DIRECTORATE OF DISTANCE & CONTINUING EDUCATIONS
MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI – 627012

OPEN AND DISTANCE LEARING(ODL) PROGRAMMES

(FOR THOSE WHO JOINED THE PROGRMMES FROM THE ACADEMIC YEAR 2023 – 2024)

B.Sc. CHEMISTRY

COURSE MATERIALS

SKIL ENHANCEMENT COURSE – IV

ENTREPRENEURIAL SKILLS IN CHEMISTRY

By

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UNIT -I

Food Chemistry

Food adulteration-contamination of food items with clay stones, water and toxicchemicals -Common adulterants.

Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast, MSG, vinegar.

Dyes

Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing

UNIT II

Hands on Experience (Students can choose any four)

Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques.

Preparation of Jam, squash and Jelly, Gulkand, cottage cheese.

Preparation of products like candles, soap, detergents, cleaning powder,

shampoos, pain balm, tooth paste/powde rand disinfectants in small scale.

Extraction of oils from spices and flowers.

Testing of water samples using testing kit.

Dyeing – cotton fabrics with natural and synthetic dyes

Printing – tie and dye, batik.

Recommended Text

George S &Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai.

Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.

Reference Books

Shyam Jha,Rapid detection offood adulterants andcontaminants (Theory and Practice),Elsevier, e Book ISBN 9087128004289, 1st Edition,2015

Website and e-learning source

https://www.vlab.co.in/broad-area-chemical-sciences

Entrepreneurial Skills In Chemistry

Food Chemistry Food adulteration:

Adulterated food is impure, unsafe and it is a legal term meaning that a food product fails to meet federal or state standards. If any inferior or cheaper substance has been substituted wholly or some part. Which may result in the loss of actual quality of food item. These are the some of the common adulterants used in food items for various reasons. In the United States, the Food and Drug Administration (FDA), regulates and enforces laws on food safety and has technical definitions of adulterated food in various United States laws. As per FSSAI, the definition of food adulteration takes into account not only the intentional addition or substitution or abstraction of substances which adversely affects the nature, substance and quality of foods, but also their incidental contamination during the period of growth, harvesting, storage, processing, transportation and distribution.

Any material which is or could be employed for making the food unsafe or sub-standard or misbranded or containing extraneous matter is called an adulterant. It is any substance that lessens the purity of effectiveness of a substance.

Intentional adulteration

Intentional adulterants are sand, chips, stones, mud, powder, water, mineral oil and coaltar, dyes. These adulteration cause harmful effects on the body.

Name of the food article	***Adulterant***	**Simple method for detection of adulterant**
Ghee or Butter	Vanaspathi	Take about one teaspoonful of melted ghee or butter with equal quantity concentrated Hydrochloric Acid in a test tube and add to it a pinch of cane sugar. Shake well for one minute and test after 5 minutes. Appearance of crimson colour in lower (acidic) layer shows the presence of ‘vanaspathi’. This test is specific for seasame oil which is compulsorily added to vanaspathi.

		Some of coaltar dyes also gives a positive test
	Mashed potatoes, sweet potato and	Add a drop of tincture of iodine. Iodine which is brownish in colour turns to blue if mashed potatoes/sweet potatoes/other starches are

	other starches	present.
Milk	Water	The lactometer reading should not ordinarily beless than 1.026.
		The presence of water can be detected by putting a drop of milk on a polished vertical surface. The drop of milk either stops or flows slowly leaving a white trail behind it; whereas milk adulterated with water fill flow immediately without leaving a mark.
	Starch	Add tincture of iodine, indication of blue colour shows that the presence of starch. This test is not valid if skimmed milk or other thickening material is added.
Khoa	Starch	Add a tincture of iodine. Iodine of blue colourshows the presence of starch.
Edible oils	Argemone oil	Add concentrated nitric acid to a sample and shake carefully. Red to reddish brown colour in acid layer would indicate the presence of argemone oil.
	Mineral oil	Take two ml of edible oil and add a quantity of N/2 alcoholic potash. Heat in boiling water both for 15 minutes and add 10 ml of \ water. Any turbidity within 5 minutes indicates the presence of mineral oil

	Castor oil	Dissolve some oil in petroleum either in a test tube and cool in a ice salt mixture. Presence of turbidity within 5 minutes indicates the presence of oil.
Sweet meat, Ice cream, Sherbet	Metanil yellow (a non permitted coal tar dye)	Extract colour with luke warm water from food article. Add few drops of conc.HCl. If magenta red colour develops the presence of metanil yellow is indicated.

Dals	Kesari dal	Add 50ml of dilute Hydrochloric acid to dal and keep on simmering water for about 15 minutes. The pink colour if develops indicates the presence of kesari dhal.
	Clay,stones, gravels lead chromate	Visual examination will detect these adulterants. Shake five grams of dhal with five ml of water and add few drops (yellow) of Hydrochloric Acid. A pink colour shows the presence of colour.
Hing	Soap stone (pumice stone) or other earthly matter.	Shake with water, soap stone or other early matter will settle to the bottom.
	Starch	Same test as in the case of Milk
Tea leaves	Exhausted tea or black or bengal gram dal husk with colour	tea leaves sprinkled on wet filter would immediately release added colour.
		Spread a little slaked lime on white porcelain tile or glass plate. Sprinkle a little tea dust on the lime. Red orange or other shades of colour spreading on the lime will show the presence of coal tar dye. In the case of genuine tea, there will be only a slight greenish yellow colour due to chlorophyll which appears after sometime.

Saffron	Dyed tendrils of maize cob.	Genuine saffron will not break easily like artificial. Artificial saffron is prepared by soaking maize cob in sugar and colouring it with coal tar dye. The colour dissolves in water if artificially coloured. A bit of pure saffron when allowed to dissolve in water will continue to give its saffron colour so long as it lasts.

Wheat, bajra and other food grains	Ergot (fungus containing a poisonous substance)	Purple black longer size grains in bajra show thepresence of ergots.
		Put some grains in a glass containing 20% salt solution. Ergot floats over the surface while sound grains settle down.
	Dhatura-seeds	Dhatura seeds resemble chillies seeds with blacklish brown colour which can be separated out by close examination.
Sugar	Chalk powder	Dissolve in a glass of water, chalk will settle down at the bottom.
Black pepper	Dried seeds of papaya fruit	Papaya seeds can be separated out from pepper as they are shrunken, oval in shape and greenish brown or brownish black in colour. The suspected papaya seed in black pepper sample is distinguishable by its characteristics repulsive flavour quite distinct from the bite of black pepper.
	Light berries	Light berries float on spirit

Silver leaves	Aluminium leaves	On ignition genuine silver leaves burn away completely, leaving glistening white spherical ball of the same mass whereas aluminium leaves are reduced to ashes of dark grey blackish colour. The silver foil is very thin and if crushed between two fingers, crumbles to powder. Aluminium foil is comparatively thicker and only breaks to small shreds when passed similarly.
Turmeric	Coloured saw dust metanil yellow	Take a teaspoon full of turmeric powder in a test tube. Add a few drops of conc. Hydrochloric Acid. Instant appearance of violet colour which disappears on dilution with water. If the colour. Metanil yellow (an artificial dye) non permitted coal tar dye is indicated. This test is only for metanil yellow
Chilli powder	Stones	Any grittiness that may be felt on tapping the sediment at the bottom of glass confirms the presence of brick powder or sand. Smooth white residue at the bottom indicates the presence of soapstone.
Jaggery Powder	Chalk powder	Add few drops of HCl. Effervescence indicates adulteration. Stir a spoonful

		sample of sugar in a glass of water. The chalk settles down.
Cloves	Volatile oil extracted cloves	Exhausted cloves can be identified by its small size and shrunken appearance. The characteristics pungent taste of genuine cloves is less pronounced in exhausted cloves.
Rawa	Iron filling	By moving a magnet through it,iron fillings can beseparated.
Rice	Marble or other stones	A simple test is to place a small quantity of rice onthe palm of the hand and gradually immerse the same in water. The stone chips will sink
Wheat flour (maida)	Atta from which maida suji has been extracted	When dough is prepared from resultant wheat flour, more water has to be used and chapaties prepared out of this blow out. The normal taste of chapaties prepared out of this blow out wheat is some what sweetish whereas those prepared out of adulterated wheat flour will taste insipid.
Common salt	White powdered stone, chalk	Stir a spoonful of simple salt in a glass of water. The presence of chalk will make the solution white and other insoluble impurities will settle down.

