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UNIT III

DETECTION METHODS OF FOOD ADULTERATION

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TEST FOR SESAME OIL IN OTHER OILS

INTRODUCTION

- Sesame seeds are important oil seed crop cultivated in Asia and Africa for a long time.
- Recently, sesame oil has received great attention because of its bioactive compound including tocopherols, phytosterols, resveratrol, flavonoids and also its sensory qualities and antioxidants activity.
- Sesame oil has a long self life and is used as cooking oil or seasoning and margarines, because of its high stability and resistance to oxidative deterioration.

SESAME OIL 1.FOURIER TRANSFORM INFRARED (FTIR) SPECTROSCOPY

- Sesame oil is known also by containing nearly 85% unsaturated fatty acids specially high contents of essential linoleic and linolenic acids which make a good food source.
- Sesame oil is manufactured by solvent extraction from raw sesame seeds followed by the refining process, or by pressing sesame seeds without refining

- FTIR spectroscopy is a powerful tool for detecting adulteration in edible oils.
- It works by measuring the infrared absorption of different chemical bonds in the sample.
- This method can identify the presence of other oils like sunflower, soybean, or colza oil, even in small quantities

2.GAS CHROMATOGRAPHY (GC)

- Gas chromatography is another effective method for detecting adulteration.
- It separates the different components of the oil mixture and identifies them based on their retention times.
- This technique is particularly useful for detecting animal fats in vegetable oils and vice versa

3.HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC)

- HPLC is used to separate, identify, and quantify each component in a mixture.
- It's especially useful for detecting specific compounds that might indicate adulteration.

4.CHEMICAL TESTS

- There are various chemical tests available, such as the Baudouin test for sesame oil and the Halphen test for cottonseed oil.
- These tests can help identify the presence of specific oils in a sample.

BAUDOUIN TEST

The Baudouin test is a common test used to identify sesame oil:

- Add 5 mL of concentrated hydrochloric acid and 0.4 mL of furfural solution to 5 mL of sesame oil in a measuring cylinder with a glass stopper.
- Shake the mixture vigorously for two minutes.
- Allow the mixture to separate.
- If the acid layer turns pink or red, sesame oil is present.
- The pink or red color is caused by the presence of sesamol, a phenolic component. The Baudouin test can detect as little as 0.2% sesame oil in other oils

Other tests for identifying sesame oil include:

- **Raman spectroscopy:** This test uses spectral data to identify sesame oil.
- **Odor fingerprints:** This test uses odor fingerprints to detect sesame oil fraud.
- **GC–MS:** This test uses a DB-23 column, high purity helium, and other parameters to identify sesame oil.
- **Solubility in solvents:** The solubility of oils in solvents depends on the nature of the glycerides in the oil.

INTRODUCTION

- Adulteration of edible oils is a significant concern in the food industry, as it can affect the quality, nutritional value, and safety of the final product.
- Among the various oils subject to adulteration, cottonseed oil often finds its way into blends, sometimes without proper labeling.
- Detecting this adulteration is crucial for maintaining the integrity of food products.

COTTON SEED OIL

HALPHEN TEST

- The Halphen test is a chemical analysis method specifically designed to identify the presence of cottonseed oil in other edible oils.
- Named after its developer, the test is based on the detection of unique cyclopropenoic fatty acids (such as sterculic and malvalic acids) that are characteristic of cottonseed oil.

- **PRINCIPLE**
- The test involves a chemical reaction between the cyclopropenoic fatty acids in cottonseed oil and a reagent mixture containing sulfur in carbon disulfide and amyl alcohol.
- The presence of cottonseed oil is indicated by a distinctive cherry-red color that develops during the reaction.

PROCEDURE

1. **Sample Preparation**: A small sample of the oil is mixed with the reagent.
2. **Reaction:** The mixture is heated to initiate the reaction.
3. **Observation:** The development of a cherry-red color indicates the presence of cottonseed oil.

