

Fatty acid and test specific objective



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Contents

- STEROID CORE/NUCLEUS REFERENCES

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INTRODUCTION

Lipids are organic compounds found in living organisms that are insoluble or slightly soluble in water but soluble in non-polar organic solvents. Lipids can be classified into four groups which are -fats, oils, and waxes, -compound lipids, -steroids, and -derived lipids. Various experiments are done on lipids.

Some tests are for saturation, presence of certain compounds, or for the different chemical reactions that lipids undergo. Lipids may be composed of esters, amides, alcohols, cyclic, acyclic, or polycyclic structures, and may also be a combination of these.

OBJECTIVES

General Objective: At the end of the experiment, students must be able to familiarize themselves with the different classes of lipids and to be able to identify each kind of lipid of lipid based on the chemical properties of its hydrolyzed products.

A. SPOTTING EFFECT

Specific Objective: Test for the presence of lipids by means of locating translucent spots/area in the filter paper.

B. SOLUBILITY Specific Objective: To test for the solubility of the suspected lipid-containing samples.

C. TEST FOR UNSATURATION (BROMINE WATER TEST)

Specific Objective: To test for unsaturation of lipids through a change in colour or discoloration of the bromine water. To test for the presence of carbon-carbon double bonds.

D. ACROLEIN TEST Specific Objective: To test for the presence of glycerol/glycerin or fats.

E. AMMONIUM MOLIBDATE TEST Specific Objective:

F. 1. EXTRACTION OF BRAIN LIPIDS Specific Objective:

F. 2. DETECTION OF BRAIN LIPIDS

A.) Molisch Test Specific Objective: To determine the presence of carbohydrates in a lipid solution

B.) Ninhydrin Test Specific Objective: To determine the reaction of the ninhydrin reagent to the residue B dissolved in water.

C.) Soda-Lime Test Specific Objective: To determine the change in color of the moistened red and blue litmus paper when exposed to the vapor of the heated mixture of Soda-lime and Residue B. To determine whether the mixture is an acid or a base by noting the change in color of the litmus paper.

D.) Leibermann-Burchard Test Specific Objective: To determine the change in color made when acetic anhydride and sulfuric acid were added to a tube containing residue C dissolved in methylene chloride and to a tube containing vegetable oil To compare residue c and vegetable oil through the intensity and color of their resulting solution

RESULTS AND DISCUSSIONS

A. SPOTTING EFFECT

Visible Positive Result: Translucent spot (area where light passes through)

Sample| Observations| 1(Vegetable Oil)| Presence of translucent spot|

2(Vitress hair polish)| NR| 3(Pantene Conditioner)| NR| (Collagen Age Stick)|

Presence of translucent spot at the sides of the sample| 5(Body Lotion)| NR|

Grease Spot Test This simple test for lipids has been used for centuries.

Lipids that are derived from glycerol and sphingosine, a long-chain base that is the backbone of sphingolipids, will produce translucent “ spots” or “ stains” on fabrics. If the lipid is not a derivative of glycerol or sphingosine, it will not produce a translucent spot on the fabric. The grease-spot test requires that the lipid be in liquid form. Semi-solid lipids, because of the higher degree of saturation in the fatty acid chains, ave melting points higher than room temperature and therefore need to be mildly heated before testing. Also, it was stated in the test to dissolved the suspected lipids in methylene chloride, that is because, methylene chloride is a non-polar solvent, and lipids are mostly non-polar, thus non polar dissolves in non polar. And if the suspected lipid is a lipid, then it won't affect its polarity and we would still be able to see the translucent spot.

B. SOLUBILITY

Samples| Vegetable Oil| Lecithin (Egg yolk)| Water| Immiscible| Miscible|

Methylene Chloride| Miscible| Immiscible| Ether| Miscible| Immiscible|

Toulene| Miscible| Immiscible| Lipids are any of a group of organic

compounds, including the fats, oils, waxes, sterols, and triglycerides, which are insoluble in water but soluble in non-polar organic solvents, are oily to

the touch, and together with carbohydrates and proteins constitute the

principal structural material of living cells. It is predominantly composed of

the elements carbon, hydrogen, and oxygen. Many classes of lipids also

contain nitrogen and phosphorus. The relative amounts of these elements,

as well as their structural positions, determine the degree of solubility of the lipid in various solvents.

