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Nutrition Lab Schedule

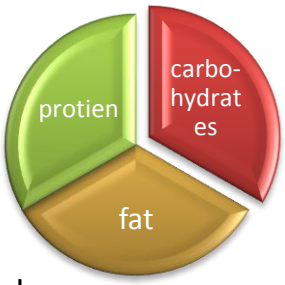
Week #	topic
1	Introduction + lab safety
2	**Module 1: Food Analysis** • **Determination of carbohydrates:** *Colorimetric determination of sugars in dates by using phenol-sulfuric acid method *Differentiation between starch in white and whole-wheat bread
3	• **Determination of lipids:** Determination of total lipids in food by Bligh and Dyer Method
4	• **Determination of protein:** Determination of protein in food by kjeldahl method
5	• **Determination of vitamins:** *Determination of vitamin c in foods by iodometric aseay *Determination of nicotinic acid in food
6	• **Determination of minerals:** Determination of chloride content in cheese
7	• **Determination of water:** Determination of water content in cow's milk • **Determination of food preservatives:** Determination of citric acid content in fruit juices
8	• **Extra lab:** *Determination of sugar content in soft drinks *spectrophotometric determination of phosphate in soft drinks
9	**Module 2: Nutrition** • Energy balance and healthy body weights
10	• Food composition tables and computerized dietary analysis program's

11	• Planning a healthy diet: Principles of meal planning Food labels
12	Dietary guidelines and my pyramid

Each student will choose a case and apply all what she/he had learned in nutrition module

Colorimetric Determination of Sugars in Dates by using phenol-sulfuric acid method

Background



- Carbohydrates are one of the three macronutrients that provide energy to our bodies.
- It can be classified as **simple** or **complex.** Simple carbohydrates are commonly referred to as sugars where as complex carbohydrates are referred to as polysaccharides. starch, glycogen and cellulose are examples of polysaccharides.

- Sugars such as glucose and fructose is naturally occur in honey, fruits and fruit juices.
- Dates are good example of sugar-rich fruit since 100gm of dates contain 63 gm sugar as shown in the table below

Dried dates (edible parts) Nutritional value per 100 g (3.5 oz)	
Energy 280 kcal 1180 kJ	
Carbohydrates	75 g
- Sugars	63 g
- Dietary fibre	8 g
Fat	0.4 g
Protein	2.5 g
Water	21 g
Vitamin C	0.4mg
Manganese	0.262 mg

principle

Carbohydrates are destroyed by strong acids (such as sulfuric acid) and/or high temperature. Under these conditions a series of complex reactions takes place:

these products then condence with phenolic compounds such as phenol to produce a stable orange-yellow compounds that are useful for carbohydrates analysis

Therefore, a standard curve must be used. Ideally, the standard curve will be prepared using mixtures of the sugars present in the same ratio as they are found in the unknown.

If this is not possible, D-Glucose is used to prepare the standard curve.

Materials

1- Spectrophotometer and colorimetric tubes.
2- Syringe dispenser for sulfuric acid or 5ml cylinder.
3- Pipette 1ml.
4- Blender or mortar.
5- Dates.
6- Phenol 5%: dissolve 50gm of redistilled phenol in water and dilute to 1-L.
7- Sulfuric acid, 96% Reagent grade.
8- different Sugar solution (fructose 0.01,0.03, 0.05, 0.07 mg/ml).

Method

1 Preparation of date's homogenate

1- Weigh accurately 1 date, then weigh 1 gram of it (from the pulp).
2- Homogenize in 50ml of distilled water in a warring blender.
3- Boil for 10 min.
4- Cool, and filter in a 100 ml volumetric flask, and complete to volume with water. Shake well to mix. Decolorize with charcoal if necessary.
5- Dilute 1ml of the above solution to 100ml and use it as unknown

2 Measuring the sugar content

	Tube 1	Tube 2	Tube3	Tube4	Unknown tube
Standard fructose	1 ml of 0.01 mg/ml	1ml of 0.03 mg/ml	1ml of 0.05 mg/ml	1ml of 0.07 mg/ml	
Unknown solution					1ml
5% phenol And mix well	1ml	1ml	1ml	1ml	1ml
Sulfuric acid And mix well	5 ml	5ml	5ml	5ml	5ml
Boil all the tubes for 5 min.					
Stand all the tubes in air for 10 min.					
Cool to room temperature					
Read the absorbance of the yellow-orange color at 490 nm for hexoses.					

calculations

- Fill the table with your results:

Conc. (mg/ml)	absorbance
0.01	
0.03	
0.05	
0.07	

- Draw a standard curve of conc. Vs. abs.??
- Determine the concentration of the sugar from the standard curve ?

