CONTENTS

EXPERIMENT 1

STANDARDIZATION OF RECIPES

OBJECTIVE:

- To Know the standardizing of recipe and serving size
- To Know the standardize house hold measurement

STEPS TO DEVELOPING STANDARDIZED RECIPES:

- The first step to developing standardized recipes is choosing a recipe that it would like to prepare in facility.
- The recipe should be prepared and retested until a high-quality product is produced.
- Write down the recipe clearly on a standardized recipe form. Using a standardized form will ensure that all to the necessary information is complete. The recipe form enclosed can be duplicated and three hole punched so it can be filed in a 3-ring binder. It would be wise to number or code all recipes.
- The recipe form includes a space to write in exact ingredients and quantities either in volume measure or by weight. Weight is a more accurate measurement and should be used when a scale is available.
- List step-by-step directions for preparation and cooking, including needed preparation equipment, pan size, oven temperature, and cooking time.
- Include yield and serving size meets the meal pattern for the Food Based Menu Planning options. This information will allow referring to the recipe when filling out daily production records.
- Record the nutrient analysis of each recipe if it is available.

Standardized recipe form

Recipe Name———————— category ———————— recipe#————————

Ingredients	For ---- Servings		Directions
	Weight	Measure	

Serving size ———————— Temperature ————————
Minutes————
Yield ————————————

SELF ASSESSMENT QUESTIONS:

1. How to standardize a given recipe?

REFERENCES:

1. Lowe, B. “experimental cookery” starch, flour and bread. Chap. 12 p 388-395. 1955.

EXPERIMENT 2

STARCH
(PHYSICAL PROPERTIES OF STARCH)

OBJECTIVE:

- To study the swelling properties of different starch granules
- To demonstrate that starch thickened products increase in viscosity as the starch paste cools
- To study the factors affecting gelatinization of cornstarch.

PRINCIPLES:

1. starch granules will settle to bottom of the pan during cooking unless the starch mixture is stirred enough ti keep the starch granules evenly dispersed throughout the mixture.
2. Gelatinization is dependent on – ratio of liquid to starch (concentration of starch) and temperature to which the starch mixture is cooked.
3. The source of the starch will determine – the temperature required for gelatinization and the degree of thickening (consistency).
4. Gelatinized starch granule loses its thickening property as a result of hydrolysis of acid and rupture of granule by mechanical means (over stirring).
5. Volume of starch containing food increases as a result of swelling of starch granules.
6. Dextrinisation of starch reduces amount of gelatinization.

INTRODUCTION:

The thickening property of starch is due to fact that the hydrated starch has adhesive qualities, as cementing or binding material. Starch occurs in small particles known as granules. The granule size and shape are characteristic for each plant and can be identified under microscope.

Starch may be treated with water and heat that it swells enormously and forms a paste. Starch is hygroscopic. Larger granules of starch swell first followed by the smaller.

METHOD:

THICKENING PROPERTIES OF STARCH

Comparative thickening properties of corn starch, wheat flour, rice flour and arrowroot flour.

In a small vessel mix 1 level table spoon of the thickening agent with ½ cup cold water. Add the water gradually to avoid lumping.

Heat over a moderate flame until it comes to a boil. Stir constantly. Note the temperature at which the mix begins to thicken, the clearness of paste after boiling and the relative thickness of the paste.

Use viscosimeter (if available) or line spread test to find out the viscosity of the paste.

Compare with pastes of other types prepared in the laboratory. Record results

S. No	Source of starch	Temperature of thickening	Clearness of paste	Comparative thickness of paste
1.	Corn starch			
2.	Wheat flour			
3.	Rice flour			
4.	Arrowroot flour			

LINE SPREAD TEST:

Pour 2 table spoons of batter into the cylinder. Allow the batter to spread for 2 minutes. Quickly take 4 readings from the 4 sides of the line spread. The line spread is found by averaging the 4 readings. Calculate the area of spread of the batter in 2 minutes using the following formula.

Area of spread = $\eth r2^2 - \eth r1^2$

Where r1 is the radius of the cylinder given

Where r2 is the radius of the final circular spread of the batter

MICROSCOPIC EXAMINATION OF STARCH GRANULES (RAW AND COOKED)

Stain the different starch granules(corn, rice, wheat and arrowroot) with lugoles iodine solution and observe the size of the granuke under the microscope both in the raw and in the cooked state.

Scrape the surface of a cut potato and mount the raw starch granules with and without lugoles iodine. Draw the size and shape of the granules. Boil the potato for 15, 30, and 45 minutes. At the end of each period amount the cooked starch granules with lugoles iodine and observe change in size and shape both under low and high power of the microscope. Draw the starch granules.

SELF ASSESSMENT QUESTIONS:

2. Did you observe any difference in the microscopic structure of different starch granules? Why?

3. Did you observe any difference in the size and shape of starch granules after cooking? Why?

REFERENCES:

2. Lowe, B. “experimental cookery” starch, flour and bread. Chap. 12 p 388-395. 1955.

3. Morr, M.L. “ introductory foods” A laboratory manual of food preparation and evaluation.1970.

EXPERIMENT 3

GELATINIZATION OF STARCH

OBJECTIVE:

- To observe the effect of concentration, temperature, sugar and acid on gelatinization of corn starch.

BASIC RECIPE:

corn starch : 15 gms

Water : 236 ml

1. Moisten corn starch with a small amount of water in a small deep container. Add remaining water gradually stirring until all lumps have disappeared.
2. Cook over direct heat, stirring constantly until the temperature of the paste is 95^0C. Remove from the fire immediately and note the clarity of the paste.
3. Pour into custard cups. Allow it to cool and then keep it in the refrigerator. Note the clarity of the gel.

EFFECT OF CONCENTRATION ON GELATINIZATION:

Prepare the basic recipe by using 10, 15, 20 and 25 grams of corn starch. The different pastes should be three pastes into different custard cups and cool.

After removing from the refrigerator, invert gels on the plates and note gel height and firmness.

EFFECT OF TEMPERATURE ON GELATINIZATION:

Prepare five times than basic recipe in a deep pan of small diameter when the mixture has reached 70^0C, remove 1/50 of the substance in a custard cup. Repeat at 80^0C, 90^0C and 100^0C. Care should be taken to fill the cups to the same height. After cooling and keeping in the refrigerator note the firmness of the gel and gel height by inverting the gel on to a saucer.

EFFECT OF SUGAR ON GELATINIZATION:

Prepare the basic recipe without sugar and with 12.5 gm, 25 gm, 35 gm and 50 gm of sugar. Mix the sugar with the corn starch before adding water. Observe the different gels formed for firmness and note the gel height.

EFFECT OF ACID ON GELATINIZATION (1N CITRIC ACID = 70.05 GMS/100ML)

Prepare basic recipe using distilled water; 0.1N citric acid, 0.25N citric acid and 0.5N citric acid.

Note the clarity of paste; clarify of gel, consistency and taste of the gel in each case.

To observe the thickening property and jelling property of different starchy foods in comparison to corn starch.

PROCEDURE:

Prepare a sweet starch sauce as follows with corn starch, maida, wheat flour, arrowroot flour and rice flour.

3 tbsp. of starch or flout

2 tbsp. of sugar and 236 ml of water

Blend the starch or flour with the sugar thoroughly in a small saucepan add water gradually and blend well. Heat to boiling stir constantly. Boil for one minute. Pour in jelly mould and chill for several hours. Unmould onto a plate or saucer and test. Note gel height wherever possible. Tabulate the results.

SELF ASSESSMENT QUESTIONS:

1. Did you observe any difference in the microscopic structure of different starch granules? Why?
2. Did you observe any difference in the size and shape of starch granules after cooking? Why?
3. Define gelatinization. Explain clearly the effect of temperature, concentration of starch, sugar and acid on gelatinization.

REFERENCES:

1. Lowe, B. “experimental cookery” starch, flour and bread. Chap. 12 p 388-395. 1955.
2. Morr, M.L. “ introductory foods” A laboratory manual of food preparation and evaluation.1970.

EXPERIMENT 4

WHEAT COOKERY (PREPARATION OF BREAD)

OBJECTIVE:

a. To make the student understand the principles behind the preparation of bread and let them determine the effect of kneading and beating the dough on the final product.

b. To make them evaluate the final product, bread, objectively and subjectively.

c. To demonstrate the plasoelastic nature of gluten

PRINCIPLES:

1. Dry yeast is blended with warm water and sugar and held at a warm temperature, which causes the yeast cells to grow and multiply, yielding carbon dioxide gas for leavening action.
2. Kneading of dough develops extremely elastic gluten structure essential for holding gases on fermentation by yeast.
3. Kneading of dough more evenly distributes yeast cells throughout the sough structure for more even leavening action.
4. Kneading dough after first fermentation period further increases dispersion of yeast and gas cells.
5. Oven heat causes rapid increase in yeast activity with increase in loaf volume during first part of the baking period.
6. factors which contribute to the browning of the (a) dextrinization of the starch (b) caramalization of sugars, (c) millard reaction – interaction of CHO and protein.