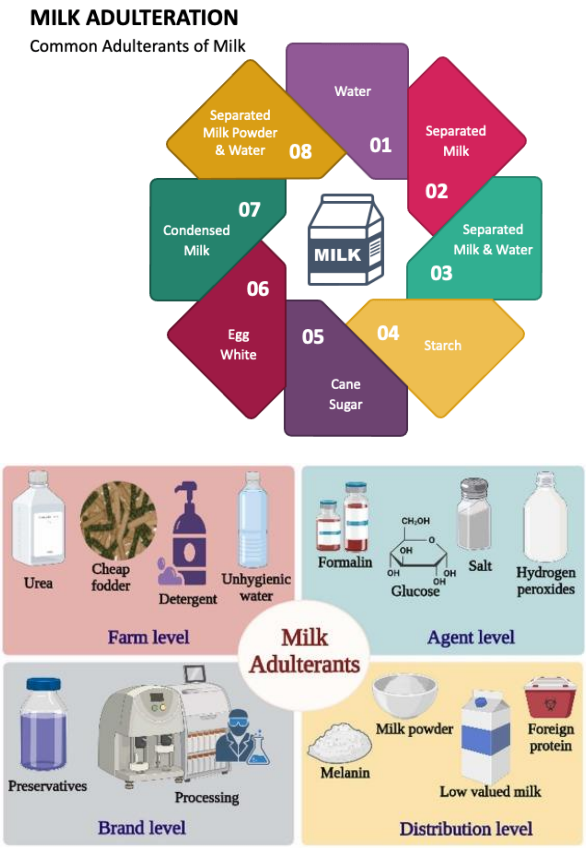
Mustard seeds	Argemone Seeds	Mustard seeds have smooth surface. The argemone seeds have grainy and rough surface and are blacker hence can be separated out by close examination.
Honey	Molasses (sugar and water)	A cotton wick dipped in pure honey when lighted with a match stick burns. If adulterated the presence of water will not allow the honey the honey to burn. If it does it will produce a cracking sound.
Supari	Colour and sachharin	Colour dissolves in water. Saccharin gives excessive and lingering sweet taste.
Pulses (green peas)	Colour dye stuffs and dals	Sample is kept immersed in water for about half an hour and stirred. Colour separation indicates adulteration.
Cinnamon	Cassia bark	Cinnamon barks are very thin. Cassia barks are thick and stiff, Cinnamon barks can be rolled
Coffee	Chicory	Gently sprinkle the coffee powder sample on the surface of water in a glass. The coffee floats over the water but chicory begins to sink down within a few seconds. The falling behind them a trail of colour due to large amount of caramel they contain.

	Tamarind or date- seed powder	Sprinkle the suspected coffee powder on white blotting paper and spray over 1% sodium carbonate solution. Tamarind and date-seed powder will, If present, stain blotting paper red.

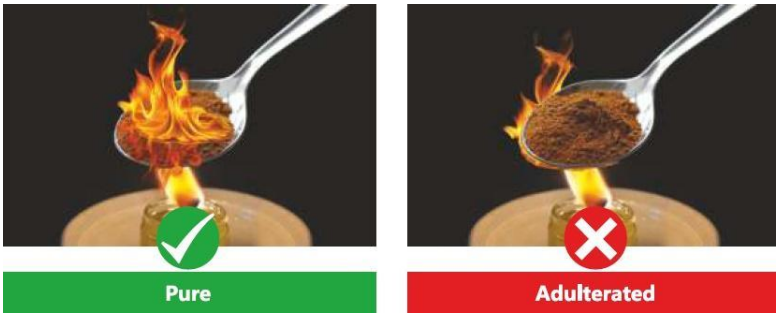
Common adulterants.

Milk and milk products like milk powder, butter, ghee, khoa, sweets Coffee, tea Sweetening agents like sugar, honey, gur Non-alcoholic beverages like aerated drinks, squashes, juices, sherbets, and Miscellaneous items like confectionery, jams, sauces, ice creams and prepared food items like sweets *(laddoo, burfi, jalebi)*, curries, rice preparations like biryani, tandoori meat dishes. Let us now discuss about the adulterants found in each of these commonly consumed food items separately. We shall start with milk.

Milk: In milk, the most widely used adulterant is *water*. Not only do the milk vendors add water to the milk sold loose but there also exists a racket of removing a portion of the milk from plastic pouches of well known companies and diluting the remaining milk with water. Such addition of water is very easily detected by measuring the specific gravity or relative density of the milk. Sometimes, to avoid detection, the vendors increase the specific gravity of diluted milk by adding *sugar, starch or urea*. Addition of preservatives like formalin, boric acid, hydrogen peroxide and neutralizers like sodium bicarbonate and caustic soda is also prevalent to increase the shelf life of the milk. This is especially done in summer months when milk spoils easily and by vendors who have to transport the milk over long distances. Contaminants usually found in milk are the *pesticide residues* (from pesticides sprayed in cattle sheds), *antibiotic residues* (from medications given to the cattle) and *aflatoxin* (from aflatoxin contaminated feed given to the cattle).



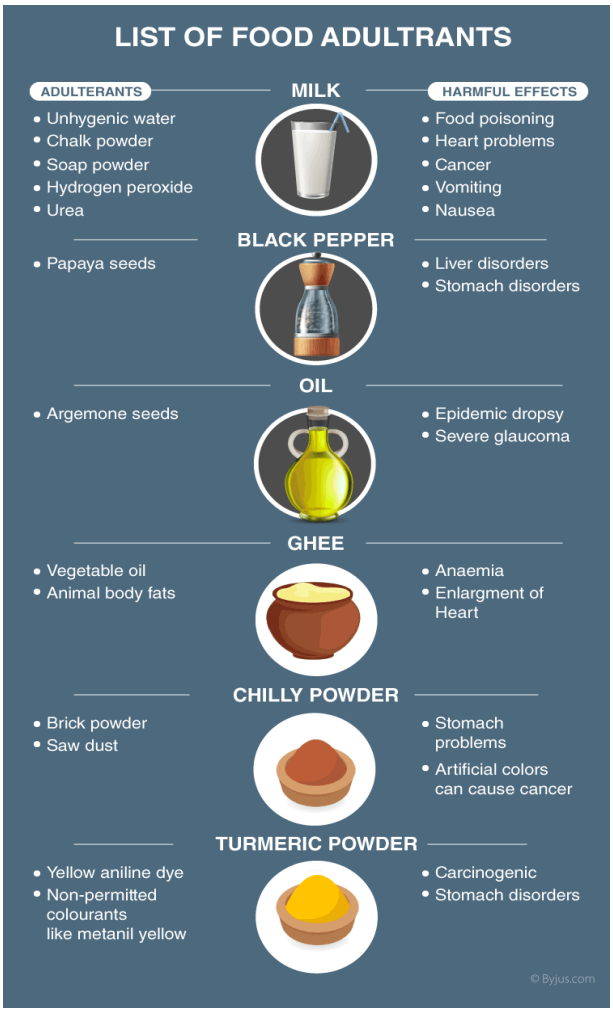
Edible fats and oils: The most common adulterant in edible oils is a *cheaper oil*, which may or may not be edible. The cheaper oils generally used to adulterate expensive cooking oils are castor oil, mineral oil, argemone oil, palmolein, cottonseed oil and rapeseed oil. *Ghee* is usually found to be adulterated with *vanaspati* or hydrogenated oils. *Lard*, a cheaply available animal body fat, may also be added. Contaminants which have been detected in oils are the *pesticide residues* (from the pesticides which had been sprayed on the oil seed crops before harvesting) and *aflatoxin* especially in unrefined groundnut oil (from use of poor quality, fungus infested groundnuts). The process of refining the oil destroys the aflatoxin and hence it is safer to consume refined oils.



Spices: Cheaper agricultural produce like *wheat starch, jowar, rice, corn and arrowroot starch* are used in a number of expensive foods like ground spices (red chilli powder, turmeric, coriander powder, *garam masala* etc.). The starch which is white in colour is usually dyed to the colour of the spice to which it is being added. Sometimes essential oils derived from expensive spices like cloves are extracted and the exhausted spice is sold as such. Cinnamon bark may be mixed with the bark of another similar looking tree, asafoetida may be mixed with a foreign resin, seeds of black pepper may be mixed with papaya seeds and mustard seeds may be mixed with argemone seeds which look similar.