  (suppose it is 0.05 mg/ml).

  0.05 mg/ml = 0.00005 g/ml

  0.00005g/ml × 100 ×100 (for the dilution)= 0.5 gm/ 1 gm of date

- Calculate the kcal provided by the whole date(suppose that the weight of the whole date was 10 gm)?

  *The whole date contains 5 gm of sugar

  1 gm of sugar ⟶ 4 kcal

  5 gm ⟶ ?

The Kcal provided by the whole date from sugar= 5×4=20 Kcal

Advanteges of the method

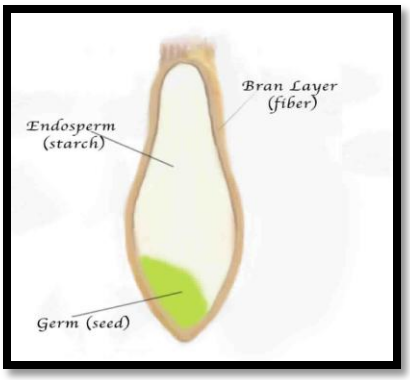
- ✓ This method is simple, rapid, sensitive, specific for all carbohydrates and widely applied.
- ✓ Under proper conditions, the phenol-sulfuric method is accurate to +/- 2%
- ✓ All classes of sugars, including sugar derivatives and oligo- and polysaccharides can be determined by this method.

Refrences

- Nielsen, S. (2003): Food Analysis. Third Edition. Kluwer Academic/Plenum Publishers .
- حسن، إبراهيم محمد، أبوعرب، عاطف أنور (٢٠٠٢): تحليل الأغذية. الطبعة الأولى. دار الفجر للنشر والتوزيع.
- http://en.wikipedia.org/wiki/Phoenix_dactylifera

Differences between starch in white and whole-wheat bread

Background



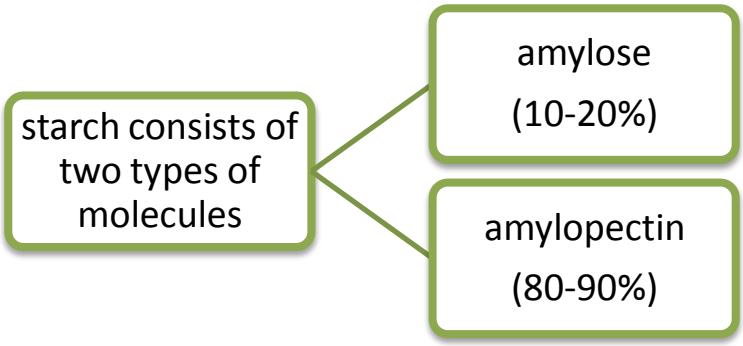
- both white and whole wheat bread are made from wheat flour.
- Wheat berries used to make flour have 3 parts:

the bran	the endosperm	the germ
• rich in nutrients and fiber	• contains starch and protiens	• rich in vitamins and minerals

- White flour uses only the endosperm, while whole-wheat flour uses all the three parts.

  ⇒ We can conclude that white breads contains **<u>more starch</u>** than whole-wheat bread

Principle



Amylose in starch is responsible for the formation of a deep blue color in the presence of iodine. The iodine molecule slips inside of the amylose coil.

Materials

1-Iodine.
2- Part from whiten bread.
3- Part from brown bread..
4- Dishes.

Procedure

1- Cut pieces of white and brown bread in 2 dishes.
2- Add drop of iodine solution on the bread by droper.
3- Record your observation.
4- How the color of iodine change and why?

References

Rolfes, S., Pinna, K., and Whitney, R.P. (2006): Understanding normal and clinical nutrition. Seventh edition. Thomson wadsworth.

http://www.elmhurst.edu/~chm/vchembook/548starchiodine.html

Determination of total lipids in food by Bligh and Dyer Method

Background

- Lipids, proteins, and carbohydrates constitute the principal structural components of foods.
- The general classification of lipids that follows is useful to differentiate lipids in foods:

General Classification

Simple lipids
ester of fatty acids with alcohol

- **fats** (esters of fatty acids with glycerol)
- **waxes** (esters of fatty acids with long-chain alcohols such as vitamin A esters)

Compound lipids
compounds containing groups in addition to an ester of a fatty acid with an alcohol