METHOD:

Ingredients

Maida - 2 cups
Sugar – 1 table spoon
Salt – ½ tea spoon
Yeast dried – 1 pkt. Or ¼ oz or 7-8 gm.
Milk – ¾ cup
Fat – 2 tab. Spoon
Egg – one

1. Scald the mild and cool it to lukewarm. Measure lukewarm milk into a small bowl, and the fried yeast. Stir until blended. Add sugar. Stir until blended. Allow this yeast mixture to stand while measuring the remaining ingredients. The yeast activity is initiated.
2. Measure remaining ingredients; add the egg and 1 cup of the flour to the yeast mixture. Beat until the batter is smooth (about 100 strokes)
3. Add the shortening, salt and half of the remaining flour. Stir until the mixture is smooth and well blend. If the dough is sticky at this stage, add about half of the remaining flour, stir until well blended.
4. if the dough is still too sticky to turn out on a slightly floured board , add the remaining portion of flour and stir into dough. If the dough is not sticky at the end of step 3, use the flour which was put into the dough to lightly flour the bread board.
5. Put the dough on to lightly floured board. Knead the dough until it is lightly blistered under the surface of the dough; the dough has a satiny sheen; the dough has become resistant when punched lightly with the finger, the dough springs back.
6. Place the dough in a lightly greased bowl; lightly greased the surface of the dough. Allow the dough to rise at least 10 minutes. Cover with a paper towel or a clean damp cloth during fermentation. To double in bulk is preferable if time permits yeast grows best at a temperature of 80-85^{0}F. This temperature should be maintained during the rising period. When the dough has doubled in bulk, a light touch with the fingers leaves a depression.
7. Lightly knead the dough to evenly distribute gas cells.
8. Shape dough into rolls; place rolls in a well greased baking pan; it should come to the ends but not fill the end of the pan and should be about half of the height of the pan. A thin film of shortening on the surface will keep the rolls from drying during the proofing period.
9. Allow the shaped rolls to rise until double in bulk. This may take 20 minutes or longer; do not have rolls on too warm a place for this rising period. The dough should appear very light and loaf should nicely fill the pan; when pressed the mark should not remain, when small bubbles appear on the surface this indicates that the dough has reached a point when it must go in the oven.
10. bake rolls in an oven preheated to 400^0 F for 20-25 mints, when done the rolls should have a golden brown crust on both the top and bottom surface; the will sound allow when tapped. Immediately remove the rolls from the pans and leave uncovered on racks to cool. The tops may be brushed with melted butter.

OBJECTIVE EVALUATION OF THE PRODUCT:

1. Volume measurement by seed displacement method:

   Place the loaf of bread in a small, square enamel tray and fill the tray to the brim with mustard seeds. With the help of a 500 ml measuring cylinder read the volume of the mustard seeds. Remove bread and again fill the tray to brim with mustard seeds. Find out the volume of the seeds, with 500ml measuring cylinder. By difference, the volume of a loaf of bread is obtained.

2. Tenderness measurement:

   Determine the shortness of a slice of bread with a shortometer.

3. Texture study:

   Judge the distribution of gas in bread with the help of ink prints of slices of bread.

SUBJECTIVE EVALUATION:

Conduct sensory evaluation of bread with trained panel members. Prepare suitable score cards.

EXTRACTION OF GLUTEN AND A STUDY OF ITS EXPANDING CAPACITY:

Weight 30 Gms of wheat flour and make into stiff dough. Knead for a short time. Wash off the starch under running water leaving a small fraction of the original dough which is called crude gluten. Record the weight and volume. Bake the washed out gluten balls at 400^0F. Record the weight and volume of the baked gluten balls.

Repeat the above test with maida flour, rice flour, ragi flour and arrowroot flour. Tabulate and compare the results.

SELF ASSESSMENT QUESTIONS:

1. Did you observe any changes in the physical attributes of bread by varying the amount of kneading and excluding fermentation? If so, explain the changes.

2. what is an oven spraying?

REFERENCES:

1. Morr, M.L. " introductory foods" A laboratory manual of food preparation and evaluation.1970.

2. Lowe, B. "experimental cookery" starch, flour and bread. Chap. 12 p 388-395. 1955.

PREPARATION OF BISCUITS

OBJECTIVE:

- To provide an opportunity to compare quality characteristics of sweet and salt biscuits
- To provide an opportunity for the application of the objective test in the preparation of biscuits.

METHOD:

Ingredients:

Butter – 250 gm
Sugar – 30gm
Flour – 250 gm
Milk – 125 gm
Baking powder – 7.5 gm
Ajwain seeds – 2.5gm
Salt – ¼ tsp.

Mix the powdered sugar and fat with a spoon vigorously and the creaming is then continued for 2 minutes. During the mixing the sugar crystals and the fat are blended into a smooth fluffy mass. Sift again the salted flour with baking powder, milk and flour mixes are added alternately with small quantities of the flour mixture to the creamed fat sugar. Mix into a soft and smooth dough.

Set aside small cup of dough for objective measurements. Take the remaining dough and roll the thick dough and cut with biscuit cutter. Place it on the prepared baking pan. Bake at 375^0C and kept for about 15 minutes until brown colour obtain and then cool. Objective and subjective evaluations are following as per the bread preparation.

PREPARATION OF PLAIN CAKE

OBJECTIVE:

- To provide an opportunity to compare quality characteristics of baked cakes
- To provide an opportunity for the application of the objective test in the preparation of plain cake.

PRINCIPLES:

1. Cake flour protein produces a weak gluten structure.
2. Plastic fat can entrap air incorporated with addition of sugar to the fat during the creaming process. The amount of air incorporated is dependent on the make at which sugar is added to the fat. Amount of work done in creaming the fat and sugar after each addition of sugar.
3. Gluten formation is delayed or inhibited by sugar, fat, high ratio of liquid to flour and baking powder residues.
4. Emulsifiers in shortening give greater dispersion of the fat in the batter and the baked cake.

METHOD:

Ingredients:

Butter – 56 gm
Sugar(powder) – 100gm
Egg – 1 no.s
Flour – 150 gm
Milk – 122 gm
Baking powder – 5 gm
Vanilla – ½ tsp.
Salt – ¼ tsp.

Mix the powdered sugar and fat with a spoon vigorously and the creaming is then continued for 2 minutes. During the mixing the sugar crystals and the fat are blended into a smooth fluffy mass. After this, the egg yolks are beaten and added and the mixing is continued until all the ingredients are blended into a homogenous mass (1 minute). Sift again the salted flour with baking powder, milk and flour mix are added alternately with small quantities of the flour mixture to the creamed fat sugar egg base (3 minutes). The egg whites are beaten stiff and folded into the batter at the end.

Set aside small cup of batter for objective measurements. Take the remaining batter and pour into a weighed and prepared cake pan. Weigh the pan again. Bake at 370^0 F and kept for about 25 minutes to cool.

I. VARIATION IN THE PORTION OF INGREDIENTS:

1. Add 2.5 gm of baking powder.
2. Add 10 gm of baking powder (for these two recipes the rest of the ingredients are same as per standard recipe).
3. Stored egg.
4. Double the amount of butter 112 gms.

Take the ½ cup batter set aside and do the objective tests.

1. Temperature of the batter.
2. pH of the batter.
3. Specific gravity of the batter.
4. Line spread test.
5. Weight of the batter= weight of the cup+ batter – weight of the cup.
6. Volume measurement of the cake by seed displacement method.
7. Shortness of the cake with a shortometer.
8. Specific volume= $\frac{\text{Bulk volume of the cake}}{\text{Weight of the cake}}$

II. VARIATION IN THE METHOD OF MIXING:

Have all the ingredients at room temperature. Sift flour, baking powder, salt and sugar into mixing bowl. Add fat and part of the milk and flavouring. Beat vigorously with a spoon or mix with electric mixer as per instruction for 2 minutes. Scrap the bowl frequently. Add the remaining liquid and unbeaten egg. Continue beating for 2 more minutes. Keep the total time to 6 minutes.

Prepare basic recipe and the variations to evaluation. Compare them for differences in texture and flavour and other attributes.

SELF ASSESSMENT QUESTIONS:

1. What is creaming?
2. What are the differences between cake batter and bread dough?

REFERENCES:

1. Morr, M.L. " introductory foods" A laboratory manual of food preparation and evaluation.1970.

EXPERIMENT 5

PULSE COOKERY

OBJECTIVE:

- To know the effect of soaking time on pulse cooking
- To know the effect of ordinary and distilled water on cooking of pulses.
- To know the effect of acid and alkali on cooking of pulses.

METHOD:

EXPERIMENT I: EFFECT OF SOAKING ON PULSE COOKERY:

OVERNIGHT SOAKING:

Weigh about 80gm of red gram dhal and it is soaked for overnight later it is divided into four parts each of it about 20 gm. Then these 20 gm of dhal is cook with tap water, distilled water, alkali (baking soda) and in acid (citric acid or lemon juice).

Note the weight of dhal before and after soaking and cooking. Tabulate the results on texture, colour and time of cooking.