Miscellaneous food items: Colour seems to be an adulterant, which is added to a large variety of foods viz. non-alcoholic beverages, confectionery, sweets and savouries, to improve their appeal to the consumer. According to the Food Safety and Standard Regulations 2011, you may recall reading in Unit 7, only some artificial or synthetic colours are permitted for use in foodstuffs. Colours other than the ones prescribed by law are referred to as *non-permitted colours*. The most commonly used *non-permitted synthetic colours* reported in various studies are *Orange II, Sudan dyes, Metanil Yellow, Auramine, Malachite Green and Rhodamine B.* In addition, extraneous matter like *sand, husk, sawdust, wood pieces,*

stones, straw etc. are also used as adulterants especially in cereals and pulses to increase the bulk. Similar looking foreign pulse grains, which are mostly toxic, may be used to adulterate popular *toor* or *arhar dhal*. *Metal adulterants include iron filings (in suji) and nickel (in vanaspati)* which are present mainly as a result of poor processing techniques and aluminium foils used instead of silver foils in several products like sweets. Intense or artificial sweeteners like saccharin may be added in excess to non-alcoholic beverages or to foods in which it is not permitted like confectionery and sweets. Non-permitted sweeteners like dulcin and several other chemicals like urea, acetic acid, sodium hydroxide, sodium bicarbonate are also used as adulterants.



Hands on Experience (Students can choose any four)

Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques.

FOOD PRODUCT	ADULTERANT	DETECTION
Coffee and Tea	Twigs, Stem or other foreign substances	Visual Inspection: Examine the appearance of coffee and tea. The adulterant present is comparatively different.
	Chicory	Solubility Test: Genuine coffee dissolve in water leaving behind minimal residue. Adulterant may not dissolve completely.
	Artificial colours	Take a tea samples in a test tube and then add few drops of strong alcohol to it and then evaporate it till dryness and then add water to it. If the colour changes red/orange/yellow. Then the tea adulterant is azo.
	Coal tar dye	Take a small amount of tea sample in a test tube and add 5 ml of conc.HCL to the test tube. Appearance of pink or crimson shows the presence of cola tar dye in the tea sample.

Pepper and Chilli Powder	Starch	Add Iodine solution to the sample. Starch will turn into blueblack in colour.
	Brick powder	Chilli/pepper powder is added in a beaker containing water. Brick powdr will settle down while pure Chilli/pepper powder floats.
Turmeric Powder	Yellow lead salts	2g of turmeric powder is taken in a test tube. con.HCL is added to it. Magenta colouration indicates the presence of oxides of leads.
	Chalk	2g of turmeric powder is taken in a test tube. Few drops of water is added to it. Effervescence will indicates the presence of chalk.
	Metanil Yellow.	A sample of turmeric powder is teaken in a test tube. Then add 1N H_2SO_4 . Disappearance of red colour on adding distilled water indicates the presence of Metanil Yellow.
	Aniline dyes	Add few drops of water to th sample. Then add 5ml of Spirit to it. Disappearance of yellow colour indicates the presence

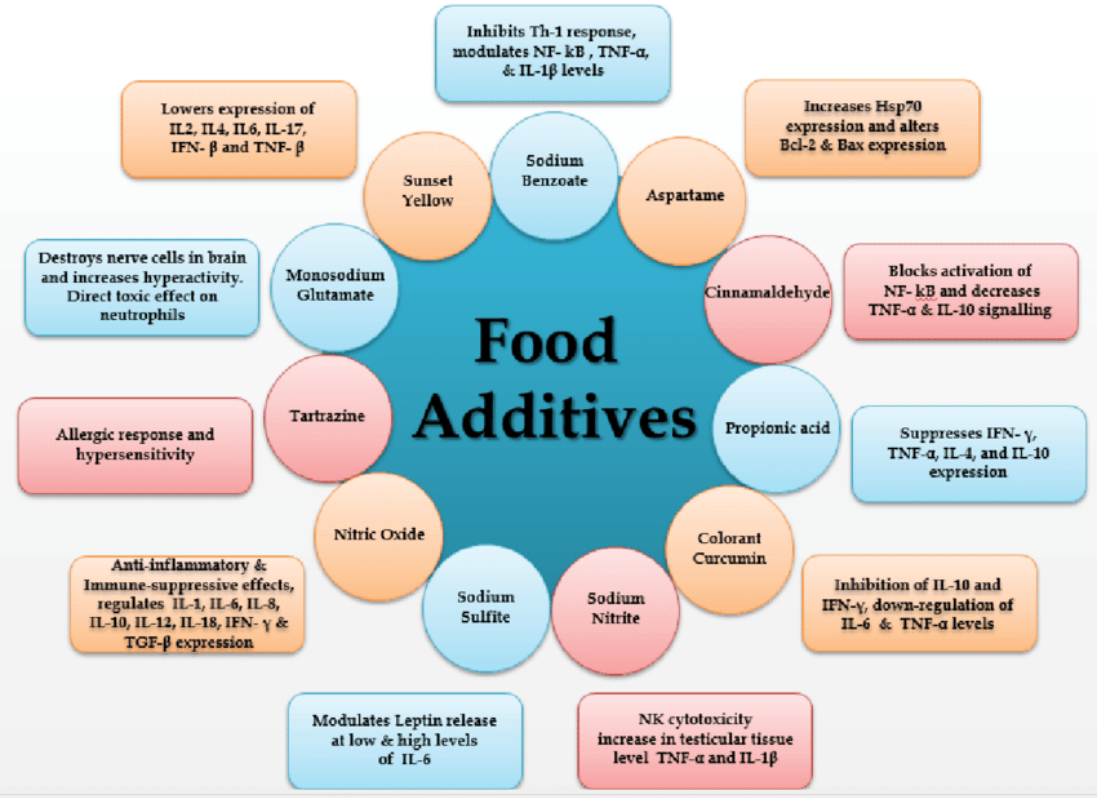
		of aniline dye.
	Starch	Add Iodine solution to the sample. Starch will turn into blueblack in colour.
Buttr /ghee	Vegetable oils	About 5g of ghee is taken in bottle and little quantity of sugar is added to it. By closing the cap and the bottle is shaken well and placed it for 5 mins. Red colour precipitates indicates the presence of oils.
	Vanaspathi	Add a tablespoon of ghee to the test tube and heat it up. Then ad con.HCL with a pinch od sugar. Shake well. Pink od rd colour indicates the presence of vanaspathi.
	Starch	Add Iodine solution to the sample. Starch will turn into blueblack in colour.
	Impurities	A teaspoon of butter is heated in a vesels. If it melts immediately and turn brownish in colour, then it is pure. While it turns yellow in colour. Then surely it is an adulterant.
Milk	Sugar	To the 1 ml of milk add 0.5ml of conc. HCl and 0.05 g of resorcinol to it. Then mix it and

		shake well. Now placed in a boiling water bath for 5 mins. Red colour indicates the presence of added sugar to milk.
	Salt	Take 5ml of sample, 1 ml of 0.1 N silver Nitrate solution in a test tube. Mix it well and add 0.5 ml of 10% Potassium chromate. Appearanc of yellow colour indicates the presence of added salt.
	Starch	Add Iodine solution to the sample. Starch will turn into blueblack in colour.
	Developed or Natural acidity	Acidity is determined by titrating a known volume of milk with standard alkali to the point of an indicator like phenopthaline
	Water	Put the milk on a polished slanting surface. Pure milk stays or flows slowly leaving a white trail behind. Milk adulterated with water will flow immediately without leaving a mark.
Honey	Starch/glucose/ dextrin	Add Iodine solution to the sample. Starch will turn into

		blueblack in colour.
	Impurities	Mix a few drops of honey with vinegar, if the mixture starts to foam, then the honey is adultrated
	Adulterant	Dip the match stick in honey and then trying to light it using match box. Pure honey will ignite easily.

FOOD ADDITIVE

According to the Food Safety Standard Authority of India (FSSAI). Food additive may be defined as any substance not normally consumed as a food by itself or used as a typical ingredient of the food, whether or not it has nutritive value, the intentional addition of which to food for a technological (including organoleptic) purpose in the manufacture, processing, preparation, treatment, packaging, transport or holding of such food results, or may be reasonably expected to result (directly or indirectly), in it or its by-products becoming a component of or otherwise affecting the characteristics of such food but does not include - contaminants or substances added to food for maintaining or improving nutritional qualities. In simpler terms, food additives are the substances which are added to food by the manufacturers to facilitate processing or to improve appearance, texture, flavour and keeping quality. The term does not include chance contaminants which might unknowingly enter our food, or substances added to food for maintaining or improving nutritional qualities. Its usage is restricted to substances added intentionally to foods. Such substances include oxidizing agents, flavours, propionate sorbate, vitamins etc.



Antioxidant

Antioxidant means a substance which when added to food retards or prevents oxidative deterioration of food. According to the FSS (Food Product Standard and Food Additive) Regulation, 2011 this does not include substances like sugar, cereal, oils, flours, herbs and spices. Under the regulation, no antioxidant other than lecithin, ascorbic acid and tocopherol shall be added to any food. However the following antioxidants, not exceeding in concentration mentioned against each, may be added to edible oils and fats except ghee and butter.