- **phospholipids** (glycerol esters of fatty acids,phosphoric acids, and other groups containing nitrogen such as phosphatidyl choline)
- **cerebrosides** (compounds containing fatty acids, a carbohydrate , and a nitrogen moiety)
- **sphingolipids** (compunds containing fatty acids, a nitrogen moiety and phosporyl group

Derived lipids
(substances derived from neutral lipids or compound lipids

they have the general properties of lipids(such as fatty acids,sterols and hydrocarbons)

- Foods may contain any or all types of the lipid compounds previously mentioned

Principle

- Lipids are soluble in organic solvents and insoluble in water.
- Therefore, water insolubility is the essential analytical property used as the basis for the separation of lipids from proteins, water, and carbohydrates in foods.
- **Solvent selection:**

  Ideal solvents for fat extraction should have:

  1. A high solvent power for lipids and low or no solvent power for proteins, amino acids, and carbohydrates.
  2. Evaporate readily and leave no residue
  3. Have a relatively low boiling point
  4. Nonflammable
  5. Nontoxic in both liquid and vapor state
  6. Should penetrate sample particles readily
  7. Inexpensive.

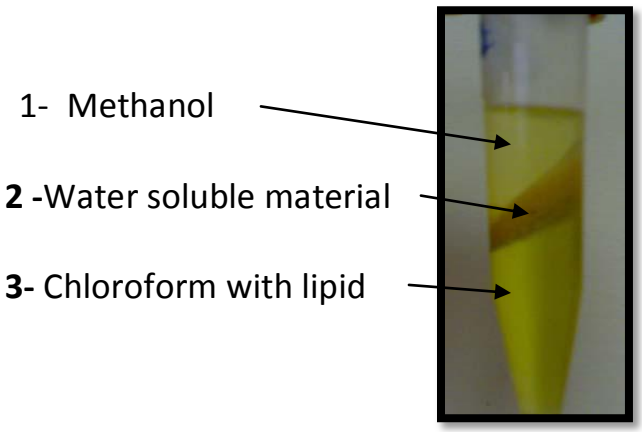
- For general extraction of almost all lipids from biological samples, either a mixture of ethanol and ethyl ether or a mixture of chloroform and methanol is used.
- The lipids are generally bound to proteins in the biological samples and in that situation (as lipoprotein) cannot be efficiently extracted by non-polar organic solvents alone. The inclusion of methanol or ethanol helps in breaking the bonds between the lipids and proteins.

Materials

1. Samples such as chocholate,chips,….etc.
2. Distilled water
3. Conical flasks, beakers, fin capillary
4. Chloroform and ethanol mix. (2:1 v/v)
5. centrifuge

Procedure

1- Weigh 2g of sample.
2- Grind it with 10 ml of distilled water
3- Transfer in conical flask with 30 ml of chloroform and ethanol mixture (2 : 1 v/v) and mixed well.
4- For complete extraction, it is advisable to keep this for 30 minutes at room temperature in dark place.
5- At the end of this period centrifuge for 10-15 minutes at 2000-3000 rpm.
6- Generally 3 layers are seen, a clear lower layer of chloroform containing the entire lipid.



7- The methanol layer is discarded and the lower layer is carefully collected free of inter phase either by sucking out with a fin capillary or by filtration through glass wool.

8- The organic layer "lower layer" is taken in a pre-weighed beaker (W1) and carefully evaporated by keep the sample in warm water bath. It is also advisable to keep the sample covered with a dark paper to protect from light, because some lipids get polymerized or decomposed on exposure to light and heat.

9- When the solution is free of organic solvents, the weight is determined again (W2).

Calculations

- the weight of lipids =W1 – W2= z gm lipids/2 gram sample.
- Calculate the kcal provided by the sample?

  1 gm of lipid → 9 kcal

  z gm → ?

The Kcal provided by the sample= Z × 9= Y Kcal

Refrences

- Nielsen, S. (2003): Food Analysis. Third Edition. Kluwer Academic/Plenum Publishers .

Determination of proteins in food by kjeldahl method

Background

The kjeldahl method was developed in 1883 by a Danish chemist called john kjeldahl. This method is used to determine the amount of nitrogen in foods. Then, a conversion factor is needed to convert the measured nitrogen concentration to a protein concentration.

The kjeldahl method can be divided into 3 steps:

digestion → distillation → titration

principle

1 digestion

The food is digested by heating it in the presence of sulfuric acid (an oxidizing agent which digests the food).

Such reactions can be speeded up by adding a catalyst such as potassium sulfate, which raises the boiling point of the digesting acid and thus the temperature of the reaction.