EXPERIMENT II: EFFECT OF 2 HOURS SOAKING ON PULSE COOKERY:

OVERNIGHT SOAKING:

Weigh about 80gm of red gram dhal and it is soaked for two hours later it is divided into four parts each of it about 20 gm. Then these 20 gm of dhal is cook with tap water, distilled water, alkali (baking soda) and in acid (citric acid or lemon juice).

Note the weight of dhal before and after soaking and cooking. Tabulate the results on texture, colour and time of cooking.

EXPERIMENT III: EFFECT OF WITHOUT PRIOR SOAKING:

WITHOUT PRIOR SOAKING:

Weigh about 80gm of red gram dhal and it is not soaked later it is divided into four parts each of it about 20 gm. Then these 20 gm of dhal is cook with tap water, distilled water, alkali (baking soda) and in acid (citric acid or lemon juice).

Note the weight of dhal before and after cooking. Tabulate the results on texture, colour and time of cooking.

All the variations are repeated with green gram dhal, peas, soya bean, and whole bengal gram dhal.

SELF ASSESSMENT QUESTIONS:

1. How does soaking affect the colour, texture and flavour of pulses?
2. Write the effect of acid and alkali on the texture of pulses?

REFERENCES:

1. Charley, H. Food Science. 1982.

EXPERIMENT 6

EFFECT OF DIFFERENT LEAVENING AGENTS IN INDIAN FOOD PREPARATION

(The role of leavening agents in the preparation of idli)

OBJECTIVE:

- To demonstrate the role of air, steam and carbondioxide as leavening agents in idli.
- Air is incorporated by vigorous grinding, carbondioxide is obtained by either biological or chemical sources and steam is due to the water added to the batter.
- Leavening is increasing the surface area by creating or occluding within it myriads of gas bubbles. The created gas is mainly co2. A leavening agent aerates a mixture and thereby lightens it. Leavening action may be produced by physical, chemical or biological means.

STANDARD OR BASIC RECIPE:

Parboiled rice – 2 cups
Blackgram dhal – 1 cup
Salt - 2 tsp.

METHOD:

1. Soak parboiled rice in 300ml of water and soak dhal separately in 200ml of water for 3 hrs.
2. Grind rice into a coarse paste, and blackgram dhal into a very smooth paste (a puffy mass). Use 250 ml of water during the entire grinding.
3. Mix rice paste, dhal paste, and salt together and set it for fermentation for 12hrs.
4. After fermentation add ½ tsp. soda to 1ml water, dissolve, and add to the batter and mix. Do not overmix.
5. Steam the batter by taking a leveled ladle (small) full of batter for each idli. Keep the steaming time (7 minutes) constant for all the samples of basic and variations. See that the water boiling when you keep the samples for steaming.

VARIATIONS:

Product 1: This will indicate the role of fermentation. Same as the basic but avoid fermentation.

Product 2: This will indicate the role of steam. Same as the basic but use only half the amount of water used for batter in basic.

Product 3: This will indicate the role of chemical leavening agents. (a) same as the basic recipe but avoid adding baking soda. (b) Same as the basic recipe but add 1 tsp. baking soda.

Product 4: a) prepare batter as given in standard recipe but add (60g) cup of sour butter milk and ferment. Check the pH of the butter milk.

b) Add ½ tsp. baking soda to the batter. Same as the basic recipe.

Product 5: Follow the basic. Add ½ tsp. baking powder to the fermented batter before cooking idlis.

Product 6: Follow the basic. Add 1 tsp. baking soda to the fermented batter before cooking idlis.

In all cases, the conditions must be controlled (with the exception of the variables) with respect to (a) proportion of ingredients. (b) Length of grinding time. (3) Method of mixing.

OBJECTIVE AND SUBJECTIVE EVALUATION:

1. Measure the weight and volume of the entire batter before and after fermentation and record the yield of idlies.
2. Measure pH of the batter prior to and after fermentation.
3. Record the specific gravity of the batter prior to and after fermentation.
4. Measure volume of the batter prior to and after fermentation using a 50 ml measuring cylinder. Transfer 25 ml of batter into measuring cylinder and record the level of batter after fermentation.
5. Take 100 ml batter and determine viscosity prior to and after fermentation by line spread test.
6. Measure the volume of one cooked idli in basic recipe and each variation by seed displacement method. Afterwards weigh the idlies and calculate the specific volume of one idli.
7. Do the microscopic observation of batters just before cooking.
8. Make the ink blots of cut section of idli.
9. Take the shortometer reading of idlies from basic recipe and variations
10. Do the subjective evaluation by scoring method. Use a descriptive score card.

SELF ASSESSMENT QUESTIONS:

1. Give example of other Indian preparations, where the action of leavening agents (natural) is same as in idli.
2. Compare the natural and artificial leavening agents and describe their actions.

REFERENCES:

1. Morr, M.L. “introductory foods” A laboratory manual of food preparation and evaluation.1970.
2. Lowe, B. “experimental cookery” starch, flour and bread. Chap. 12 p 388-395. 1955.

EXPERIMENT 7 (A)

VEGETABLE COOKERY

OBJECTIVE:

- To demonstrate the effects of cooking time on the colour and texture of vegetables.
- Effects of cooking time on vegetables with strong flavour and odour.
- Effects of cooking medium like, baking soda (alkali) and lime or tamarind juice (acid) and milk on the texture and colour of vegetables.
- Effects of different methods of cooking like (a) boiling (b) cooking covered and open (c) steaming (d) pressure cooking on the colour and texture of vegetables.

EXPERIMENT 1: EFFECT OF COOKING TIME ON VEGETABLES

Take four 30gms portions of the vegetables (1) green leafy vegetables (2) beans (3) carrots and (4) beat root. Add a cup of water to each. Cook the vegetables for 5, 15, 30, and 60 minutes. Cover the vessel with a suitable lid. Remove 10ml of water from each vessel into a test tube and ¼ of the vegetable on to plate. Note intensity of colour of extract in the test tube at each time interval. Note the colour and texture of vegetables each time. Discuss the results noted.

EXPERIMENT 2: EFFECT OF COOKING TIME ON VEGETABLES

Cook 100gm of cabbage in water sufficient to cover, in a distilling flask. Catch the distillate in a flask receiver held in ice water. After the water begins to boil count the time. Catch four portions changing the flask every three minutes. Cork the flask containing the distillate. Smell the distillates at the end of the class. Test for sulphide by adding few drops of lead acetate. Note the type of flavour you get the degree of difference in flavour.

EXPERIMENT 3: EFFECT OF COOKING MEDIUM ON THE COLOUR AND TEXTURE OF COLOURED VEGETABLES

Wash 125 gm of beans. Cut into 1" pieces and divide into 5 equal parts. Cook as follows.

Conventional way: take 100ml of tap water, bring it to boil and add one portion of the cut beans and cook for 20 minutes.

Repeat it with distilled water and cook for 20 minutes in covered vessel.

Effect of baking soda (alkali): Boil 100 ml of tap water to which 1/8 tsp. of baking soda is added. Now add the third portion of the cut vegetables and cook for 20 minutes in a covered vessel. Drain the water and put the vegetables on a plate.

Effect of lime juice (acid): Take again 100 ml of tap water and 1 tsp. of lime juice in a vessel. Bring it to boil and add the fourth portion of the vegetable. Again cook this for 20 minutes as previously, drain off the water and place on a plate.

Effect of milk: Take 100 ml of milk and boil. Now add the last portion of vegetable to milk and cook for 20 minutes.

These experiments also with:

Green leafy vegetables (chlorophyll)

Beet roots containing red pigment (anthocyanins)

Carrots containing yellow pigment (carotenoids)

Compare the colour, texture and flavour of the vegetables in each case and discuss the observations.

EXPERIMENT 4: EFFECT OF COOKING ON VEGETABLES CONTAINING VARIOUS PIGMENTS AND FLAVOURS.

PROCEDURE:

Preparation of vegetable: take about 25×7=175 gm of each of 4 varieties of vegetables – green beans, carrots, onions and green leafy vegetables. Clean the vegetables. Cut each variety of vegetable into pieces of equal size. Divide the whole weight into 7 portions of 25 gm each. Cook each vegetable by the different cooking methods (1. Boiling with minimum water covered. 2. Boiling with minimum water 3. Boiling prolonged time prolonged cooking. 4. Boiling for the first few seconds and covers. 5. Steaming. 6. Pressure cooking and 7. Raw vegetable). Take 25 gm of the vegetable for each method.

Immediately you take the sample out preserve it under cover.

Results:

Arrange all the cooked vegetables and the corresponding raw vegetables on the demonstration table. For each variety of vegetable there will be cooked samples by the 6 methods plus one uncooked sample. So there will be in total 35 samples to be arranged.

Note the colour, flavour and texture of each sample and discuss. Evaluate which method of cooking is most preferred by the class members for each vegetable.

SELF ASSESSMENT QUESTIONS:

1. What effects does covering the pan have on the flavour of cabbage and onions?
2. Do variations in cooking methods have as much effect on carrots as on the other vegetables tested?
3. How does prolonged cooking with excess water affect the colour, texture and flavour of a vegetable?

REFERENCES:

1. Halliday, E.G. and L. I. Nobel. " hows and whys of cooking" the university of Chicago press, Chicago.
2. Griswold Ruth, M. "The experimental study of foods", Vegetables and Fruits. 1962.

