value is the concentration of a material in air that will kill 50% of the test subjects (animals, typically mice or rate) when administered as a single exposure (typically 1 or 4 hours). Also called the “median lethal concentration” and “lethal concentration 50”, this value gives you an idea of the relative acute toxicity of an inhalable material. This is closely related to the LC_{50} value which is the lowest concentration reported to have killed animals or humans. This value applies to vapors, dusts, mists and gases. Solids and liquids use the closely related LD_{50} value.

Table 3 The toxicity classes of LC_{50}.

Inhalation of LC_{50} (exposure of rats for 4 hours) ppm	Toxicity rating
$LC_{50} \leq 10$	Extremely Toxic
$10 < LC_{50} \leq 100$	Highly Toxic
$100 < LC_{50} \leq 1{,}000$	Moderate Toxic
$1{,}000 < LC_{50} \leq 10{,}000$	Slightly Toxic
$10{,}000 < LC_{50} \leq 100{,}000$	Practical non-Toxic

Table 4 The LC_{50} value of each solvent when breathed in the rat.

Solvents	LC_{50} value (ppm)
1-Butanol	8,000/4 hrs.
n-Butyl acetate	2,000/4 hrs.
Ethanol	20,000/10 hrs.
Ethyl acetate	16,000/6 hrs.
1-Propanol	1,762.56/4 hrs.
2-propanol	16,000/8 hrs
Propyl acetate	>8,000/4 hrs.
Toluene	>26,700/ 1 hr.
o-Xylene	459/6 hrs.
p-Xylene	4,550/4 hrs.
m-Xylene	5,267/6 hrs.
Xylene	5,000/4 hrs.

APPENDIX E

Presentations of this thesis

This thesis was presented as a poster at Technopolis, Suranaree University of Technology, Nakhon Ratchasima, Thailand. 31st Congress on Science and Technology of Thailand during 18-20 October 2005 which was poster presented by Mr. Natthee Phettae. In the topic of The development of Appropriate Thinners for Plastic Printing.

And this thesis was presented as a poster at Prince of Songkla University, Songkla, Thailand. 4th PSU Symposium on Graduate Research on 31 March 2006 which was poster presented by Mr. Natthee Phettae. In the topic of the Development of Appropriate Thinners for Plastic Printing.