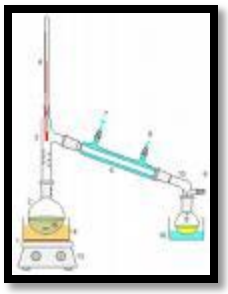
Digestion converts any nitrogen in the food into ammonia, and other organic matter to water and carbon dioxide.

PROTEIN+ $H_2SO_4 \longrightarrow SO_4^{-2} + NH_4^{+} + H_2O + CO_2$

Ammonia is not liberated in an acid solution because the ammonia is in the form of ammonium ion (NH_4^{+}) which binds to the sulfate ion SO_4^{-2} and thus remains in the solution:

$NH_4^{+} + SO_4^{-2} \longrightarrow (NH_4)_2SO_4$ ammonium sulfate

2 distillation



To separate the ammonia from the digestion mixture, the solution must be made alkaline by adding sodium hydroxide, which converts ammonium sulfate into ammonia gas:

$(NH_4)_2SO_4 + 2\ NaOH \rightarrow 2NH_3 + 2H_2O + Na_2SO_4$

The ammonia gas that is formed is distilled into a receiving flask which contains boric acid and Tashiro indicator(methylene blue and methyl red).

The low PH of the solution in the receiving flask converts ammonia gas into the ammonium ion, and simultaneously converts the boric acid to the borate ion:

$NH_3 + H_3BO_3$ (boric acid) $\rightarrow NH_4^+ + H_2BO_3^-$ (borate ion)

3 titration

Borate anion (proportional to the amount of nitrogen) is titrated with 0.02 N hydrochloric acid:

$H_2BO_3^- + H^+ \rightarrow H_3BO_3$

Materials

1. Protein sample such as milk, cheese, meat,…etc.
2. Potassium sulfate
3. Conc. Sulfuric acid
4. Round-bottom flask
5. 250 ml volumetric flask
6. 45% sodium hydroxide (freshly prepared)
7. 2% boric acid
8. Tashero indicator= methylin blue: methyl red (2:1)
9. 0.02 N hydrochloric acid

Procedure

1 digestion

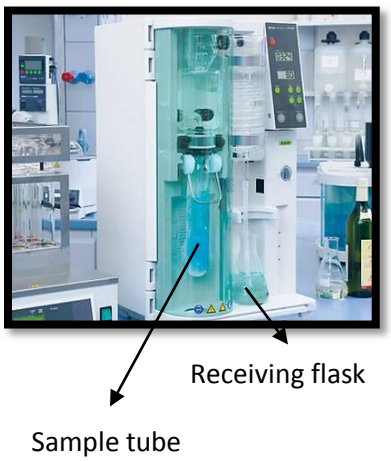
1- Weigh out 1 gram of the sample and grind it. Then, put it a round-bottom flask.

2- Add 1 gram of the catalyst.
3- Add 20ml concentrated sulfuric acid and start heating until the color of the sample becomes black.
4- Continue the heating at low temperature until boiling ends.
5- Rise the temperature until the sample become colorless.
6- Cool the flask.
7- Transfer the solution into 250 ml volumetric flask and complete the volume with distilled water.
8- Repeat the previous steps but without the food sample → (blank)

A reagent blank should be run to subtract reagent nitrogen from the sample nitrogen

2 distillation

1- Pipette 10 ml from the solution into sample tube in the kjeldahl instrument (distillation unit k-314) .
2- Add 10 ml sodium hydroxide and start heating.
3- The ammonia is received in the receiving flask which contains 10 ml boric acid and 4 drops from Tashiro indicator.
4- Distillation will take about 15 minutes, where the
5- color of the solution changed from pink to green.



3 titration

1- Fill the buret with 0.02 N HCl.
2- Titer the solution in the receiving flask until purple color appears.
3- Repeat the same steps on the blank.

Calculations

1L 1N of HCl = atomic weight of N

1 ml (0.02 N) of HCl = $\frac{14}{1000\ x\ 50}$ g of N

(ml of acid needed for sample – ml of acid needed for blank) = ??