EXPERIMENT 7 (B)

VEGETABLE COOKERY

OBJECTIVE:

- To study the factors responsible for browning of vegetables and fruits.
- To demonstrate the effect of sugar, alkali, acid, heat and water and wet cloth on browning.
- To study the effect of reducing agents like sodium sulphite or inhibitors present in common foods, on fruits and vegetables.

DETERMINATION OF FACTORS RESPONSIBLE FOR BROWNING OF FRUITS AND VEGETABLES

EXPERIMENT 1: EFFECT OF FREEZING ON BROWNING REACTIONS

Cut the following vegetables and fruits into halves. Leave one half in the freezer and the other exposed at room temperature (use a clean stainless steel knife).

Apple, banana, tomato, guava, potato, brinjal and raw plantain

Study the extent of browning among all the fruits and vegetables and also between frozen and unfrozen samples of each vegetable.

Note: Take 25-30gm of the fruit or vegetable for each of the experiment in this practical.

EXPERIMENT 2: EFFECT OF METAL IONS FERROUS ON THE RATE OF BROWNING

Cut vegetables (a potato and a raw plantain) and fruits (banana and guva) with an iron knife and leave exposed at room temperature. Compare these with the unfrozen samples from experiment No. 1 at the end of the class.

EXPERIMENT 3: EFFECT OF CHANGING PH ON BROWNING REACTIONS

Take citric acid solution (1:4 citric acid : water, lime juice and ordinary water). Note the pH of these solutions and soak the cut pieces of vegetables and fruits and set aside. Examine the samples at the end of the class.

Similarly use alkaline water NaHCO3, Nacl (1tsp. in 100ml of water). Note the pH of these solutions and soak the cut pieces of vegetables and fruits and examine the samples at the end of the class (use pH paper in all these cases).

Note the intensity or browning with change of pH from acid to alkaline ranges.

EXPERIMENT 4: EFFECT OF HEAT ON BROWNING REACTIONS

Take the same vegetables and fruits, cut and put them in boiling water. Continue boiling for 3 more minutes. Remove the vegetables and fruits from the water and set aside. Note your observations at the end of the class.

EXPERIMENT 5: EFFECT OF PREVENTING OXYGEN FROM COMING INTO CONTACT WITH THE CUT SURFACE OF FRUITS AND VEGETABLES:

1. Sprinkle sugar on the cut surface of apple, banana, potato and brinjal immediately after cutting.
2. Soak the cut vegetables and fruits I water that has been boiled vigoursly for several minutes and cooled.
3. Soak the cut fruits (apple, banana) in sugar syrup and set aside.
4. Cover the cut vegetables and fruits with a wet cloth and set aside. Compare all the samples at the end of the class. The unfrozen samples in experimental no.1 are the controls.

   Note your observations and discuss.

EXPERIMENT 6: EFFECT OF REDUCING AGENTS OR INHIBITORS ON BROWNING REACTIONS

1. Sprinkle sodium sulphite on cut surface of the vegetables and fruits.
2. Sprinkle pineapple juice or glutathione or cystene on the cut surface of the vegetables (the two amino acids in very dilute concentrations).

Set aside the samples for observations at the end of the class. Assign reasons for your observations.

SELF ASSESSMENT QUESTIONS:

1. What is the difference between enzymatic and non-enzymatic browning?
2. From the observations made which are the factors responsible for browning in fruits and vegetables?
3. How can the occurrence of browning in fruits and vegetables be prevented in home environment?

REFERENCES:

1. Lowe, B. “experimental cookery”. 1965.
2. Mark, E.M., and G.F. Stewart. Advances in food research. 1951.

EXPERIMENT 8

MILK COOKERY

OBJECTIVE:

- To study the physical and chemical characteristics of raw and boiled milk.
- To demonstrate the effect of adulteration of milk on its protein quality.
- To demonstrate the effect of acid and heat on the protein of milk.

EXPERIMENT I:

NOTE THE FOLLOWING CHARACTERISTICS OF RAW MILK.

1. Record the PH by putting a drop f milk on PH paper in the range of 6 and above.
2. Observe fat globules of homogenised and non—homogenised milk under the microscope.
3. Observe colour of milk.
4. Record the boiling point of milk (this can be done under part B).

pH CHANGES OF MILK ON BOILING AND ON STORAGE:

Pour 100 ml of milk in an open vessel and boil. Note the boiling point. Let it cool. Note the PH while the milk is still warm, after one hour and two hours.

Let the milk stand overnight at room temperature and note the pH. (Use PH meter for all measurements).

Compare the pH at different periods on storage of milk and assign reasons for the changes observed.

EXPERIMENT II:

FORMATION OF SKUM OR SKIN AND CHARACTERISTICS OF ITS COMPONENTS:

Boil 100 ml of milk in an open vessel and allow it to cool without disturbing.

1. Note carefully the colour of the scum assign reasons for this.
2. Remove the scum and test a portion of it with biuret reagent – Note the change and give inference.
3. Dry remainder of the scum in an evaporating dish and extract the residue with small portions of ether. Take the ether extract into portions of ether. Take the ether extract into another evaporating dish and evaporate the ether. Spot a small portion of the residue on a paper and note your observations.

4. Ash the ether extracted residue in a silica dish and dissolve the ash with a small amount of HCl and the ash solution after neutralizing. Note the precipitate formed. Give your inference.

Identify the nutrients of the scum from the observations in these tests.

Note: set the basic recipe and all variations in katories of similar size and shape. Invert the set curd on to plates and compared the body, shape and texture. Taste each product and record observations.

EXPERIMENT 9

PREPARATION AND EVALUATION OF CHEESE, CURD AND ICE CREAM

CHEESE

EXPERIMENTS IN CHEESE

The objective is to demonstrate the best method of preparing cottage cheese.

EFFECT OF DIFFERENT TEMPERATURE UPON THE TEXTURE AND PREPARATION OF CURD IN MILK

Place 100ml of clabbered milk in each of beakers. Suspend each beaker in a large beaker containing water and suspend a thermometer in each beaker of milk. Heat slowly until the specified temperatures (in degrees C) has been reached.

Beaker 1 = 25^0C	Beaker 4= 55^0C
Beaker 2 = 35^0C	Beaker 5 = 75^0C
Beaker 3 = 45^0C	Beaker 6 = 95^0C

In each case held the temperature along enough for the curd to separate from the whey if separation is possible at the temperature used. Pour each portion through cheese cloth and allow it to drain. After the dripping has ceased press the files of the cheese cloth gently and score for the curd in terms of texture and volume.

Curd

The body, texture and flavor of curds set by different procedures.

RECIPE:

Ingredients: Milk- 200ml; starter- ¼ tsp

PROCEDURE:

Scald milk, cook at a temperature of 40^0C. Add starter, mix well, pour into cups (katories). Cover with alluminium foil and set aside for 16-18 hours.

VARIATIONS:

1. Repeat first step, but add starter to scalded milk without cooling.
2. Repeat first step, but add starter to cold scaled milk.
3. Repeat first step, but add 3tsp. of starter.

Observe which of the variations gives a good acceptable product with reasons.

ICE CREAM

OBJECTIVE:

- To prepare ice cream in the laboratory and to how the role of ingredients on the preparation of ice cream.

METHOD:

The steps followed in ice cream preparation are

- Calculation of preparation of each ingredient.
- Pasturisation
- Freezing of milk
- Ageing of milk
- Freezing of packing ice cream

The mix is pasturised at 71^0C for 30minutes.

BASIC ICE CREAM:

Ingredients:

Milk – 1lt
Sugar – 5tsp
Ice cream mix – 2tsp

METHOD:

Ice cream is prepared by boiling the milk and mix ice – cream powder with cold water and add this paste to milk and sugar to boiling milk and stir it, cool to room temperature. Pour it into an aluminum vessel and put it in deep freezer for setting. Remove it after 8-16 hrs.

VARIATIONS:

- Basic recipe.
- Basic recipe with corn flour to ice cream powder
- Basic recipe with milk is boiled to ¾ volume
- Basic recipe beaten once

NOTE: Note the characteristics like texture, taste, flavor, porosity and colour of different variations of ice cream in tabular form.

SELF ASSESSMENT QUESTIONS:

1. What effect changing temperature has upon the texture and volume of milk curds?
2. Who of the temperature had upon the texture and volume of milk curds?

REFERENCES:

1. Lowe, B. “experimental cookery” starch, flour and bread. Chap. 12 p 388-395. 1955.
2. Morr, M.L. “ introductory foods” A laboratory manual of food preparation and evaluation.1970.

EXPERIMENT 10

EGG COOKERY

OBJECTIVE:

- To study the qualities and characteristics of fresh and deteriorated eggs.
- To study the effect of temperature and time of cooking and procedures adopted to cook eggs on its thickening quality and development of green, iron, sulphur complexes.
- To study the role of eggs in coagulation, emulsification and foaming in mixed dishes along with the improvement of colour, flavor, and palatability.
- To demonstrate the various factors affecting the stability of egg white foams.