- **Natural antioxidants**

Come from organic sources like fruits, vegetables, grains, and meat. They're preferred because they're renewable, don't use hazardous chemicals, and have health benefits.

1.Vitamin E (Tocopherols and Tocotrienols): Found in various nuts, seeds, vegetable oils, and leafy greens, vitamin E is a potent antioxidant that protects cells from oxidative damage.

2. Vitamin C (Ascorbic Acid): Abundant in citrus fruits, berries, and green vegetables, vitamin C is a water-soluble antioxidant that scavenges free radicals and regenerates vitamin E.

3. Polyphenols: Found in fruits, vegetables, tea, coffee, wine, and cocoa, polyphenols are a diverse group of antioxidants with various health benefits. Examples include flavonoids (quercetin, catechins), phenolic acids (gallic acid, caffeic acid), and resveratrol.

4. Carotenoids: Pigments responsible for the red, orange, and yellow colors in fruits and vegetables, carotenoids like beta-carotene, lycopene, and lutein have antioxidant properties and contribute to human health.

5. Glutathione: Present in fruits, vegetables, and meats, glutathione is a tripeptide antioxidant that plays a crucial role in detoxification and protecting cells from oxidative stress.

- **Synthetic antioxidants**

Created in a lab by combining chemical compounds. They're used in food, cosmetics, pharmaceuticals, and to stabilize nonfood materials like plastics and rubber.

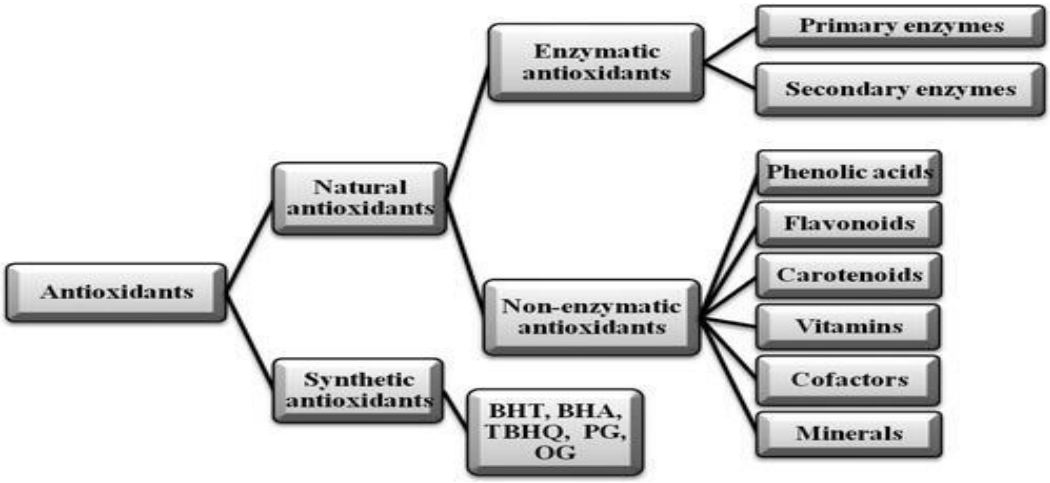
1.Butylated Hydroxyanisole (BHA): A synthetic antioxidant commonly used to prevent lipid oxidation in foods like fats, oils, and processed meats.

2. Butylated Hydroxytoluene (BHT): Similar to BHA, BHT is a synthetic antioxidant used to prevent oxidation in foods, cosmetics, and pharmaceuticals.

3. Propyl Gallate: Another synthetic antioxidant used to prevent rancidity in fats and oils, propyl gallate is often combined with other antioxidants like BHA and BHT for enhanced efficacy.

4. Tertiary Butylhydroquinone (TBHQ): A synthetic antioxidant added to oils, fats, and processed foods to extend shelf-life by preventing oxidative deterioration.

5. Ethoxyquin: Primarily used as a preservative in animal feed, ethoxyquin is also employed as an antioxidant in some food products, especially in the seafood industry.



Glazing agents (hazardous effect) Glazing agents are substances used in food processing to provide a shiny or glossy appearance to food products, improve their visual appeal, and protect them from moisture loss. While many glazing agents are safe for consumption, some may pose potential health risks or have hazardous effects under certain conditions. Here are some considerations regarding glazing agents and their potential hazards:

1. Synthetic Glazing Agents: Some synthetic glazing agents may contain harmful chemicals or additives that could pose health risks if consumed in large quantities or over long periods. For example: o Certain synthetic waxes, such as polyethylene glycol (PEG), may contain impurities or residues that are potentially carcinogenic. Synthetic glazing agents may also contain allergens or sensitizers that could trigger adverse reactions in susceptible individuals.

2. Contamination Risk: Glazing agents, especially those derived from animal sources, may carry the risk of contamination with pathogens or harmful substances. For instance: Shellac, a common glazing agent derived from the resin secreted by the lac beetle, may contain residues of insecticides or other contaminants used in the lac cultivation process. Beeswax, another natural glazing agent obtained from honeybees, may contain pesticide residues or environmental contaminants.

3. Potential Allergens: Some glazing agents, particularly those derived from natural sources like beeswax or shellac, may trigger allergic reactions or intolerances in

sensitive individuals. Symptoms may include skin rashes, itching, swelling, or respiratory issues.

4. Digestive Issues: In rare cases, consumption of certain glazing agents may lead to digestive discomfort, such as nausea, bloating, or diarrhea, particularly in individuals with underlying gastrointestinal conditions or sensitivities.

5. Regulatory Concerns: While many glazing agents are approved for use in food products by regulatory authorities, concerns about their safety and potential health effects may arise due to insufficient data or conflicting research findings. Regulatory agencies continually assess the safety of food additives, including glazing agents, based on available scientific evidence. Overall, while glazing agents are generally considered safe when used within recommended limits and under appropriate conditions, consumers with specific dietary restrictions, allergies, or health concerns should exercise caution and consult with healthcare professionals or regulatory authorities if unsure about the safety of specific additives. Additionally, food manufacturers should adhere to regulatory guidelines and quality standards to ensure the safety and integrity of food products containing glazing agents

Food colorants

Food colorants are substances added to food and beverages to impart or enhance color, making them visually appealing to consumers. They play a crucial role in food presentation and perception, influencing consumer preferences and purchasing decisions. Food colorants can be classified into two main categories: natural and synthetic.

Natural Food Colorants:

1. Carotenoids: Naturally occurring pigments found in fruits, vegetables, and other plantbased foods. Examples include beta-carotene (orange), lycopene (red), and lutein (yellow).

2. Anthocyanins: Water-soluble pigments responsible for the red, purple, and blue colors in fruits, vegetables, and flowers. Examples include cyanidin (purple),

delphinidin (blue), and pelargonidin (red).

3. Chlorophyll: The green pigment found in leafy green vegetables, algae, and some herbs. Chlorophyll is often used as a natural green food colorant.

4. Betanin: A red pigment extracted from beets, betanin is commonly used as a natural red food colorant in various food products.

5. Annatto: Derived from the seeds of the achiote tree, annatto is used as a natural yellow to orange food colorant in cheese, butter, and other dairy products.

6. Turmeric: A spice derived from the rhizomes of the turmeric plant, turmeric contains the yellow pigment curcumin and is used as a natural food colorant.

Synthetic Food Colorants:

1. **FD&C Dyes**: Synthetic colorants approved for use in food and drugs by the U.S. Food and Drug Administration (FDA). Examples include FD&C Red No. 40 (Allura Red AC), FD&C Yellow No. 5 (Tartrazine), and FD&C Blue No. 1 (Brilliant Blue FCF).
2. **Lake Colors**: These are water-insoluble forms of synthetic dyes, formed by combining the dye with an insoluble base. Lake colors are used in products where water solubility is not required, such as coatings, confections, and oil-based products.
3. **Natural Identical Colors**: Synthetic colorants chemically identical to naturally occurring colors, but manufactured synthetically. They are often used as alternatives to natural colorants due to cost-effectiveness and stability.
4. **Caramel Color**: A widely used brown food colorant produced by heating carbohydrates, such as sugar or corn syrup. Caramel color is used in beverages, baked goods, sauces, and

confections.

While both natural and synthetic food colorants are regulated by food safety authorities, concerns have been raised about the safety of some synthetic colorants, particularly in sensitive individuals or when consumed in large quantities. As a result, there is increasing demand for natural food colorants derived from plant-based sources, driven by consumer preferences for clean-label products and concerns about synthetic additives. Regulatory agencies continuously assess the safety of food colorants and establish maximum permitted levels to ensure consumer safety.