No. of grams of N = $\frac{(corrected\ acid\ value) x\ 0.00028\ g}{1\ ml}$ × 250 (for dilution)= Y gm

% N = $\frac{Y}{sample\ weight\ x\ volume\ used}$ x 100 = $\frac{Y}{0.1\ x\ 10}$ = Z%

Then, a factor is used to convert %N to % crude protein. Since most proteins contain 16% N, so the conversion factor is 6.25 (100/16 = 6.25)

% N x 6.25 = % protein

Conversion factors for various foods are given in the table below

Food	Factor
Animal origin	
Eggs	6.25
Meat	6.25
Milk	6.38
Vegetable origin	
Barley	5.83
Corn (maize)	6.25
Millets	5.83
Oats	5.83
Rice	5.95
Rye	5.83
Sorghums	6.25
Wheat: Whole kernel	5.83
Bran	6.31
Endosperm	5.70
Beans: Castor	5.30
Jack, lima, navy, mung	6.25
Soybean	5.71
Velvet beans	6.25
Peanuts	

Advantages

1- Applicable to all types of foods
2- Inexpensive

Disadvantages

1- Measures total organic nitrogen not just protein nitrogen
2- Time consuming
3- Corrosive reagent

References

1- Nielsen, S. (2003): Food Analysis. 3rd edition. Kluwer academic/ Plenum Publishers
2- http://www.fao.org/docrep/006/y5022e/y5022e03.htm
3- http://www-unix.oit.umass.edu/~mcclemen/581Proteins.html
4- http://www.brooklyn.cuny.edu/bc/ahp/SDKC/Chem/SD_KjeldahlMethod.html

Determination of vitamin C in food by Iodometric Aseay

Background

- Vitamin C is a water-soluble vitamin that is necessary for normal growth and development.
- It called also Ascorbic acid.
- It is found in green peppers, citrus fruits, strawberries, tomatoes, broccoli, turnip greens and other green sweet and white potatoes, and cantaloupe.
- fish and milk contain small amounts.

principle

Vitamin C can be assayed by **direct** titration with iodine. Iodine oxidizes the dihydroxy-functional group to an alpha diketone group in the dehydro-ascorbic acid product.

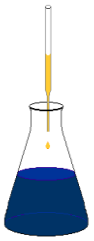
Materials

1- Iodine 0.1 N, freshly prepared.
2- Standard ascorbic acid 0.1 gm/100 ml.

3- Starch indicator 1%.
4- Source of vitamin C such as Tang, tablets, fruit juice,…..ect.

procedure

1- Weigh accurately about 20 g of the sample of dehydrated juice solid provided (Tang) or 10 ml if you are using juice.
2- Add about 100 ml of water to the flask just before it is to be titrated, followed by 5 ml of starch solution.
3- Cover the opening of the flask with plastic or aluminum foil, and shake well to dissolve the sample completely. Then, punch the foil to admit the tip of your burette.
4- cover the burette with aluminum foil .
then, Insert burette tip through the foil covering the mouth of the flask and titrate to the first appearance of the blue starch-triiodine color,with 0.1 N iodine solution
5- Repeat the titration.



Calculations

1L 1N of I_2 = M.wt of ascorbic acid.

1ml (0.1N) of I^- = $\frac{176.14}{1000\times10\times2}$ gm ascorbic acid

1 ml (0.1 N) of I^- = 0.008806 gm of ascorbic acid.

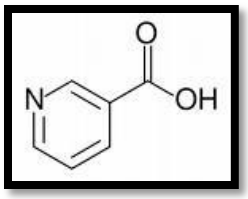
(titr no.) of I^- = ??

No. of grams of ascorbic acid in the sample= $\frac{(titr\ no.)\times 0.008806\ gm}{1\ ml}$ = Y gm

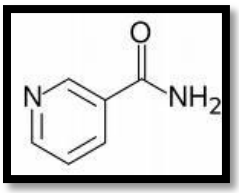
Gm% ascorbic acid= $\frac{Y}{sample\ weight}$ × 100= z%

Determination of nicotinic acid in food

Background



Niacin, also known as nicotinic acid or vitamin B3, is a water soluble Vitamin



nicotinamide is the amide of nicotinic acid. In cells, niacin is incorporated into nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP) which plays essential roles in energy metabolism in the living cell and DNA repair.

- Niacin is found in whole grain foods such as brown rice and whole wheat bread. Other good sources of niacin are yeast, tuna and salmon, beef, peanuts, and mushrooms.

Principle

Nicotinic acid is pyridine-3-carboxylic acid, and can be determined by **direct** titration with carbonate-free 0.1 N sodium hydroxide using phenol red or phenolphthalein as indicator.

Materials

1. yeast

Phenolphthalein is a complex organic dye that is colorless in acidic solutions and pink in solutions that are slightly alkaline, or basic.