TESTS FOR QUALITY AND FRESHNESS OF EGGS:

EXPERIMENT 1: PH AS A DETERMINANT OF EGG QUALITY:

Break one fresh and one stored egg (stored for more than 3 days) into two different plates. Note the difference in pH of both yolk and albumin with the help of a pH indicator paper (pH indicator range – 6 and above). Note yolk height and thickness of albumin also. Comment on the differences observed.

EXPERIMENT 2: YOLK AND ALBUMIN INDEX IN FRESH AND STORED EGGS:

Take one fresh egg, break it and carefully pour the contents on a flat glass plate, measure the height of the yolk by inserting a thin broom stick at the centre and carefully holding it on a measuring scale. Also measure the width of the yolk spread with the broom stick held at 2 or 3 different places calculate the mean width or diameter. Now find the yolk index using the formula.

$$\text{Yolk index} = \frac{\text{Height of the thick yolk}}{\text{Width of the yolk}}$$

For measuring albumin index measure the height of the thick albumin at a nearer point to yolk by carefully inserting a broom stick and carefully holding it on to a scale. Now measure the width of the thick albumin spread at two or three different places. Calculate the mean width. Now find the albumin index using the above formula.

$$\text{Albumin index} = \frac{\text{Height of the thick albumin}}{\text{Width of the albumin}}$$

Repeat the experiment with a deteriorated egg and note the yolk and albumin index. Is there any difference in the measurements made? Assign reasons for this.

CONDITIONS FOR COOKING EGGS WITHIN THE SHELL, IN WATER:

(Coagulation of egg yolk and egg white)

EXPERIMENT 3:

Determination of the effect of different temperatures and time of cooking on coagulation and texture of the white and yolk of egg

1. Cook egg in water, maintained at different temperatures and time as specified below in the table.

Take a large quantity of water as it is easy to maintain the temperature. Lower the heat after the desired temperature is reached, cook in each case for the desired time and then remove.

Sl. No	Temperature^0 C	Time (Minutes)	Score for texture & firmness	
			Albumin	Yolk
1.	70			
2.	80			
3.	100			
4.	100			
5.	100			
6.	100			

Note: maintain the temperature by adding cold water and keep the flame in sim.

Which of these gives a tender and desirable product for eating? Why?

EXPERIMENT 4:

EFFECT OF TEMPERATURE, TIME OF COOKING AND TYPE OF COOKING UPON THE FORMATION OF A GREEN RING IN A HARD COOKED EGG:

Boil 2 fresh and one deteriorated egg (mark on the egg shell with lead pencil) for 15 minutes. Remove from fire and take out one fresh egg, immediately and put it in running cold water, cool the other two eggs, in the water used fro boiling. After cooling first remove the shell and then remove the white and note the difference in the two varieties.

Cook another egg for 30 minutes at 80 and cool it immediately in cold running water and observe for the green ring formation.

Compare all these eggs with each other and with the eggs cooked for 2, 5 and 10 minutes at 100^{0}C in experiment No. 3

EXPERIMENT 5:

FUNCTION OF EGG AS A FOAMING AGENT:

Basic recipe: Take egg white 25 gm.

1. Support a funnel, containing filter paper, with diameter of about 125 mm. on a stand. Under the funnel place a 100ml graduated cylinder.

2. Using a bowl and rotary beater chosen as standard for this experiment, beat the egg white until it is stiff enough to hold a peak but still is shiny. Note the time required for beating.

3. Transfer all the beaten egg white to funnel using a plate scraper or spatula. Cover with a watch glass or plastic film. Compare the volume of the foams after they are in the funnels.

4. Record the volume of liquid drainage into the cylinder from the egg white foam every 10minutes. For a period of 1 hour.

5. Draw a graph of the results with drainage time in the X axis and ml of liquid drained from egg white foam on the Y axis.

VARIATIONS:

A. Type of beater –

1. Rotary beater choosen as standard.

2. Electric mixer using a small mixing bowl and the highest speed.

B. Extent time of beating constant for both:

1. Beat half the time of the standard.

2. Beat half the more than the standard.

EXPERIMENT 6:

FUNCTION OF EGG AS EMULSIFYING AGENT – PREPARATION AND EVALUATION OF MYONNASE:

RECIPE:

Sugar	: ¼ tsp.	Salt	:1/8 tsp.
Mustard powder	:1/8 tsp.	Egg yolk	:8 gm.
Vinegar	:7.5 ml	Oil	:55 gm.

METHOD:

1. Have all ingredients at room temperature. Mix the sugar, salt and mustard in an enamel bowl that fits the beater well.
2. Add the egg yolk and half the vinegar. Beat with a rotary or electric beater until well blended.
3. Add 2 tbsp. of the oil a few drops at a time, beating constantly when electric beater is used, the additions of 4 tbsp. of oil should require 5 minutes speed (use speed 4 if there are 10 speeds). Scrape the sides of the electric beater each time.
4. Add the remaining vinegar and blend.
5. Add the remaining oil, about a table spoon at a time beating constantly.

VARIATIONS:

A. Method of mixing:

   1. Mix the basic recipe with rotary beater.
   2. Mix the basic recipe with an electric beater.

B. Method of adding ingredients:

   1. Use the basic recipe except add all the vinegar to the egg yolk and seasonings.
   2. Use the basic recipe except add half the vinegar to the egg and seasonings and the remaining half after all the oil has been added.
   3. Use the basic recipe except add all the oil at a time.

C. Variations in the emulsifying agent:

   1. Use twice the egg yolk in the basic recipe.
   2. Use half the egg yolk in the basic recipe.
   3. Use 8 gm. of whole egg, instead of egg yolk.
   4. Mix 1 tbsp. of corn starch with ¼ cup of water. Cook until clear, stirring constantly. Cool to room temperature. But not until form. Make mayonnaise basic recipe using 1 tbsp. of this corm starch paste and 4 gm. of egg yolk instead of 8 mg of egg yolk.

D. Variations in the amount of vinegar:

   1. Make mayonnaise using 4ml of vinegar.
   2. Make mayonnaise using 15ml of vinegar.

E. Use of broken emulsions:

   If the oil in the mayonnaise from any experiment separates, reemulsify it by adding egg yolk gradually while beating constantly. Examine all the mayonnaise preparations under the microscope. Test the stability of the emulsion in each case by weighing 10 gm. Sample into a centrifuge tube, centrifuging at top speed for 15 minutes and observing the separated oil.

Results: record results as follows:

Attributes of mayonnaise

Variations	Stiffness	Colour	Flavor	Stability (volume of oil separated)	Microscopic appearance of emulsion (draw the size and shape of fat globule)
Basic					
Method of mixing					
Method of adding ingredients					
Variations in emulsifying agent					
Variations in amount of vinegar					

SELF ASSESSMENT QUESTIONS:

1. What is difference you observe between a rapidly cooled egg and a slowly cooled egg?
2. Demonstrate the preparation of a standard mayonnaise?

REFERENCES:

1. Dr. Swaminathan. Food science chemistry and experimental foods. 1990.

EXPERIMENT 11

MEAT COOKERY

OBJECTIVE:

- To acquaint the students with the different cuts of meat (breast, shoulder, leg etc.).
- To demonstrate the effects of different methods of cooking on meat cuts.
- To demonstrate the tenderizers on texture of meat.

DIFFERENT CUTS OF MEAT:

Study the lamb chart and identify the different cuts from a fresh carcass.

Tender cuts: these include the prime rib roasts, steaks or roasts from the loin and sirloin, leg of lamb, fresh port hams and port, lamb and veal chops.

Less tender cuts: these are used for pot roasts swin steak braised meat dishes stews and soups. If ground meat is cooked as a tender cut.

METHODS OF COOKING MEAT

BRAISING

EXPERIMENT 1:

Less tender cuts from the weak flank rounds or muscles from rounds should be taken for the purpose. Braising is a process of cooking meat slowly in a covered utensil in a small amount of liquid or steam. The cooking can be done either in top of the stove or in the oven. Brewing in a small amount of fat before steaming is an optimal stop in braising.

Set the electric oven at 360^0F. Take sauce pan and add 15 gm fat (1tbsp). Brown the meat well in all sides, slip a small rack under the meat, add ¼ cup of water and over tightly. Change temperature of the meat to 185^0F. Add more water during cooking if necessary. After the meat has been browned, it is cooked slowly on top of the range or in an oven at 350^0F about 1 hour in total will be required for cooking.

EXPERIMENT 2:

Roasting means, cooking in covered in dry heat. Wipe the roast with damp cloth; place the leg of lamb on a rack in an open pan. Standard temperature of roasting is 150^0C. Constant oven temperature or the meat is first seared at 250^0C for 20 minutes and then cooking is done at 125^0C. For roasting meat is placed on flat open pan with a rack if the bony structure is not sufficient to keep the meat cut of the drippings. The meat is not basted and no water is added. Salt is not added for experimental purpose.

