Experiment title and number: Alcoholic Beverage Analysis | Date: 03/08/08 | 30

Name | Course: Chem. | Section: 120 | Lab partner

Alcoholic Beverage Analysis

Purpose: The purpose is to determine the percent by volume of alcohol in an alcoholic beverage by distillation of a beer, ale, or wine, removing the water & ethanol.

Procedure:

1. Obtain beverage, twice amt. of what is to be used.
2. Beer=50mL, ale=30mL, table wine=20mL, & dessert wine=10mL.
3. Shake until frothing stops if carbonated.
4. Pipet approx. amt. of beverage into 500mL dist. flask.
5. Dilute 100mL with d.i. water
6. Add boiling chips, spray w/ anti-foam spray
7. Assemble distallation apparatus.
8. Heat gently, until frothing stops.
9. Distill sample until 75mL of distillate has been obtained in a 100mL graduated cylinder.
10. Transfer distallate to a 250mL volumetric flask & dilute to volume with d.i. water.
11. Mix well.
12. Pipet 10mL of contents of volumetric flask into 500mL dist.fl.
13. Pipet 10mL of standard 0.2M $K_2Cr_2O_7$ into same flask.
14. Record exact concentration of $K_2Cr_2O_7$ solution.
15. Add 50mL of 3M sulfuric acid to same flask.
16. Add boiling chips & assemble reflux system.
17. As it gets to a boil, adjust heat to a gentle boil, & continue refluxing for 90 minutes.
18. While refluxing, do practice titrations.
19. After 90min turn off heat & cool.
20. Transfer to 100mL volumetric flask.
21. Dilute & mix.
22. Pipet 10mL into 2 250mL flasks, adding 5 drops of ind., & titrate w/ 0.025M iron(II) ammonium sulfate.
23. Disolve iron(II) ammonium sulfate with di H_2O in 250mL fl.
24. calculations

Caution: Place fold-in flap under yellow sheet before writing, to protect the pages that follow.

Experiment title and number	Date	35

Name	Course	Section	Lab partner

Chemical Reactions:

① $3C_2H_5OH + 2Cr_2O_7^{2-} + 16H^+ \longrightarrow 3CH_3COOH + 4Cr^{3+} + 11H_2O$

② $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

Data:

Alcohol: Corona Extra Beer	
Alcohol Obtained:	50mL
Mass $Fe(NH_4)_2(SO_4)_2$	2.4416g
Titration #1 Reading	20.32mL
Solution in Buret #1	50.00mL
Actual Titrated Amount #1	29.68mL
Titration #2 Reading	20.58mL
Solution in Buret #2	50.00mL
Actual Titrated Amount #2	29.42mL
Titration #3 Reading	20.31mL
Solution in Buret #3	50.00mL
Titration #3 ~~Reading~~ Amount #3	29.69mL
Average Titration	29.68mL

Calculations:

$$M_{Fe^{+2}} = \frac{2.4416g\ Fe^{2+}}{392.17g\ Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O} \Big/ 0.250L$$

$$= 0.0249\ mols/L\ Fe^{+2}$$

$$M_{Cr_2O_7^{-2}} = \frac{0.0249\ mols/L \times 0.02968L\ Fe^{2+} \times \frac{1\ mol\ Fe^{2+}}{6\ mol\ Cr_2O_7^{-2}}}{0.01L\ Cr_2O_7^{-2}}$$

$$= 0.0123\ mols/L\ Cr_2O_7^{2-}$$

$$\text{moles } Cr_2O_7^{-2}\ (\text{excess}) = \frac{0.0123\ mols\ Cr_2O_7^{-2}}{1L} \times 0.01L\ Cr_2O_7^{-2} \times$$

$$= 0.00123\ \text{moles } Cr_2O_7^{-2}\ (\text{excess})$$

$$\text{or } 1.23 \times 10^{-3}\ \text{moles } Cr_2O_7^{-2}\ (\text{excess})$$

$$\text{moles } Cr_2O_7^{-2}\ (\text{total}) = 0.2M\ Cr_2O_7^{-2} \times 0.01L\ Cr_2O_7^{-2}$$

$$= 0.002\ \text{moles } Cr_2O_7^{-2}$$

$$\text{moles } Cr_2O_7^{-2}\ (\text{reacted w/ ETOH}) = 0.002\ \text{moles } Cr_2O_7^{-2} - 0.00123\ \text{mol } Cr_2O_7^{-2}$$

$$= 7.7 \times 10^{-4}\ \text{moles } Cr_2O_7^{-2}\ (\text{reacted})$$

$$\text{moles ETOH (reacted)} = 7.7 \times 10^{-4}\ \text{mol } Cr_2O_7^{-2} \times \frac{3\ \text{mol ETOH}}{2\ \text{mol } Cr_2O_7^{-2}}$$

$$= 0.001155\ \text{moles ETOH} \times 25$$

$$= 0.0289\ \text{moles ETOH}$$

$$\text{grams ETOH} = 0.0289\ \text{mol ETOH} \times \frac{46.07g\ \text{ETOH}}{1\ \text{mol ETOH}}$$

$$= 1.33g\ \text{ETOH}$$

$$\text{WT:VOL} = \frac{1.33g\ \text{ETOH}}{50mL} \times 100 = 2.66\%$$

Caution: Place fold-in flap under yellow sheet before writing, to protect the pages that follow.

Experiment title and number	Date	36

Name	Course	Section	Lab partner

Calculations:

VOL:VOL% = $\frac{1.33g\ ETOH}{(50mL \times 0.789)} \times 100\% = 3.37\%$

proof = 3.37% × 2
= 6.74 proof

Conclusion:

I conducted 3 separate titrations, but I took the two that were within one percent of eachother and took the average of those. It took 29.68mL for the solution to react. After conducting my calculations I was able to obtain an alcohol % of 3.37% and a proof of 6.74. The alcohol I used was regular Corona Extra Beer, which I originally obtained 50mL of. After researching the alcohol % of Corona Extra Beer, I discovered it has a 4.6% alcohol percent. The reason I believe why my calculated percent was lower was due to error. This experiment took 2 weeks to conduct & included lots of steps. The possibilities of error could be endless. Some prime examples would be improper titration, not refluxing long enough, & an incorrect reading of the buret. Although my final percent was not correct, I believe the tieing together of ALL equations we have learned was the most vital part of this experiment.

Average of titrations:

#1 50.00mL − 20.32mL = 29.68mL used
#3 50.00mL − 20.33mL = 29.67mL used

$29.68mL + 29.67mL = \frac{59.35mL}{2} = 29.675mL$

average titration = 29.68mL

Grams of $Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$:

$392.17g\ Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O \times .250L \times 0.025\frac{mol}{L}$
= 2.4511g iron(II) ammonium sulfate

Caution: Place fold-in flap under yellow sheet before writing, to protect the pages that follow.