Lipids with high hydrocarbon content are relatively nonpolar in nature and insoluble in water. The ionic character of a lipid can be altered by changes in solvent pH. For example, if the solvent contains a strong acid or a strong base, hydrolysis of some of the ester bonds will occur. When this happens,

the products of hydrolysis may have solubility properties very different from those of the original lipid molecule. Structures of the different Samples and

Solvents Sample 1: Vegetable Oil (Oleic acid) Oleic acid has the chemical formula $C_{17}H_{33}COOH$

Due to its large nonpolar portion, oleic acid is insoluble in water and, being less dense than water, it floats on the water surface. The polar $-COOH$ end, however, is attracted to water molecules. So, a thin coating of oleic acid on

the surface of water results in the molecules aligning themselves in an

upright position with the polar ends oriented toward the water surface. If

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there is sufficient surface area for the water, the oleic acid will spread out and will form a film one molecule thick. Such a layer is known as a monolayer. Sample 2: Lecithin (Egg yolk) Lecithin is a glycerophospholipid, or more specifically a Phosphatidyl Choline.

Glycerophospholipids are made from glycerol, two fatty acids, and (in place of the third fatty acid) a phosphate group with some other molecule attached to its other end. The hydrocarbon tails of the fatty acids are still hydrophobic, but the phosphate group end of the molecule is hydrophilic because of the oxygens with all of their pairs of unshared electrons. This means that phospholipids are soluble in both water and oil. Phosphatidyl Choline are most abundant in phospholipids of animals, are key building blocks of membranes and are the main phospholipid of plasma lipoprotein.

Other examples of Phosphatidyl Cholines are Stearic Acid and Linoleic acid which are also known as Lung surfactants.

ADDITIONAL INFORMATION ON SOLVENTS USED

Water In water, oxygen is the electron hog (has a higher electronegativity) and the hydrogen is left wanting. The electrons spend more time with the oxygen atom, so it gains a slight negative charge. In contrast, the hydrogen atoms have a slight positive charge. These slight charges and the shape of water (bent – like the letter “v”) make the water molecule polar (having two poles – positive and negative).

Methylene Chloride Dichloromethane (DCM or methylene chloride) is the organic compound with the formula CH_2Cl_2 . Dichloromethane more commonly known as Methylene Chloride is only slightly polar, and is often <https://assignbuster.com/fatty-acid-and-test-specific-objective/>

regarded as being non-polar. Yes the dipoles from the Chloro-Carbon Bonds do not cancel, but Chloro-Carbon Bonds are only slightly polar to begin with. Ether The carbon-oxygen-carbon bond in ethers is much like the carbon-carbon bond in alkanes. The lack of any oxygen-hydrogen bond makes hydrogen bonding impossible. There is very little intermolecular association.

Therefore, the properties of ethers are much like alkanes. Ethers are essentially non-polar and insoluble in water. Toluene Toluene, also known as methylbenzene, or Toluol, is a clear water-insoluble liquid with the typical smell of paint thinners, reminiscent of the related compound benzene. It is hydrocarbon that is a non-polar molecule. Answer to study question no. 1: Lipids that are derived from glycerol and sphingosine, a long-chain base that is the backbone of sphingolipids, will produce translucent “ spots” or “ stains” on fabrics.

Its like those we see on the brown paper bags that contained greasy food like burgers, the paper bag becomes a little soggy and once placed in light, we would be able to see the light through.

C. TEST FOR UNSATURATION (BROMINE WATER TEST)

We were asked to place 1mL of vegetable oil and lecithin in separate test tubes. After that, we must add 1mL of bromine water and shake the sample. We then were asked to observed the changes. Compound| Visible Result|
Vegetable Oil| formation of two layers; a top white layer and a bottom colourless layer | Lecithin| yellow solution|

The purpose of the test is to test for unsaturation of lipid samples, specifically fatty acids. Fatty acid unsaturation can be determined by the <https://assignbuster.com/fatty-acid-and-test-specific-objective/>

number of carbon-carbon double bonds present. The principle of the reaction is halogenation as shown in the following equations. General equation: $\text{Br-Br} \mid \mid \text{CH}_2=\text{CH}_2 + \text{HBr}_2 > \text{CH}_2\text{-CH}_2$ Equation for the experiment: Vegetable Oil: Lecithin (Egg Yolk): Lecithin: There would be minimal reaction for lecithin because there is only one carbon-carbon double bond present found in the 2nd carbon. This is why the bromine water changed from orange to yellow or a yellow solution formed.

Lecithin is less unsaturated than vegetable oil. The one responsible for the visible result is the presence of carbon-carbon double bonds or alkenes in a fatty acid or when testing for unsaturated fats.