VARIATION:

1. Use standard oven temperature 150^0C.
2. Use constant oven temperature 163^0C.
3. Roast in a covered pan.

4. First sear the meat at 250^{0}C for 20 minutes and the dcook at 125^{0}C.

BROILING:

EXPERIMENT 3:

Tender cuts are preferable for this method of cooking. Broiling, pan broiling and frying are quick methods of cooking meat by dry heat. In broiling heat is directly applied to meat whereas in pan broiling the meat is put into a hot pan and no fat is added during cooking as fats pours out from the meat.

For pan broiling use a beally metal skillet and adjust so that the heat is uniform and is not too rapid. Place the thermometer at the bottom of the skillet and heat until desired temperature is maintained before the steak is till an interior temperature of 75^{0}C.

EXPERIMENT 4:

Cooking meat in water:

This is used for less tender cuts of meat. Cut the meat into cubes of the desired size and cook in covered vessels. Amount of water must be sufficient to cover the meat. Use 2 gm of salt per pound of meat.

EXPERIMENT 5:

Method of preparing brown stew:

Cut meat into cubes. Dredge meat cubes with flour. Add salt, sear in hot pan (searing means placing the meat on an open pan in a hot oven for a few minutes) using fat. Cook cubes at simmering temp. 85-90^{0}C. put browned cubes in heated water. Add desired amount of water but it should not be more than the amount of broth that covers meat and vegetables when served.

Variations: one may cooked without searing.

Results: record the palatability scores for tenderness, colour, texture and flavor in all the methods of cooking applied. For testing tenderness apply sheer test and also by subjective test the scorer.

EXPERIMENT 6:

Methods of tenderizing meat:

Less tender cuts of meat are used.

Use of enzymes: Use papain for the purpose. Soak tough meat in a solution of papain (1 tsp. papain in 100ml of water) and cook. Note the time taken to cook.

Variations:

1. Cooking meat without the enzyme.
2. Cooking meat with ½ tsp. of enzyme in 100ml of water.
3. Cooking the meat with 1 tsp. of enzyme in 100ml of water.
4. Cooking the meat with 100gm raw papaya.

In each case note the time taken to cook. Cook in sim.

EXPERIMENT 7:

Effect of acid on meat during cooking:

Venigar is generally used for cooking. Soak meat in venigar solution (3tbsp. venigar diluted to 50ml) for one hour. Use less tender cuts and do it for roasting or stewing.

Variations:

1. Use curds and cook.
2. Use tomato juice and cook.

The meat should get covered with the liquid used. Tabulate the results for (1) time of cooking (2) scores for the different attributes like tenderness, colour, taste and texture and discuss.

SELF ASSESSMENT QUESTIONS:

1. Which of these temperatures and methods of cooking gives a good acceptable product?
2. What is the type of heat application for the different methods of cooking? How does this method affect the less tender and cuts?
3. Which of the variation in cooking takes less time and yields a better cooked product?

REFERENCES:

1. Griswold, R.M., “the experimental study of foods”. 1962.
2. Dr. Swaminathan. Food science chemistry and experimental foods. 1990.

EXPERIMENT 12

FATS AND OILS

Objective:

- To demonstrate the effects of different smoking points of fats on deep fat fried foods.
- To show the effect of different amounts of added substances like egg yolk sugar, salt, vinegar in mayonnaise.

EXPERIMENT 1:

SMOKE POINT OF FATS AND OILS

Comparison of smoke points of several fats and oils:

Weight 50 gm of each fat sample (ground nut oil, gingelly oil, coconut oil, dalda, refined oil and ghee) into a small katori. The top of the fat when melted should be at least ½ inch below top of the dish. Heat the sample in a well ventilated area where smoke can be seen against a dark background. Put the evaporating dish on sim over a wire gauge and be careful that the flame never comes up around the sides of the dish. Heat the fat until it gives off continuously a thin bluish smoke. Observe the temperature. If slight puff of smoke appears before the sample begings to smoke continuously, it should be disregarded. Cool reheat and observe the smoke points again. Repeat the same the third time and note smoke points.

Each time of heating along with the smoke point also determine the changes in viscosity (by capillary flow) and colour.

Results: compare the smoke points of the various fats and oils with each other and with published values.

EXPERIMENT 2:

To demonstrate the effects of oils with different smoking points on foods:

Take 50gm of wheat flour and prepare poori using the fats and oils given above. Compare the taste, texture and the amount of oil absorbed by the prepared product. Tabulate the results and indicate which product is the best.

Weight of frying pan and oil before frying – weight of frying pan + oil after frying

SELF ASSESSMENT QUESTIONS:

1. How does the smoking point of a fat effect its use in deep fat frying?
2. How do monoglycerides affect smoke points?

REFERENCES:

1. Dr. Swaminathan. Food science chemistry and experimental foods. 1990.

EXPERIMENT 13

SUGAR COOKERY

OBJECTIVE:

- To know the properties of solutions having either sugar or salt.
- To learn about the stages of sugar cookery in candy making and effect of certain ingredients on the stages of cookery of sucrose solution.

MATERIALS REQUIRED:

Thermometer, cooking equipment, bowl of cold water, tartaric acid, glucose and jiggery

STAGES OF SUGAR COOKERY IN CANDIES MAKING COMPARISON WITH COLD WATER:

Dissolve lump of sugar in ½ cup of water. Bring the solution to boil. Remove ½ tea spoon of sugar solution and dropped into cold water. All at each of the following temperature should test stage of sugar solution i.e. 105^0C, 111^0C, 113^0C, 118^0C, 120^0C, 127^0C, 145^0C and 175^0C.

EFFECT OF GOLDEN SYRUP, GLUCOSE, DEXTROSE, JAGGERY ON STAGES OF COOKING OF SUCROSE SOLUTION:

1. Dissolve ½ cup of sugar and ½ cup of golden syrup in ½ cup of water and proceed the same as stages of sugar cookery.
2. Dissolve ½ cup of sugar and ½ cup of glucose in ½ cup of water and proceed as stages of sugar cookery.
3. Dissolve ½ cup of sugar and ½ cup of dextrose syrup in ½ cup of water and proceed the same as stages of sugar cookery.
4. Dissolve ½ cup of sugar and ½ cup of jaggery syrup in ½ cup of water and proceed the same as stages of sugar cookery.

Tabulate the results and compare with different temperature of various sugar solution and different stages of cooking.

REFERENCES:

1. Dr. Swaminathan. Food science chemistry and experimental foods. 1990.

EXPERIMENT 14

SUGAR COOKERY

Crystallization and factors affecting crystallization

OBJECTIVE:

- To acquaint the student with selected factors which affect crystallization of sugars from syrup mixtures.

a. Concentration of sugar.
b. Temperatute of cooking.
c. Extent of agitation.
d. Addition of interfering agents.

- To give students an opportunity to study these factors in the preparation of a fondant.

METHOD:

Crystallization from a concentrated sugar solution in fondant

PART A:

Sugar – 20gm. Distilled water – 118ml.

Put the ingredients in a sauce pan. Stir slightly but not enough to distribute sugar on the sides of the pan. Suspend the thermometer in such a way that the bulb is in the centre of the sugar solution. Cover the pan with a piece of aluminum foil pressed against the thermometer and sides of the pan, this permits steam to dissolve any sugar crystals that may be on the sides of the pan. Try to regulate the heat so that the total cooking time is about 15 minutes. Remove the aluminum foil after the syrup has boiled for about 3 minutes so that water can evaporate. Cook until the temperature is 115^0C. Record the cooling time. Transfer immediately to a bowl taking care not to remove crystals from the sides of the pan. Allow to cool to 50^0C. Note whether crystals form on the surface while the syrup is cooling. Beat rapidly and vigorously with a wooden spoon until stiff. The beating must be continuous. Record beating time. Immediately after beating pickup fondant and working time. Immediately after beating pickup fondant and work with hands until all the lumps have disappeared and a smooth consistency is obtained.

PART B:

Effect of added substances on fondant made with distilled water:

1. Prepare fondant by according to the basic recipe adding 0.2 g of cream of tartar.
2. Prepare fondant by adding 0.8 g of cream of tartar.
3. Prepare fondant by adding 12 g of butter.
4. Prepare fondant by adding 80 g of jiggery syrup.

PART C:

Effect of beating temperature and beating time on fondant:

Consistency:

1. Prepare fondant according to basic recipe, but beat the syrup after it has cooled to 70^0C.

2. Repeat C(1) but beat the syrup immediately after cooking.

3. Repeat C(1) but beat the syrup slowly after it has cooled to 50^0C and decrease the time of beating. Record the beating time.

Examine the crystals in the fondants prepared by all the methods stated above under the microscope. Make drawings of the crystals in each case paying attention to the size and shape of the crystals.

Note: In every case examine the crystals again after one week of storage of the fondant.

Microscopic examination of crystals:

Take a dry, clean microscopic slide. Transfer a drop of turpentine to the slide, a tiny grain of candy from the center of the ball of the fondant. Press a cover slip on it and move it until a thin layer of crystals is obtained. Examine the slide under the microscope under low and high power.

REFERENCES:

1. Charley, H. Food Science. 1982.

EXPERIMENT 15

MICROBIAL ANALYSIS OF FOODS

OBJECTIVE:

- To determine the total number of microorganisms present in food products.
- To determine the presence of coliform bacteria in the selected food products.