2. mortar
3. distilled water
4. centrifuge
5. conical flasks
6. sodium hydroxide (0.1 N)

Procedure

1- Weigh accurately about 2g of sample.
2- Grind thoroughly in a mortar with about 10 ml of distilled water
3- centrifuge at 3000 rpm for 10 min.
4-transfer supernatant into conical flask for titration
3- Add about drops of either phenol red or phenolphthalein.
4- Titrate with 0.1 N NaOH until the end point is reached.

Calculations

1L 1N of sodium hydroxide = M.wt of nicotinic acid

1 ml (0.1 N) NaOH = $\frac{123.11}{100\times10}$ gm of nicotinic acid

1ml (0.1 N) NaOH = 0.0123 gm of nicotinic acid

(titr no.) = ??

No. of grams of nicotinic acid in the sample= $\frac{(titr\ no.)\times 0.0123}{1\ ml}$ = Y gm

Gm % nicotinic acid= $\frac{Y}{sample\ weight}$ × 100= Z

References

http://hgic.clemson.edu/factsheets/hgic4076.htm

webhost.bridgew.edu/ihutchins/11%2520

Determination of chloride content in cheese.

Background

Sodium chloride is added to cheese to enhance its taste, and also as a preservative so that some types of cheese will keep well at room temperature. In the industrial preparation of certain cheeses, such as mozzarella, it is important to check that the quantity of salt added is of an optimum concentration.

Principle

Sodium chloride is precipitated in acidic solution with silver nitrate; the excess unreacted silver nitrate is determined by back titration with athiocyanate solution.

1 step

An excess volume of a silver nitrate solution is added to the Solution containing chloride ions, forming a precipitate of silver chloride. The term 'excess' is used as the moles of silver nitrate added are known to exceed the moles of sodium chloride present in the sample so that all the chloride ions present will react.

$$Ag^{+}_{(aq)} + Cl^{-}_{(aq)} \longrightarrow AgCl_{(s)}$$

2 step

The solution is titrated with potassium thiocyanate . The titrate remains pale yellow as the excess (unreacted) silver ions react with the thiocyanate ions to form a silver thiocyanate precipitate.

$$Ag^{+}_{(aq)} + SCN^{-}_{(aq)} \longrightarrow AgSCN_{(s)}$$

3 step

Ferric alum is used as an indicator. Once all the silver ions have reacted, the slightest excess of thiocyanate reacts with Fe^{+3} to form a dark red complex.

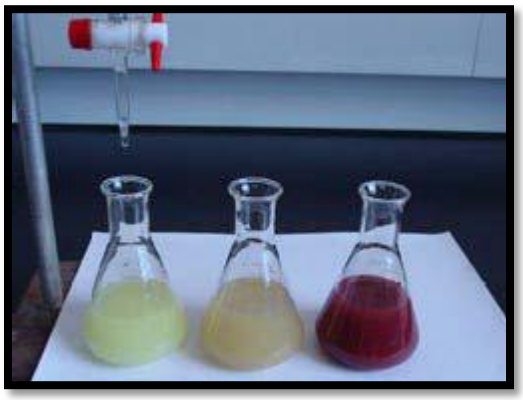
$$Fe^{+3}_{(aq)} + SCN^{-}_{(aq)} \longrightarrow [FeSCN]^{+2}(aq)$$

Materials

1. O.O5 M silver nitrate
2. Conc. Nitric acid
3. Potassium thiocyanate
4. Ferric alum indicator
5. Starch, freshly prepared.

Procedure

1- Weigh accurately a sample of cheese (about 1.5 g) into a conical flask.
2- Add 10 ml water and heat the flask to about 75 ^{0}C in water bath for 10 minutes.
3- Add 25 ml of standard 0.05 M silver nitrate, using a pipette.
4- Add 5 ml conc. nitric acid.
5- Digest the cheese curd by boiling gently for 10minutes.
6- Cool, and add about 50 ml water.
7- Filter quantitatively.
8- Titrate with standard potassium thoicyanate using iron (III) alum (Ferric alum) indicator (2ml).



Left flask: before the titration endpoint, addition of SCN-ions leads to formation of silver thiocyanate precipitate, making the Solution cloudy. Here the solution also takes a faint yellow color due to the color of the Cheese extract. **Centre flask:** at the endpoint all the free silver ions have been precipitated by SCN-. The slightest excess of SCN- forms a dark red colored complex with theFe3+ ions from the ferric ammonium sulfate indicator, giving the solution a slight orange/ red coloration. **Right flask:** If addition of SCN- is continued past the endpoint, further ferric thiocyanate complex is formed and a stronger dark red color results.

the titration should be stopped when the first trace of dark red color is observed

Calculations

1L 1N of silver nitrate= M.wt. of sodium chloride

1 ml (0.05N) of silver nitrate= $\frac{58.443\ g}{1000 \times 20}$ of NaCl

1 ml (0.05N) of silver nitrate = 0.0029 g of NaCl

(25 ml - TITER NO.) = ??