Preservatives in Food

Preservatives are added to food to fight spoilage caused by bacteria, molds, fungus, and yeast. Preservatives also help keep food fresh for longer periods of time. What are preservatives made of? Preservatives can be made of "natural" chemicals such as salt or alcohol. They can also be man-made, or synthetic chemicals. Preservatives are added to food to fight spoilage caused by bacteria, molds, fungus, and yeast. Preservatives can keep food fresher for longer periods of time, extending its shelf life.

Food preservatives also are used to slow or prevent changes in color, flavor or texture and delay

rancidity.

Leavening Agent

leavening agent, substance causing expansion of doughs and batters by the release of gases within such mixtures, producing baked products with porous structure. Such agents include air, steam, yeast, baking powder, and baking soda.

Air and steam Leavening of baked foods with air is achieved by vigorous mixing that incorporates air bubbles, producing foam. Egg white is well suited to this purpose because it produces voluminous and strong foams that retain their expanded structure when dried by the baking process. Egg white is used in such baked products as angel food cake, chiffon cakes, and sponge cakes. Gluten, the elastic protein of flour, may also be whipped to produce a foam, as in beaten biscuits.

Puff pastes, which are used for light flaky pastries, are expanded by water vapour (steam) pressure. During baking, as the interior of the product nears the boiling point, the vapour exerts pressure within bubbles that have been incorporated earlier by other means, producing swelling.

Fermentation

Leavening also may be achieved by the process of fermentation, which releases carbon dioxide gas. Bakers' yeast, composed of living cells of the yeast strain *Saccharomyces cerevisiae*, Is available as a pressed cake and in a powdered form. When added to doughs, yeast initiates fermentation by acting upon certain sugars contributed by other dough ingredients, releasing both carbon dioxide and substances that affect the flavour and aroma of the baked product. Yeast-leavened products include most types of breads and rolls and such sweet dough products as coffee cakes, raised doughnuts, and Danish pastries. The sourdough method, used for rye breads, employs a small portion of dough, or sponge, in which sugar-fermenting bacteria have been allowed to develop. When added to a fresh dough mixture, the sponge produces fermentation. Commercial sour cultures are sometimes used as substitutes for naturally fermented sourdoughs. Paking powders, containing phosphates, release part of their gas at room temperature and part when heated. Double-acting baking powder, the most widely used type, contains sodium aluminum sulfate and calcium acid phosphate and releases a small amount of gas when mixed and the balance when heated.

Baking soda

Baking soda is added to doughs and batters in which acid is provided by other ingredients, such as honey, sour cream, molasses, or cocoa. If used without acid ingredients, baking soda may produce yellowing and undesirable odours and flavours in the finished product.

Mixtures leavened with baking soda require quick handling to avoid release of most of the gas before baking. Baking soda, also known as sodium bicarbonate or bicarbonate of soda, is a popular baking ingredient. It gives foods like bread, cakes, muffins, and cookies a light, fluffy texture. That's because it has leavening

properties, meaning that it reacts with an acid, such as vinegar or lemon juice, and causes dough to rise by producing carbon dioxide. Still, baking soda has a variety of household uses aside from cooking. Here are 22 health benefits and uses of baking soda. Baking soda is a handy all-purpose item due to its wide variety of uses, from cleaning countertops to supporting oral care. Here's a comprehensive list of household uses.

Yeasts

✓ Yeasts are omnipresent, eukaryotic, single-celled organisms that belong to the fungus kingdom. They are estimated to have originated hundreds of million years ago and constitute about 1% of the total fungal population. Around 1500 species of yeasts are currently known. The most common examples of yeast include ***Saccharomyces cerevisiae***, ***Candida albicans***, ***Blastomyces*** **and** ***Histoplasma*****.**

✓ They are unicellular fungi that contain the same organelles as found in a mature eukaryotic cell such as nucleus, endoplasmic reticulum, mitochondria, vacuole and cytoskeleton. It is a prolific organism that plays significant roles in food, pharmaceutical and beverage industries.

✓ The cell wall of yeasts is made up of glycoproteins, polysaccharides like chitin and mannoproteins. The vacuoles in the yeast cell occupy around 20% of the cell volume and are important for breaking down proteins, storing nutrients and maintaining homeostasis.

MSG (Monosodium glutamate)

✓ Monosodium glutamate, commonly known as MSG, is one of the most controversial food

additives approved for use by the Food and Drug Administration (FDA).

✓ While it's "generally recognized as safe" (GRAS) to be used in the food supply by

regulatory agencies, some research suggests that it may negatively affect health .

✓ This article explains what MSG is, what foods it's typically added to, and what the

research says about possible health implications.

Fast food

One of the best-known sources of MSG is fast food. Some restaurants add MSG to a number of popular dishes, including fried rice. MSG is also used by franchises like Kentucky Fried Chicken and Chick-fil-A to enhance the flavor of foods. For example, Chick-fil-A's Chicken Sandwich and Kentucky Fried Chicken's Extra Crispy Chicken Breast are just some of the menu items that contain MSG.

2. Chips and snack foods

Many manufacturers use MSG to boost the savory flavor of chips. Consumer favorites like Doritos and Pringles are just some of the chip products that contain MSG. Aside from being added to potato chips, corn chips, and snack mixes, MSG can be found in a number of other snack foods, so it's best to read the label if you want to avoid consuming this additive.

3. Seasoning blends

Seasoning blends are used to give a salty, savory taste to dishes like stews, tacos, and stir-fries. MSG is used in many seasoning blends to intensify taste and boost the umami flavor without adding extra salt (12Trusted Source). In fact, MSG is used in the production of low sodium items to increase flavor without the addition of salt. MSG can be found in many low sodium flavoring products, including seasoning blends and bouillon cubes. Additionally, MSG is added to some meat, poultry, and fish rubs and seasonings to enhance the palatability of foods

4. Frozen meals

Frozen meals can be a convenient and cheap way to put food on the table, and they often contain

MSG. Many companies that make frozen dinners add MSG to their products to improve the savory

flavor of the meal. Other frozen products that often contain MSG include frozen pizzas, mac and cheese, and frozen breakfast meals

5. Soups

Canned soups and soup mixes often have MSG added to them to intensify the savory flavor that

consumers crave. Perhaps the most popular soup product that contains this controversial additive is Campbell's chicken noodle soup. Many other soup products, including canned soups, dried soup mixes, and bouillon seasonings, can contain MSG, making it important to check individual product labels if intending to avoid eating any foods with MSG.

6. Processed meats

Processed meats like hot dogs, lunch meats, beef jerky, sausages, smoked meats, pepperoni, and

meat snack sticks can contain MSG. Aside from being used to enhance taste, MSG is added to meat products like sausage to reduce the sodium content without changing the flavor (18Trusted Source).

One study found that replacing sodium with MSG in pork patties enhanced the salty flavor and

acceptability of the product without negatively affecting taste (19Trusted Source).

7. Condiments

Condiments like salad dressing, mayonnaise, ketchup, barbecue sauce, and soy sauce often contain added MSG. In addition to MSG, many condiments are also packed with other additives like added sugars, artificial colorings, and preservatives. These added ingredients can contribute to poor health, therefore it's best to limit these and instead purchase products made with whole food ingredients whenever possible. If you're concerned about using MSG-containing condiments, consider making your own so that you have complete control over what you're consuming. For starters, you can try out these delicious and healthy salad dressing recipes.

8. Instant noodle products

A staple for college students around the world, instant noodles provide a quick, filling meal for those on a budget. Some manufacturers use MSG to boost the savory flavor of instant noodle products. Many popular instant noodle packages are often of low nutritional value as they are made with refined carbs and are high in sodium and preservatives which could harm your health. Instant noodle consumption has

been associated with increased heart disease risk factors, including elevated blood sugar, cholesterol, triglyceride, and blood pressure levels (20Trusted Source).

DYES:

➢ In the early times the colouring materials were extracted from natural sources like plants and insects.

➢ Now a days thousands of such substances are synthesised in factories on a large scale. ➢ Dyes are the organic compounds that are used to impart colour to textiles, foodstuffs, silk, wool and other objects.

➢ Dyes are capable of getting fixed to the fabrics/objects permanently and are resistant to the action of water, soap, light, acid, and alkalies.

➢ Every coloured compound cannot be used as a dye. A good dye must have most of the following properties:

1. It must have a suitable colour.

2. It must be able to fix itself or capable of being fixed to the fabric from the solution.

3. When fixed, it must be fast resistant to the action of light, water, soap, detergents, etc. during washing or to the organic solvents during dry cleaning. Why do dyes or dyed articles appear to have a characteristic colour? If a molecule absorbs light in the visible region (400 nm to 750 nm) corresponding to green colour, then it will appear violet, which is the complementary colour of green. Similarily, if a dye absorbs blue colour, it will appear yellow which is the complementary colour of blue. Thus, the dyes impart colour to fabric by absorbing the complementary colour. The colour of a compound is due to the presence of certain groups containing multiple bonds. These groups which impart colour to a compound are called chromophores. Some examples of chromophores are : –NO2 (Nitro), –N = O (nitroso), –N = N – (azo), quinonoid structures, etc. At the same time, there are certain groups which they are not chromophores themselves but they deepen the colour when present with coloured compounds. The groups which deepen the colour of a coloured compound are called auxochromes. Some examples of common auxochromes are : – OH, –NH2 , –NHR, –NR2 , –Cl, –CO2H, etc.