PRINCIPLE:

The presence of microorganisms in food may be considered harmful in some cases, while in others it is definitely beneficial. Certain microorganisms necessary in preparation of foods such cheese, pickles, sauerkraut, yogurt, and age. The presence of other microorganisms, ever, is responsible for serious and some- fatal food poisoning and toxicity as well as age. As with milk or water, the presence and number of coliform bacteria and other enteric organisms in food is indicative of fecal contamination and may suggest the presence of pathogens.

MATERIALS:

Samples of thawed frozen vegetables, ground beef and dried fruit.

MEDIA:

Per designated student group: nine brain-heart infusion agar deep tubes, three eosin—methylene

Blue agar plates, three 99-ml sterile water blanks, and three 180-ml sterile water blanks.

EQUIPMENT:

Bunsen burner, water bath, Quebec or electronic colony counter, balance, sterile glassine weighing paper, Waring blender with three sterile jars, sterile Petri dishes, 1-mi pipettes, mechanical pipetting device, inoculation loop, and glassware marking pencil.

PROCEDURE

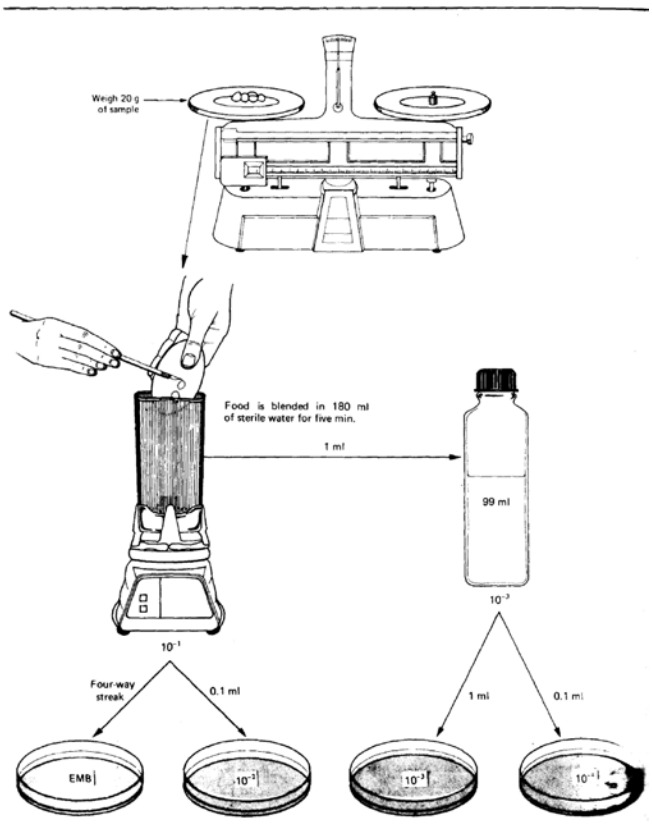
1. Label three sets of three Petri dishes for each of the food samples to be tested and their dilutions (10^{-12}, 10^{-3}, 10^{-4},). Label the three eosin—methylene blue agar plates with the names of the food.
2. Melt the brain-heart infusion agar deep tubes in a water bath, cool, and maintain at 45°C.
3. Place 20 gm of each food sample, weighed on sterile glassine paper, into its labeled Waring blender jar. Add 180 ml of sterile water to each of the blender jars and blend each mixture for 5 minutes. You will have made a 1:10 (10^{-1}) dilution of each food sample.

4. Transfer 1 ml of the 10^{-1} ground beef suspension into its labeled 99-mi sterile water blank, thereby effecting a 10^{-3} dilution, and 0.1 ml to the appropriately labeled 10^{-2} Petri dish. Shake the 10^{-3} sample dilution, and using a different pipette, transfer 1 ml to the plate labeled 10^{-3} and 0.1 ml to the plate labeled 10^{-4}. Add a 15-ml aliquot of the molten and cooled agar to each of the three plates. Swirl the plates gently to obtain a uniform distribution and allow the plates to solidify.

5. Repeat step 4 for the remaining two 10^{-1} test food sample dilutions.

6. Aseptically prepare a four-way streak plate, as described in Experiment 2, and inoculate each 10^{-1} food sample dilution on its appropriately labeled eosin—methylene blue agar plate.

7. Incubate all plates in an inverted position for 24 to 48 hours at 37 °C.



Preparation of food sample for analysis

OBSERVATIONS AND RESULTS:

Using either the Quebec or electronic colony counter, count the number of colonies on each plate. Count only statistically valid plates that contain between 30 and 300 colonies. Designate plates with fewer than 30 colonies as too few to count (TFTC) and plates with more than 300 colonies as too numerous to count (TNTC).

Determine the number of organisms per milliliter of each food sample on plates not designated as TFTC or TNTC by multiplying the number of colonies counted by the dilution factor.

Record in the chart the number of colonies per plate and the number of organisms per milliliter of each food sample.

Type of Food	dilution	Number of colonies per plate	Number of organisms per ml
Ground beef	10^{-2}		
	10^{-3}		
	10^{-4}		
Frozen Vegetables	10^{-2}		
	10^{-3}		
	10^{-4}		
Dried fruits	10^{-2}		
	10^{-3}		
	10^{-4}		

Examine the eosin-methylene blue agar plate cultures for colonies with a metallic green sheen on their surfaces, which is indicative of E. coli. Indicate in the chart the presence or absence of E. coli growth and the possibility of feacal contamination of the food.

Sample	E. coli (+) or (-)	Fecal contamination (+) or (-)
Ground beef		
Frozen Vegetables		
Dried fruits		

SELF ASSESSMENT QUESTIONS:

1. Indicate some possible ways in which foods may become contaminated with enteric organisms.

REFERENCES:

1. James, G. Microbiology Laboratory manual.1999.

EXPERIMENT 16

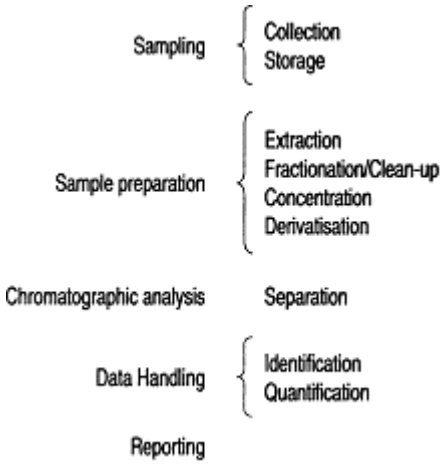
TESTS FOR PESTICIDE RESIDUES

OBJECTIVE:

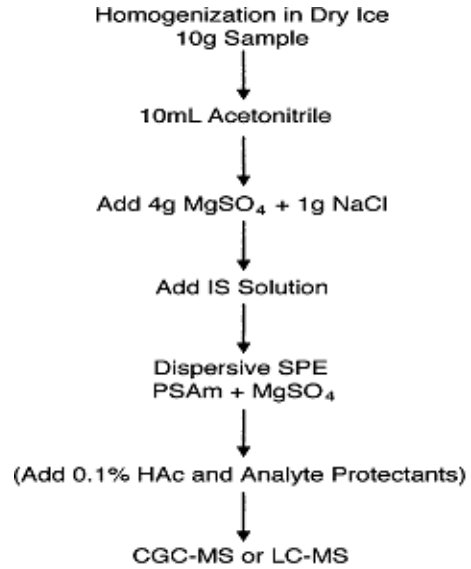
- To determine the pesticides residues in foods.

SAMPLE PREPARATION:

Food samples are usually too dilute (e.g., beverages) or too complex (e.g., meat) for direct analysis of trace contaminants and residues. Therefore, sample preparation, including homogenization, extraction, fractionation/clean-up, concentration and/or derivatization, normally precedes the analysis of food contaminants and residues showed in below figure.



Flow diagram for the analysis of contaminants and residues



Flow diagram for the solid phase extraction

CHROMATOGRAPHIC TECHNIQUES:

Thin-layer chromatography (TLC):

TC can be used for screening purposes in the analysis of pesticides. Because of its low resolving capacity, low precision, and limited detection relative to GC and HPLC, it is not used as a quantitative method. However, TLC can be used as a semiquantitative method that precedes more accurate detection and quantification. An example application is the detection and estimation of pesticides that inhibit insect enzymes such as cholinesterases. Several OP and carbamate insecticides are capable of inhibiting this group of enzymes. Once a crude extract is separated by TLC, the plate is sprayed with a solution containing the enzyme(s), followed by a solution containing a specific substrate, which releases a colored product upon hydrolysis. The lack of color change indicates enzyme inhibition, due to the presence of pesticide residues, and the zone of inhibition is proportional to the quantity of pesticide present.