- IMPORTANCE

- **Quality Assurance:** Ensures that the oil products are genuine and unadulterated.
- **Consumer Protection:** Protects consumers from potential health risks associated with undeclared ingredients.
- **Regulatory Compliance:** Helps manufacturers adhere to food safety regulations and standards.

Testing Adulteration of Oil and Fat

- **INRTODUCTION**

•Adulteration of oils and fats is a significant concern in food safety, nutrition, and industrial applications.

•Common adulterants include mineral oils, argemone oil, and non-edible oils mixed with edible oils.

•Proper analytical tests help detect adulteration and ensure oil purity.

- **Hexa Bromide Test for Linseed Oil:**
- **Definition**

- **Linseed**, also known as **flaxseed(Aazhi)**, is the seed of the **Linum usitatissimum** plant.
- It is a rich source of **omega-3 fatty acids (α-linolenic acid), fiber, and lignans**.
- Used in food, medicine, and industrial applications.

Principle

- Linseed oil contains high levels of **linolenic acid (a polyunsaturated fatty acid)**.
- When reacted with bromine, **hexabromide precipitate** is formed due to bromination at the unsaturated sites of linolenic acid.

Procedure

- **Take 1 mL** of the given oil sample in a test tube.
- **Add an equal volume** of bromine solution and shake well.
- **Keep the test tube in an ice bath** to prevent evaporation of bromine.
- Allow the reaction to proceed for **a few minutes**.
- **Observe the formation of a precipitate**.

- **Observation**
  - If a **white or yellowish precipitate** of **hexabromide** forms, the sample contains **linseed oil**.
  - If no precipitate forms, linseed oil is absent.

- **Conclusion**
- The test confirms the presence of **linseed oil adulteration** in the given sample.

Test for Added Mineral Oil in Edible Oils

Principle

- **Edible oils (vegetable oils)** contain natural **glycerides (triglycerides)**, while **mineral oils** (petroleum-based oils) **lack glycerides**.
- When mixed with **sulfuric acid**, edible oils undergo **carbonization**, turning brown/black, whereas mineral oils remain **colorless** or light-colored.

Procedure

1. Take **2 mL of the oil sample** in a dry test tube.
2. Add **1 mL of concentrated sulfuric acid** carefully.
3. Shake the mixture well and observe color changes.

Observation

- **Edible oil**: Turns **brown/black** due to carbonization.
- **Mineral oil**: Remains **colorless or light yellow** as it does not react.

Conclusion

- A **lack of dark coloration** indicates the **presence of mineral oil adulteration** in the given sample.

Final Summary

- **Hexa Bromide Test** detects **linseed oil adulteration** by precipitate formation.
- **Sulfuric Acid Test** identifies **mineral oil adulteration** by observing color changes.

TEST ADDED FOR CASTOR OIL , DETECTION OF ARGENOMONE IN SOME OTHER OIL

- ## CASTOR OIL

- It has been used for thousands of years in various cultures for its medicinal, cosmetic, and industrial applications.

- The oil is known for its distinctive pale yellow color, mild odor, and unique composition, which includes a high percentage of ricinoleic acid—a monounsaturated fatty acid that is believed to account for many of its beneficial properties. Castor oil is a vegetable oil derived from the seeds of the castor bean plant (Ricinus communis), which is native to tropical regions of Africa and Asia.

- One of the most interesting properties of castor oil is that it is a natural triglyceride. This means that it is composed of three fatty acids that are bound together by a glycerol molecule.

- The most abundant fatty acid in castor oil is ricinoleic acid. Ricinoleic acid is a unique fatty acid that has a number of beneficial properties.