Classification of Dyes

1. On the basis of source:

(a) Natural dyes: Natural dyes are dyes or colorants derived from plants, invertebrates, or minerals. The majority of natural dyes are vegetable dyes from plant sources—roots, berries, bark, leaves, and wood—and other biological sources such as fungi and lichens. There are two types of natural dyes. Additive dyes (non-substantive) such as madder must use a mordant (a chemical that fixes a dye) to bond with fibers. These are the most common type and have been used for at least 2,000 years. Substantive dyes require no pretreatment to the fabric (e.g., indigo, orchil and turmeric) and there are three types: direct dye (for cotton, e.g., turmeric, safflower); acid dye (for silk and wool, e.g., saffron, lac) or basic dye (for silk and wool, e.g., berberine). Mordants are chemical compounds that combine with the fiber and the dye forming a chemical bridge between the two. Common mordants are weak organic acids, such as acetic or tannic acid, and metal salts including aluminum ammonium or potassium sulfate, ferrous sulfate, and copper sulfate. Usually, the textile to be dyed is simmered in a mordant solution before dyeing (pre-mordanting). Other options include adding the mordant to the dye bath or treating with another mordant after dyeing to shift the color.

Natural mordant dyes are either monogenetic or polygenetic; monogenetic dyes produce only one colour irrespective of mordant, whereas polygenetic dyes produce different colours according to the mordant employed (e.g., logwood, alizarin, fustic and cochineal).

Disadvantages of Natural Dyes

Before the advent of synthetic dyes, natural dyes were widely used, often together with mordants such as alum, to dye natural fibres including wool, linen, cotton and silk, but their use declined after the discovery of synthetic dyes. However, interest in natural dyes has been revived owing to increasing demands on manufacturers to produce more environmentally friendly alternatives to petrochemical-derived dyes. One main issue associated with the use of natural dyes in the coloring of textiles is their poor to moderate light-fastness, and despite their

long tradition, not all natural dyes are especially environmentally friendly. Some natural dyes have no or little affinity for the textile materials and they require heavy-metal salts as mordants for fixation and color-fastness. Natural dyes may be sustainable but they need water and land to produce and there is insufficient dye yield per acre of plant material to sustain industrial-scale production.

Synthetic Dyes:

Synthetic dyes are manufactured from organic molecules. Before synthetic dyes were discovered in 1856, dyestuffs were manufactured from natural products but batches of natural dye were never exactly alike in hue and intensity, whereas synthetic dyestuffs can be manufactured consistently. The use of computers and computer color matching (CCM) produces color that is identical from batch to batch.

Discovery of first synthetic dye William Henry Perkin, an eighteen-year-old English chemist, was searching for a cure for malaria, a synthetic quinine, and accidentally discovered the first synthetic dye. He found that the oxidation of aniline could color silk. From a coal tar derivative he made a reddish purple dye. The brilliant purple was called mauve. The dye was not stable to sunlight or water and faded easily to the color presently named mauve, a pale purple. This discovery resulted in additional research with coal tar derivatives and other organic compounds and an entire new industry of synthetic dyes was born. In the twenty-first century, synthetic dyes are less expensive, have better colorfastness, and completely dominate the industry as compared with natural dyes. Thousands of distinctly different synthetic dyes are manufactured in the world.

Principles of dyeing

The process of applying color to fiber stock, yarn or fabric is called dyeing. There may or may not be thorough penetration of the colorant into the fibers or yarns.

The dyeing of a textile fibre is carried out in a solution, generally aqueous, known as the dye liquor or dye bath.

For true dyeing to have taken place, coloration of fabric and absorption are important determinants.

Coloration: The coloration must be relatively permanent: that is not readily removed by rinsing in water or by normal washing procedures. Moreover, the dyeing must not fade rapidly on exposure to light.

Absorption: The process of attachment of the dye molecule to the fiber is one of absorption: that is the dye molecules concentrate on the fibre surface. There are four kinds of forces by which dye molecules are bound to the fiber: 1) Ionic forces 2) Hydrogen bonding 3) Vander Wals' forces and 4) Covalent chemical linkages.

Exhaustion: In any dyeing process, whatever the chemical class of dye being used, heat must be supplied to the dye bath; energy is used in transferring dye molecules from the solution to the fiber as well as in swelling the fiber to render it more receptive. The technical term for this process is exhaustion.

Levelness: An Important Quality, evenness of dyeing, known as levelness is an important quality in the dyeing of all forms of natural and synthetic fibers. It may be attained by the control of dyeing conditions. Conditions to attain Levelness By agitation to ensure proper contact between dye liquor and substance being dyed and by use of restraining agents to control rate of dyeing or strike. Solvent Dyeing Serious consideration has recently been given to the methods of dyeing in which water as the medium is replaced by solvents such as the chlorinated hydrocarbons used in dry cleaning. The technological advantages in solvent dyeing are: 1. Rapid wetting of textiles 2. Less swelling 3. Increased speed of dyeing per given amount of material 4. Savings in energy, as less heat is required to heat or evaporate per-chloroethylene. Thus it eliminates the effluent (pollution) problems associated with the conventional methods of dyeing and finishing.

Preparation of Jam, squash and Jelly, Gulkand, cottage cheese.

PREPARATION OF JAM:

Ingredients:

- 1 kg of fruit (e.g., strawberries, blueberries, raspberries, peaches)
- 750 g of sugar (adjust to taste)

- 1 lemon
- pectin

Procedure:

Wash the fruit thoroughly. Cut the fruit into small pieces if needed Clean jars and lids in hot soapy water, then place them in a preheated oven for 15 minutes to sterilize. Alternatively, boil the jars for 10 minutes and let them air dry. Place the fruit in a large pot. Add the sugar and lemon juice. Stir the mixture and let it sit for 10–15 minutes to draw out the juices from the fruit. Heat the fruit mixture over medium heat, stirring occasionally until the sugar dissolves. Increase the heat and bring it to a rolling boil. Stir constantly to prevent burning. Skim off any foam that formson top. To check if the jam is ready, put a plate in the freezer before cooking. Drop a little jam onto the cold plate. If it wrinkles when you push it with your finger, the jam is ready. If it's too runny, continue boiling and test again after a few minutes. Once the jam reaches the desired consistency, pour it into the sterilized jars, leaving a small gap at the top. Wipe the rims of the jars clean, seal tightly, and let them cool. Store the jam in a cool, dark place. Once opened, keepit in the refrigerator.

PREPARATION OF SQUASH:

Ingredients:

- 1 kg of fruit (e.g., oranges, lemons, mangoes, or berries)
- 1 kg of sugar (or adjust to taste)
- 1 liter of water
- 1 teaspoon of citric acid (optional, for preservation and tartness)
- 1 lemon (juice, optional)

Procedure:

Wash the fruit thoroughly. If using citrus fruits, juice them. For fruits like mangoes or berries, blend them to extract juice or pulp. Strain the pulp to remove seeds or fibers if necessary. In a large pot, dissolve the sugar in water over medium heat. Stir until the sugar completely dissolves to create a sugar syrup. Bring the syrup to a

boil, then simmer for 5–10 minutes until itthickens slightly. Once the syrup has thickened, remove it from heat and let it cool slightly. Add the fruit juice to the syrup, and stir thoroughly. Add citric acid or lemon juice to enhance the tartness and act as a preservative. Adjust the tartness to your likings. Strain the squash mixture through a fine mesh sieve to remove any leftover pulp or seeds, ensuring a smooth liquid. Pour the strained squash concentrate into sterilized bottles while it's still warm, leaving a little space at the top. Seal the bottles tightly with sterilized lids. Let the bottles cool completely, and store them in a cool, dark place. To serve, mix the squash concentrate with cold water in a ratio of 1 part squash to 4–5 parts water, or according to your taste preference. You can also use soda water or sparkling water for a fizzy drink.