D. ACROLEIN TEST

Procedures: We were asked to put lecithin in a dry test tube and then add potassium bisulfate to be dissolved in it. After that, we were asked to heat the sample and to observe the changes, specifically in odour. The purpose of the test is to test for the presence of glycerin or fats in the sample. Glycerin: Glycerin, also known as glycerol, is a thick liquid that is colourless and sweet-tasting.

It freezes to a gummy paste and has a high boiling point. Glycerin can be dissolved into water or alcohol, but not oils. Glycerin forms the lipid triacylglycerol through esterification of three fatty acids to a glycerol molecule. The principle behind the test is dehydration, where an alcohol is dehydrated to an alkene. Equation: Acrolein is the simplest unsaturated aldehyde that has a burnt fat odour. It can be produced by heating glycerol

to 280°C or in our experiment, by reacting potassium bisulfate with glycerol in the presence of heat. In the experiment, a burnt fat odour was observed.

The compound responsible for this odour is acroleine.

E. AMMONIUM MOLIBDATE TEST

F. 1. EXTRACTION OF BRAIN LIPIDS

F. 2. DETECTION OF BRAIN LIPIDS

a.) Molisch Test

Procedure: To 2.0 ml of decantate A, add three drops of Molisch reagent. Mix thoroughly. Tilt the tube and carefully add 1.0 ml of concentrated sulfuric acid by allowing the acid to flow by the side of the tube. DO NOT MIX. Return tube to its original position and note the color of the ring formed at the junction of the liquids. For a positive result of this test, the formation of purple ring caused by the reaction of the alpha naphthol and the sulfuric acid must be observed.

Additional Information: Purpose: to test the presence of carbohydrates in a lipid solution Principle involved: dehydration and condensation Observations: Presence of purple ring Compound responsible for the visible result: Alpha naphthol and sulfuric acid

b.) Ninhydrin Test

Procedure: Dissolve residue B in 2.0 ml of water. Add 1.0 ml of 0.15% Ninhydrin reagent. Mix thoroughly and heat in a boiling water bath for two minutes Color of the solution: blue-violet Ninhydrin is a chemical used to

detect the presence of ammonia or primary and secondary amines and as a sign of a positive result a blue-violet solution will be produced.

The reason behind the production of the blue solution is the reaction of Ninhydrin to the amino terminal and upon further heating you would notice the increase of the intensity of the color of the solution- blue violet. With the principle of oxidation, the reaction of ninhydrin and amines including alpha amino acids the blue violet solution is produced. Additional Information:

Purpose: is to determine the presence of ammonia or primary and secondary amines. Principle involved: Oxidation Observations: the presence of blue violet solution Compound responsible for the visible result: alpha amino acids

Sample equation using a lipid sample that gave a positive result: Structural formulas of other lipids that will be tested positive in each test:

c.) Soda-Lime Test Observations:

When the moistened litmus papers placed at the tip of the stirring rod were exposed to the vapor of the heated mixture of Soda-lime and Residue B, changes in color occurred. The red litmus paper turned into blue while the blue litmus paper didn't change at all and retained its blue color. Purpose: To determine whether the mixture is basic or acidic Additional Information: Soda lime contains 94% Calcium hydroxide and 5% sodium hydroxide with 1% potassium hydroxide.

It absorbs carbon dioxide in the presence of water vapour or moisture. When used in anaesthetics it can produce carbon monoxide when used without moisture in the presence of isoflurane, enflurane and desflurane. Why must

the litmus papers be moistened first before exposing them to the fume/vapor evolved during the heating? The litmus papers are moistened to absorb the vapor of the mixture and through this; we'll be able to take note of the changes in color of the litmus papers.

d.) Liebermann-Burchard Test

SAMPLES| OBSERVATIONS| Residue C| Emerald Green Solution|

Vegetable Oil| Water - like solution, Emerald green solution| This is a sensitive colorimetric test for the presence of steroids in compounds. A color change to emerald green is a positive test for steroids, and the intensity is roughly proportional to the amount of steroid present. This is a quantitative determination of cholesterol, particularly in blood. Chloroform was used as a solvent in the early studies, but the Liebermann-Burchard (L-B) reaction, as performed today, is carried out in an acetic acid- sulfuric acid- acetic anhydride medium. Purpose: To detect the presence of steroids, especially cholesterols

Steroids are lipids containing the core structure of 17 carbons fused in a ring structure containing 3 six-member rings and 1 five-member ring. The different functionality of steroids comes from the substituent groups attached to the core structure.

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