Composition of castor oil:

Ricinoleic Acid (85-95%):

This is the most abundant fatty acid in castor oil and is responsible for its unique properties. It has a hydroxyl group (an oxygen and hydrogen atom bonded together) that gives it distinct chemical properties and allows it to be used in various industrial applications.

some other unique properties of castor oil

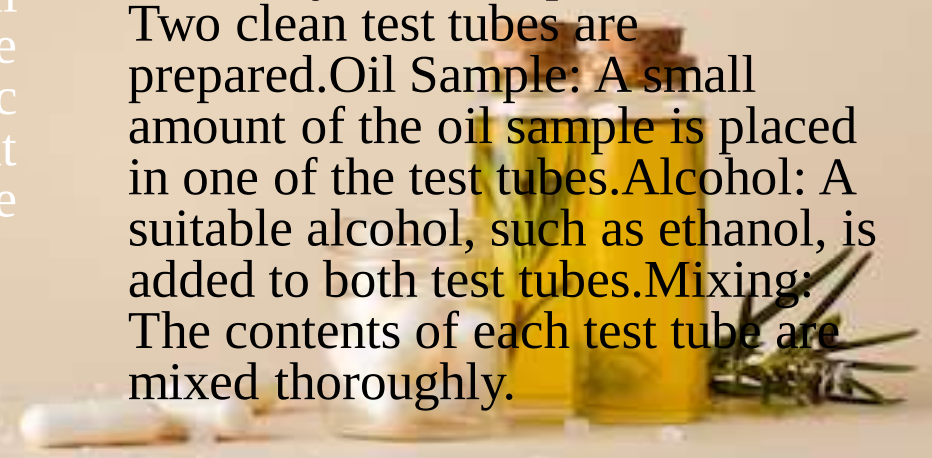
High viscosity:

Castor oil is significantly more viscous than most other vegetable oils. This high viscosity makes it an excellent lubricant for high-temperature applications and imparts a unique "thick" feel when applied topically.

- **Hydrophilicity**:
- Unlike many other oils, castor oil exhibits slight hydrophilicity due to the hydroxyl group in ricinoleic acid. This means it has a slight affinity for water, which can be beneficial in certain applications.

- **Test added for castor oil**
- 1.Solubility Test:
- Castor oil has limited solubility in alcohol. This simple test involves mixing a small amount of the oil with alcohol. If the oil dissolves readily, it likely contains other substances or is not pure castor oil.

- Solubility Test Setup:Test Tubes: Two clean test tubes are prepared.Oil Sample: A small amount of the oil sample is placed in one of the test tubes.Alcohol: A suitable alcohol, such as ethanol, is added to both test tubes.Mixing: The contents of each test tube are mixed thoroughly.



TEST FOR RANCIDITY IN OILS KRIES FOR TESTING QUALITY OF OILS.

- RANCIDITY TESTING
- Rancidity testing is essential in the feed industry, as a key indicator of product quality and shelf life. It is conducted to determine the level of oxidation in samples of feed or feed ingredients and it can be performed through a number of analytical methods.

- MEASURMENT OF RANCIDITY OILS.
- One of the most common methods for measuring the oxidative rancidity of vegetable oils is the peroxide value (PV)(12). The PV determines the amount of peroxides formed during early oxidation stages, expressed as millimoles or milliequivalents of peroxide oxygen per one kilogram of oil.

TESTE FOR RENCIDITY.

- **Peroxide value test**

Measures the amount of peroxides in the oil, which are an indicator of rancidity. This is the most common test for rancidity. p-Anisidine testMeasures the amount of aldehydes in the oil, which are another indicator of rancidity.

Free fatty acids (FFA) testMeasures the amount of fatty acids that have broken away from their triglyceride structure. Smell and taste testA simple, free test that involves smelling and tasting the oil. If the oil has no flavor, it's likely rancid.

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- KRIES TEST
- A "Kries test" is a chemical method used to assess the quality of oil by detecting the presence of rancidity, specifically by identifying aldehydes and ketones produced during the oxidation process of fats, indicating that the oil has gone rancid; essentially, it's a test to determine how oxidized an oil is.
- **TESTE FOR OIL QUALITY**
- Typical tests include oil viscosity, viscosity index, atomic emission spectroscopy, Fourier transform infrared (FTIR) spectroscopy, water contamination and particle counts. Finally, there is testing used to monitor new oils in storage. Many are unaware that lubricants in storage have a shelf life