PREPARATION OF JELLY:

Ingredients:

- 1 kg of fruit (e.g., apples, grapes, berries)
- Water (enough to cover the fruit)
- 700-900 g of sugar (adjust to taste and depending on the fruit's sweetness)
- 1 lemon (juice for added pectin and flavor balance)

-pectin (if using fruits with low natural pectin)

Procedure:

Wash the fruit thoroughly. Cut the fruit into small pieces .Place the fruit in a large pot and cover it with water. Bring the mixture to a boil, then reduce the heat and let it simmer for 30–60 minutes until the fruit is soft and mushy. Strain the mixture through a fine mesh strainer or cheesecloth to extract the juice. Avoid pressing the fruit too much, as this may make the jelly cloudy. Let the juice sit for a few hours or overnight to allow sediment to settle, then carefully pour the clear juice into a new container. Measure the amount of fruit juice you've extracted. For every 1 cup of juice, add ¾ to 1 cup of sugar (depending on the fruit and sweetness preference).Add the lemon juice for flavor and to help with setting. If the fruit has low pectin (e.g., grapes, strawberries), add powdered pectin according to the

package instructions. Heat the fruitjuice and sugar mixture over medium heat, stirring until the sugar is dissolved. Bring it to a rolling boil, stirring constantly. Skim off any foam that forms on top during boiling. Use the same method as with jam to test for readiness: chill a plate in the freezer, drop a little jelly on it. If it wrinkles when you push it, the jelly is ready. If it's too runny, continue boiling and test again after a few minutes. Once the jelly reaches the desired consistency, pour it into the sterilized jars, leaving a small gap at the top. Wipe the rims clean, seal the jars, and let them cool. Store the jars in a cool, dark place. Once opened, refrigerate the jelly.

PREPARATION OF GULKHAND:

Ingredients:

- 100 g of fresh rose petals (ideally from fragrant, organic roses)
- 200 g of sugar (or adjust according to taste)
- 1 tablespoon of honey (optional, for added flavor)
- 1 teaspoon of cardamom powder (optional, for flavor enhancement)
- A clean, dry glass jar with a tight lid

Procedure:

Pick fresh, organic roses, preferably those that are fragrant. Gently separate the petals, wash them thoroughly under cold water to remove any dust or chemicals, and let them dry completely. In a bowl, take a small portion of the dried rose petals and layer them at the bottom of the glass jar. Sprinkle an equal amount of sugar over the layer of petals.

Continue alternating layers of rose petals and sugar until you've used up all the petals and sugar. Ensure that the topmost layer is sugar. If desired, add honey and cardamom powder between the layers for additional flavor. Close the jar tightly and place it in direct sunlight for 7–14 days. During this period, the sugar will dissolve, and the rose petals will release their natural oils, combining into a thick, syrupy mixture. Shake or stir the contents of the jar gently every 2–3 days to ensure proper mixing and even absorption of sugar. After 1–2 weeks, the gulkand will be ready.

The rose petals should have softened, and the mixture will be sticky and sweet. Once ready, store the gulkand inan airtight jar in a cool, dark place or in the refrigerator. It can last for several months.

PREPARATION OF COTTAGE CHEESE:

Ingredients:

- 2 liters of whole milk (or any other high-fat milk)
- 2–3 tablespoons of white vinegar or lemon juice
- Salt (optional, to taste)

Procedure:

Pour the milk into a large, heavy-bottomed pot. Heat the milk over medium heat, stirring occasionally to prevent scorching, until it reaches a temperature of about 85°C.Once the milk isheated, remove it from the stove. Gradually add the vinegar or lemon juice, 1 tablespoon at a time, while stirring gently. You'll notice the milk will start to curdle, and the curds (solid parts) will separate from the whey (liquid). Let the mixture sit for 5–10 minutes to allow the curdling process to complete. Line a colander or sieve with a clean cheesecloth or a thin cotton cloth. Carefully pour the curdled milk into the colander to strain out the whey. Let it drain for about 5–10 minutes. For softer cottage cheese, let it drain for a shorter time; for firmer cheese, drain it longer. You can lightly squeeze the cloth to remove excess whey, but be gentle if you prefer moist cottage cheese. For a milder flavor, you can rinse the curds under cold running water to remove the residual acid. This step is optional but commonly done to improve texture and flavor. Transfer the curds to a bowl and sprinkle with a little salt, if desired, to enhance the flavor. Stir gently to combine. Your homemade cottage cheese is ready to eat! You can serve it immediately or store it in an airtight container in the refrigerator for up to 3–4 days.

Preparation of products like candles, soap, detergents, cleaning powder, shampoos, painbalm, toothpaste/ powder and disinfectants in small scale.

PREPARATION OF CANDLES:

Materials :

Wax, Wick, Mold, fragrance oils, Dye(Optional), Thermometer.

Procedure:

Set up a double boiler by filling a pot with a few inches of water and placing it on your waxto the mold and allow it to melt slowly and stir it. Use a wick holder across the top of the container to keep the wick upright and centered. Once the wax has melted, remove it from heat. Add fragrance oil (usually 6-10% of the total wax weight) and stir. Add dye want to make color candles. Stir until evenly blended. The melted waxcooled and pouring it into the mold. Slowly pour the wax, avoiding air bubbles. Allow the candleto cool and harden completely. Once done, the homemade candle ready for use.

PREPARATION OF SOAP:

Ingredients:

Lye (sodium hydroxide),Distilled water, Oils (olive oil, coconut oil, shea butter or palm oil), Essential oils (optional),Additives (optional)

Tools:

- Digital scale
- Thermometer
- Safety gear (gloves, goggles, long sleeves)
- Heatproof containers (for mixing lye solution and oils)
- Stick blender (optional but recommended)
- Soap molds (silicone molds)
- A spatula

Procedure:

Use a scale to measure out your lye and water exactly. Slowly add the lye to the water (never the other way around) while stirring gently. The solution will get hot, so set it aside in a safe place to cool. Measure and melt the oils in a heatproof container. If you’re using solid oils (like coconut oil or shea butter), heat them gently

until they're liquid. They should be close in temperature before mixing. Slowly pour the lye solution into the oils while stirring. Use a stick blender to bring the mixture to "trace." This means when lift the blender, the soap mixture leaves a trail on the surface. This takes a few minutes. Stir in essential oils, colorants, or other additives like exfoliants. Pour the soap mixture into your prepared molds, smoothing the top with a spatula. Cover the molds and let them sit for 24-48 hours to harden. After this, unmold the soap and cut it into bars if necessary. Let the bars cure in a cool, dry place for 4-6 weeks. This allows the soap to harden and fully saponify, making it safe for use.

PREPARATION OF DETERGENT:

Ingredients:

1 bar of soap (unscented or your preferred scent like Castile soap or any laundry soap bar), washing soda (sodium carbonate), borax (optional).

Procedure:

Use a cheese grater or food processor to finely grate the soap bar. In a large container, combine the grated soap, washing soda, and borax (if using). Stir well until evenly mixed. Washing soda helps to break down stains and grease. Borax acts as a laundry booster and disinfectant. Store the powdered detergent in an airtight container. For a standard load of laundry, use 1-2 tablespoons of the detergent. If your clothes are heavily soiled, you can use up to 3 tablespoons.

PREPARATION OF CLEANING POWDER:

Ingredients:

Baking soda, washing soda (sodium carbonate),borax (optional),essential oil (optional)

Procedure:

Mix the dry ingredients in a large bowl, combine the baking soda, washing soda, and borax (if using).Add essential oils (optional): If you're adding essential oils, drop them into the powdermixture and stir well to distribute the oils evenly. Baking soda is a mild abrasive and deodorizer that helps lift stains. Washing soda cut through grease and grime. Transfer the cleaning powderinto an airtight container, such as a glass jar or plastic container. Use to clean surfaces like countertops, sinks, tubs, or stovetops, sprinkle the powder onto the surface.

PREPARATION OF SHAMPOO:

Ingredients:

1/4 cup liquid castile soap,1/4 cup distilled water,1 teaspoon jojoba oil (or use coconut oil, argan oil, or olive oil),10-20 drops essential oil (rosemary, peppermint, or tea tree essential oils),1 tablespoon aloe vera gel (optional),1/2 teaspoon vegetable glycerin (optional).

Procedure:

Mix the liquid ingredients in a small bottle, combine the castile soap, distilled water, carrier oil, and optional ingredients like aloe vera gel and vegetable glycerin. Castile soap is a gentle natural soap that cleanses the scalp without stripping natural oils. Jojoba oil or carrier oil brings moisture and nourish the scalp. Alovera gel helps to soothe the scalp and promotes hydration. Add essential oils, drop them into the mixture. Essential oils like lavender are soothing, while tea tree oil is good for treating dandruff or oily scalp. Screw the cap on bottle and shake thoroughly to mix. Store the shampoo in a clean, airtight bottle. Shake before each use, as the ingredients may separate. A small amount of shampoo to wet hair, lather, and rinse thoroughly.