Number of grams of sodium chloride= $\frac{(25\ \text{ml} - \text{TITER NO.}) \times 0.0029}{1\ ml}$ = Y gm

% NaCl = $\frac{Y}{sample\ weight}$ × 100= Z g%

safety

Concentrated nitric acid is very corrosive. Wear safety glasses and take great care handling the concentrated acid. Safety glasses should be worn throughout the method, especially during the sample preparation.

Determination of water content in cow's milk

Background

The quantities of the main milk constituents can vary considerably depending on the individual animal, its breed, stage of lactation, age and health status. The average composition of cow's milk is shown in table (1).

Table (1): composition of cow's milk

Main constituent	Range (%)	Mean (%)
Water	85.5 – 89.5	87.0
Total solids	10.5 – 14.5	13.0
Fat	2.5 – 6.0	4.0
Proteins	2.9 – 5.0	3.4
Lactose	3.6 – 5.5	4.8
Minerals	0.6 – 0.9	0.8

As shown, Water is the main constituent of milk.

Principle

The water can be easily extracted from the sample, and therefore determined, by using acetone. This is because:

1

- acetone is **miscible** with water

2

- both have lower boiling points which mean they will be evaporated before any other major components such as lipids, proteins, carbohydrates and minerals

Mterials

1. crucilbles
2. Milk
3. Acetone
4. Hot plates

Miscibility is a term commonly used in chemistry that refers to the property of liquids to mix in all proportions, forming a homogeneous solution. By contrast, substances are said to be immiscible if in any proportion, they do not form a solution. For example, diethyl ether is fairly soluble in water, but these two solvents are not miscible since they are not soluble in all proportions.

Procedure

1- pipette 5 ml of milk into this crucible and weight it =x1
2- add 1 ml acetone and evaporate the milk to dryness on a hot plate (do not char the milk)
3- after complete evaporation of water, weigh the crucible again=x2

calculations

Weight of water= weight of crucible with milk (x1) – weight of crucible with dry milk (x2)

$$\text{Water \%} = \frac{(x1 - x2)}{5} \times 100$$

References

1- http://www.ilri.org/InfoServ/Webpub/Fulldocs/ILCA_Manual4/Milkchemistry.htm

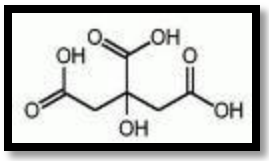
2- http://en.wikipedia.org/wiki/Acetone

3- body fluids lab manual

4- http://www-unix.oit.umass.edu/~mcclemen/581moisture.html

Determination of citric acid content in fruit juices

Background



- Citric acid is a weak organic acid which contains 3 carboxylic acid groups.
- It is a natural preservative and is also used to add an acidic, or sour, taste to foods and soft drinks
- Citric acid exists in greater than trace amounts in a variety of fruits and vegetables, most notably citrus fruits
- In biochemistry, it is important as an intermediate in the citric acid cycle, and therefore occurs in the metabolism of virtually all living things.

Principle

We can determine the amount of citric acid in a given volume of fruit juice by titrating the juice with a standard NaOH solution to form salt and water as shown in the equation below:

$$C_3H_5O(COOH)_3 + 3NaOH \rightarrow C_3H_5O(COONa)_3 + 3H_2O$$

Mterials

1- Fruit juice
2- Distilled water
3- Sodium hydroxide (0.5 M)
4- phenolphethalin

Procedure

1- in a conical flask, add 10 ml of the juice
2- add 30 ml of distilled water
3- add 3 drops of ph.ph
4- titrate the sample with sodium hydroxide until a pink color appears.

calculations

- calculate the moles of sodium hydroxide used?

$$M = \frac{\text{no. of moles}}{\text{V in liter}}$$

No. of moles= M × $\frac{\text{V in ml}}{1000}$ = M × $\frac{(\text{TITR NO.})}{1000}$ = [X] mol

- calculate the moles of ciric acid in your sample?