PREPARATION OF PAIN BALM:

Ingredients:

- 2 tablespoons coconut oil(or shea butter)
- 2 tablespoons beeswax (for consistency)
- 10 drops essential oil(e.g., peppermint, eucalyptus, or lavender)
- 1 tablespoon carrier oil (e.g., olive oil or jojoba oil)
- Optional: 1 teaspoon arnica oil for added pain relief

Procedure:

In a double boiler, combine the coconut oil and beeswax. Heat gently until fully melted. Stir in the carrier oil until well mixed. Remove from heat and let it cool slightly. Add the essential oils and optional arnica oil. Mix well. Pour the mixture into a small jar or tin. Allow it to cool and solidify completely. Store in a cool, dry place. Use as needed for muscle pain or soreness.

PREPARATION OF TOOTH PASTE:

Ingredients:

- 3 tablespoons coconut oil
- 3 tablespoons baking soda
- 10-15 drops peppermint essential oil (for flavor)
- 1 teaspoon xylitol(optional, for sweetness)
- 1 teaspoon bentonite clay (optional, for texture)

Procedure:

In a bowl, mix the coconut oil and baking soda until you achieve a smooth paste. Stir in the peppermint essential oil and xylitol (if using).If you're using bentonite clay, mix it in thoroughly for added texture and minerals. Transfer the mixture into a small jar or container with a lid.

Use a small amount on your toothbrush and brush as usual.

PREPARATION OF DISINFECTANTS:

Ingredients

- 1 cup water
- 1 cup white vinegar
- 10-15 drops essential oil

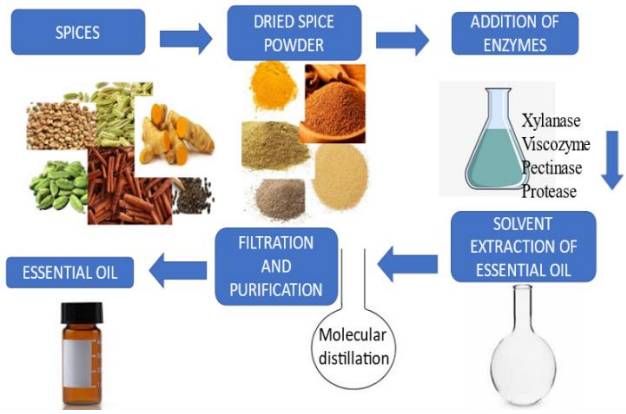
(e.g., tea tree oil, lavender, or eucalyptus for added antibacterial properties)

Procedure:

In a spray bottle, combine the water and white vinegar. Add the essential oils and shake well to combine. Clearly label the bottle for easy identification. Spray the solution on surfaces and wipewith a clean cloth. Ideal for kitchen counters, bathroom surfaces, and more.

EXTRACTION METHODS OF OILS

Essential oils are used in a wide variety of consumer goods such as detergents, soaps, toilet products, cosmetics, pharmaceuticals, perfumes, confectionery food products, soft drinks, distilled alcoholic beverages (hard drinks) and insecticides. The world production and consumption of essential oils and perfumes are increasing very fast. Production technology is an essential element to improve the overall yield and quality of essential oil. The traditional technologies pertaining to essential oil processing are of great significance and are still being used in many parts of the globe. Water distillation, water and steam distillation, steam distillation, cohobation, maceration and enfleurage are the most traditional and commonly used methods. Maceration is adaptable when oil yield from distillation is poor. Distillation methods are good for powdered almonds, rose petals and rose blossoms, whereas solvent extraction is suitable for expensive, delicate and thermally unstable materials like jasmine, tuberose, and hyacinth. Water distillation is the most favored method of production of citronella oil from plant material.



Sources of natural essential oil

Essential oils are generally derived from one or more plant parts, such as flowers (e.g. rose, jasmine, carnation, clove, mimosa, rosemary, lavander), leaves (e.g. mint, *Ocimum* spp., lemongrass, jamrosa), leaves and stems (e.g. geranium, patchouli, petitgrain, verbena, cinnamon), bark (e.g. cinnamon, cassia, canella), wood (e.g. cedar, sandal, pine), roots (e.g. angelica, sassafras, vetiver, saussurea, valerian), seeds (e.g fennel, coriander, caraway, dill, nutmeg), fruits (bergamot, orange, lemon, juniper), rhizomes (e.g. ginger, calamus, curcuma, orris) and gums or oleoresin exudations (e.g. balsam of Peru, *Myroxylon balsamum*, storax, myrrh, benzoin).

Water Distillation

In this method, the material is completely immersed in water, which is boiled by applying heat by direct fire, steam jacket, closed steam jacket, closed steam coil or open steam coil. The main characteristic of this process is that there is direct contact between boiling water and plant material. When the still is heated by direct fire, adequate precautions are necessary to prevent the charge from overheating. When a steam jacket or closed steam coil is used, there is less danger of overheating; with open steam coils this danger is avoided. But with open steam, care must be taken to prevent accumulation of condensed water within the still. Therefore, the still should be well insulated. The plant material in the still must be agitated as the water boils, otherwise agglomerations of dense material will settle on the bottom and become thermally degraded. Certain plant materials like cinnamon bark, which are rich in mucilage, must be powdered so that the charge can readily disperse in the water; as the temperature of the water increases, the mucilage will be leached from the ground cinnamon. This greatly increases the viscosity of the water-charge mixture, thereby allowing it to char. Consequently, before any field distillation is done, a small-scale water distillation in glassware should be performed to observe whether any changes take place during the distillation process. From this laboratory trial, the yield of oil from a known weight of the plant material can be determined. The laboratory apparatus recommended for trial distillations is the Clevenger system.

During water distillation, all parts of the plant charge must be kept in motion by boiling water; this is possible when the distillation material is charged loosely and remains loose in the boiling water. For this reason only, water

distillation possesses one distinct advantage, i.e. that it permits processing of finely powdered material or plant parts that, by contact with live steam, would otherwise form lumps through which the steam cannot penetrate. Other practical advantages of water distillation are that the stills are inexpensive, easy to construct and suitable for field operation. These are still widely used with portable equipment in many countries. The main disadvantage of water distillation is that complete extraction is not possible. Besides, certain esters are partly hydrolyzed and sensitive substances like aldehydes tend to polymerize. Water distillation requires a greater number of stills, more space and more fuel. It demands considerable experience and familiarity with the method. The high-boiling and somewhat water-soluble oil constituents cannot be completely vaporized or they require large quantities of steam. Thus, the process becomes uneconomical. For these reasons, water distillation is used only in cases in which the plant material by its very nature cannot be processed by water and steam distillation or by direct steam distillation.

Water and Steam Distillation

In water and steam distillation, the steam can be generated either in a satellite boiler or within the still, although separated from the plant material. Like water distillation, water and steam distillation is widely used in rural areas. Moreover, it does not require a great deal more capital expenditure than water distillation. Also, the equipment used is generally similar to that used in water distillation, but the plant material is supported above the boiling water on a perforated grid. In fact, it is common that persons performing water distillation eventually progress to water and steam distillation. It follows that once rural distillers have produced a few batches of oil by water distillation, they realize that the quality of oil is not very good because of its still notes (subdued aroma). As a result, some modifications are made. Using the same still, a perforated grid or plate is fashioned so that the plant material is raised above the water. This reduces the capacity of the still but affords a better quality of oil. If the amount of water is not sufficient to allow the completion of distillation, a cohobation tube is attached and condensate water is added back to the still manually, thereby ensuring that the water, which is being used as the steam source, will never run out. It is also believed that this will, to some extent, control the loss of dissolved oxygenated constituents in the condensate water because the re-used

condensate water will allow it to become saturated with dissolved constituents, after which more oil will dissolve in it.

Direct Steam Distillation

As the name suggests, direct steam distillation is the process of distilling plant material with steam generated outside the still in a satellite steam generator generally referred to as a boiler. As in water and steam distillation, the plant material is supported on a perforated grid above the steam inlet. A real advantage of satellite steam generation is that the amount of steam can be readily controlled. Because steam is generated in a satellite boiler, the plant material is heated no higher than 100° C and, consequently, it should not undergo thermal degradation. Steam distillation is the most widely accepted process for the production of essential oils on large scale. Throughout the flavor and fragrance supply business, it is a standard practice. An obvious drawback to steam distillation is the much higher capital expenditure needed to build such a facility. In some situations, such as the large-scale production of low-cost oils (e.g. rosemary, Chinese cedarwood, lemongrass, litsea cubeba, spike lavender, eucalyptus, citronella, cornmint), the world market prices of the oils are barely high enough to justify their production by steam distillation without amortizing the capital expenditure required to build the facility over a period of 10 years or more.