1 mol of citric acid ⟶ 3 moles of sodium hydroxide

?? ⟶ [X] moles of sodium hydroxide

No. of moles of citric acid in the sample= $\frac{\text{x mol}}{\text{3 mol}}$ × 1 mol= [Y] mol

- calculate the grams of citric acid in the sample?

$$moles = \frac{\text{wt}}{m.wt}$$

Wt= moles × m.wt= [Y] mol × 192.12 g/mol = z gram.

References

http://en.wikipedia.org/wiki/Citric_acid

webhost.bridgew.edu/ihutchins/11%2520

Determination of sugar content in soft drinks

Background

- A soft drink (also referred to as soda or carbonated beverage) is a non-alcoholic beverage
- They are called "soft" in contrast to "hard drinks" — that is, alcoholic beverages
- These drinks is typically containing water — often carbonated water — and a flavoring agent. Many of these beverages are sweetened by the addition of sugar or high-fructose corn syrup, or — in the case of "diet" drinks — with a sugar substitute. They may also contain ingredients such as caffeine and fruit juice.

principle

In this lab you will determine the densities of standard sucrose solutions. (Since sucrose and fructose are both sugars and have very similar aqueous densities, different standard sucrose solutions can be used as an indicator of the % sugar in various soft drinks.) From these densities you can make a standard calibration curve of density vs. % sugar. Then you will determine the densities of various soft drinks. Using your standard calibration curve you will find the % sugar of these soft drinks and then calculate the number of grams of sugar in these drinks.

Materials

1. Standard sucrose solutions (0%, 5%, 10%, 15%, 20%)
2. Beakers
3. Samples of soft drinks

4. scale

Method

1. Determine the weight (mass) of the standard sugar solutions by pipeting 10 mL of each standard solution (0%, 5.00%, 10.00%, 15.00%, and 20.00%) into a beaker and weighing.
2. Determine the weight (mass) of the soft drinks by pipeting 10 mL o f each soda into a beaker and weighing.

Calculations

- fill the following table with your results:

% sugar (g/100ml)	Mass of 10 ml	Density=mass/volume (g/ml)
0% (water)		
5%		
10%		
15%		
20%		
? % soft drink (1)		
?% soft drink (2)		

- draw a calibration curve of densities vs. % sugar?
- From the curve determine the % sugar of each sample of soft drink?
- Calculate the no. of grams of sugar per can? (suppose that the % sugar is 8 and the can volume is 335 ml? (8% sugar= 8 gm/100ml)

8 gm ⟶ 100ml

? gm ⟶ 335 ml

No. of gm of sugar in can= $\frac{8\times 335\ \text{ml}}{100\ \text{ml}}$ = z gm

Spectrophotometric Determination of phosphate in soft drinks

Background

- Acidulants reduce the soft drink's pH and thereby assist in beverage preservation for long-term storage.
- Acidulants can also be used as chelating agents, buffers, coagulators, and
  flavoring agents. In the latter role, the acidulant imparts a tart taste.
- The most common acidulants used in soft drinks are phosphoric and citric acids.
- Phosphoric acid is more effective in lowering the pH than organic acids, while citric acid produces a stronger tartness.
- Phosphoric acid is commonly found in colas whereas citric acid is typically added to fruit flavored beverages.

principle

phosphoric acid (H3PO4) and its anions (H2PO4, HPO42-, and PO43-) are colorless, they cannot be directly determined using visible-light spectrophotometry. Instead,we will quantitatively convert them into a colored substance, whose absorbance can be easily measured. To do this, we will react the phosphates in the soft drink with the molybdate ion, MoO^{-2}. The initial product of this reaction is the phosphomolybdate ion, [PO4.•12MoO3]3-. This complicated monster is also colorless, but when reduced (we'll use SnCl2) it turns into a material, of unknown composition, called *molybdenum blue*. Molybdenum blue is intensely colored, and when we measure the concentration of this material, we can relate that concentration to the concentration of the phosphates present in the initial soda.

Materials

1. Standard (P) (0.004 mg/ml)
2. Samples of soft drinks
3. Distilled water
4. Ammonium molybdate
5. $SnCl_2$

Method

Prepare 3 test tubes as the following:

tube	sample	standard	Blank
Standard(P)	-	1ml	-
Sample(soft drink)	1ml	-	-
D.W	3ml	3ml	4ml
Ammonium molybdate	0.8 ml	0.8 ml	0.8 ml
$SnCl_2$	0.2 ml	0.2 ml	0.2 ml

- Leave for exactly 5min.
- Read the absorbance at 620nm

calculations

$C_{unk.} = \frac{A\ unk}{A\ std} \times C_{std} = z$ mg/ml

References

http://en.wikipedia.org/wiki/Soft_drink