Gas Chromatography:

Recently, with the development of fused silica capillary columns a large number of pesticides with similar physical and chemical properties can be separated and detected. In general, GC is the preferred method for the determination of volatile and thermally stable pesticides, such as the OC and OP classes. Choice of columns and detectors is made based on the nature of the pesticides. For example, 5% diphenyl, 95% dimethylpolysiloxane stationary phase columns are commonly used in MRMs. Pesticides often contain hetero atoms, such as O, S, N, Cl, Br, and F, in a single molecule. Therefore, element-selective detectors are often used, such as a flame photometric detector (FPD), which is suited for the detection of P-containing compounds. The FPD is widely used for the detection of OP pesticides in various crops, without extensive cleanup required. For the determination of OC, the electron capture detector (ECD) is used extensively due to its high sensitivity to organic halogen compounds. With a MRM approach for multiclass detection, and using these selective detectors, several GC injections are required, which is a limitation for conventional GC analysis. Additionally, identification in conventional GC analysis is highly dependent on retention time, which is not an absolute confirmation of identity, due to matrix interferences. Coupling of fused capillary columns to the highly specific and sensitive MS detection enhances not only the confirmation process, but also the quantitative determination.

High-Performance Liquid Chromatography:

Development of HPLC analysis for the separation and detection of pesticides became a necessity as the number of pesticides with poor volatility, relatively high polarity, and thermal instability increased. Classes such as *N*-methyl carbamate (NMC), urea herbicides, benzoylurea insecticides, and benzimidazole fungicides are typically analyzed by HPLC. These compounds are often analyzed by reversed-phase chromatography (Chap. 28, Sect. 28.3.2) with C18 or C8 columns and aqueous mobile phase, followed by UV absorption, UV diode array, fluorescence, or MS detection (Chaps. 22 and 26). Following exhaustive cleanup, phenylurea herbicides can be determined quantitatively, with enhanced selectivity and sensitivity by HPLC separation and UV detection at 254nm (23). For the detection of benzimidazole fungicides, fluorescence is more sensitive than UV detection (4). When the sensitivity of UV and fluorescence detection is poor, postcolumn derivatization can be employed. For example, NMCs are determined following a postcolumn hydrolysis and derivatization coupled with fluorescence detection (4). Postcolumn derivatization, however, requires special equipment such a mixing chamber and a reactor, which

might not always be available. Additionally, interference from other compounds having fluorescence properties is a major disadvantage. Analysis of pesticides in complex systems following conventional HPLC analysis using fluorescence or UV is often inadequate. Even the use of diode array detection might not be specific enough to resolve spectral differences, which are often too small. Utilization of MS detection widened the scope of HPLC analysis of pesticides. LC-MS is becoming one of the most powerful techniques for the analysis of polar, ionic, and thermally labile pesticides.

SELF ASSESSMENT QUESTIONS:

1. Explain the importance of each of the steps in sample preparation for the analysis of pesticide residues.
2. How to analyze pesticide residue by gas chromatography?

REFERENCES:

1. Suzanne Nielsen, S. Chemical analysis of foods. 2002.

EXPERIMENT 17

DETERMINATION OF AFLATOXIN

A wide spectrum of fungi infests most of the agricultural produce including Food grains and feedstuffs under warm humid conditions, especially when the moisture content of the stuffs is high. Storage fungi such as Aspergillus sp., *Penicillium sp., Fusarium sp.* etc. grow very commonly on the moist material and make them unfit for human/animal consumption. During their growth on the materials, fungi elaborate certain metabolites called mycotoxins which are toxic to the consumer. Continuous intake of fungus-contaminated material leads to the damage of liver and kidney by the toxic substances. In severe cases liver cancer and nephropathy of kidney are produced, ultimately resulting in death. Asperigillus sp. are the most widely contaminating fungi producing aflatoxins B1, B2, and G2. Because of the potential health hazards produced by these toxins even in minute amounts, a watch over their presence in various food materials is very much inevitable. Although a large number of procedures and chemical methods are available for the identification and estimation of aflatoxins, the following method is simple and can be performed without any sophisticated equipment.

MATERIALS

- Thin Layer Chromatography (tlc) Kit
- Ultra-Violet (UV) Chamber
-Mechanical Shaker
- 'Quick-fit' Distillation Set
— Toluene
— Ethyl Acetate
— Formic Acid
— Chloroform
— Silica Gel G (tlc Grade)

PROCEDURE:

1 Weigh exactly 50g of ground sample material and transfer it into a 250mL conical flask.

2 Moist the material uniformly by adding 10—l5mL of distilled water and add about 200mL chloroform, stopper the mouth with a cotton plug in aluminium foil.

3 Shake the flask for one hour mechanically. (It is important that the oil-containing materials are defatted prior to extraction.)

4 Filter the slurry through a Büchner funnel under mild suction. Equal amount of a filtering aid such as ceite may be mixed before filtering in order to ease filtration. Wash the flask and the slurry thoroughly with additional chloroform (25mL) and collect the filtrate.

5 Transfer the filtrate quantitatively to a separatory funnel and shake with water one-half volume of chloroform. After the phases separate, drain the bottom (chloroform) phase into a flask containing about10g sodium sulphate (anhydrous) to absorb any water.

6. Concentrate the clear, chloroform extract 'under vacuum' over a warm water bath using quick fit distillation set. Make up the concentrate to a known volume with chloroform and store in amber-coloured vials under refrigeration until analysis.

PREPARATION OF TLC PLATES

1. Place 30g silica gel G (with CaSO4 as binder) in a stoppered flask, share vigorously with 60-65mL distilled water for about one minute, transfer to the applicator and spread uniformly on five clean glass plates (20 x 20cm). The exact quantity of water required to get a good slurry will vary from batch to batch of silica gel G. The thickness of layer should usually be 0.25mm.

2. Allow the plates to dry for 1—3h in dust-free conditions. Activate the gel, prior to use, for 30 mix at 110°C in a hot-air oven. The activated gel plates should be stored in a desiccator chamber.

3. Divide the gel into a number of lanes by drawing lines on the gel with a sharp needle

4. Spot different known volumes (5, 1QuL etc.) of the sample extract in various lanes carefully with a microsyringe on an imaginary line 2.5cm away from one end of the plate. Similarly spot standard aflatoxins (B1, B2, G1 and G2) mixture in the concentration range 0.0025—0.0l25ig in parallel lanes.

5. Develop the plate in a solvent system of toluene: ethyl acetate: formic acid (6: 3: 1) in a chromatographic tank for about 50 mm. By then, the solvent front might have moved up to 20mm below the top end of the plate.

6. Dry the plate at room temperature to remove the solvent. Visualize fluorescing spots of toxins under UV light in a cabinet. Protective should be worn while viewing under UV light; otherwise, eye sight will be affected.

7. Identify each fluorescing spot of the sample extract by comparing the authentic toxin spot co-chromatographed. Determine the Rf of each spot.

8. For quantitative estimation of the toxins in the sample extract, match the intensity of spots of the sample with that of standard toxin spots by diluting both to extinction. Calculate the amount of toxin in a kg sample material.

NOTES

1. Care to collect a representative sample of the experimental material. Conveniently small portions of samples from various points are collected, mixed thoroughly and quartered Sampling procedure varies from commodity to commodity (for details read the reference below).

2. Pre-run of activated plates in diethyl ether is useful to eliminate UV fluorescing substances, if any in the gel.

3. A variety of solvent systems are used for developing the plates. Choose the system to get all the spots clearly resolved.

4. The Rf value is in the order of B1>B2>G1>G2.

5. Under UV light B1 and B2 fluorescence blue and G1 and G2 green. B1 content is usually greater than the other toxins.

6. Dilution to Extinction: The standard or sample is diluted serially. Each dilution is spotted in equal volume on the plate. After developing, at one dilution a particular toxin 15 will be visible under UV light while at its next high dilution the spot will not be visible dilution at which the spot is visible is termed 'dilution to extinction'. For each toxin the dilution to extinction is different from the other.

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1. Jones, B JD (1972). Tropical Products Institute Report G 70 London p13.

EXPERIMENT 18

MICROSCOPIC EXAMINATION OF FOODS FOR MICRO FLORA

OBJECTIVE:

- To observe different microorganisms in fermented or processed foods

METHODS:

COLLECTION AND STORAGE OF BRINE SAMPLES:

Examination of pickle products, brine or pickle liquor covering the vegetable material is required. The size of container to be sampled may range from a small jar of pickles to a 1,000- bu tank of fermented brine stock. Brine samples from containers such as tanks and barrels should be taken for bacteriological analysis as follows:

For large brine tanks, insert a suitable length of 3/16-in stainless steel tubing, sealed at one end with lead or solder and perforated with several 1/16-in holes for a distance of 6 to 8 in from the sealed end, through an opening between the wooden boards composing the false head down into the brine toward the mid-depth of the vegetable material. Withdraw brine through a sanitized, attached piece of flexible tubing into a sample container. The length of the steel sampling tube is governed by the depth of the container to be sampled. Withdraw and discard approximately 100mL of brine before taking the final sample, about 10ml, into a sterile test tube. If microbial changes during the fermentation are to be followed, start sampling at the time the material is salted or brined and continue at regular intervals of 1 to 2 days during active fermentation. After each sampling, wash the whole assembly thoroughly.

For tightly headed barrels such as those used for genuine dills and salted vegetables for non- pickle use, take the sample through the top or side bung. For smaller containers, such as jars or cans of pickle products, shake thoroughly and take the sample from the center of the material by means of a sterile pipette. Wash the tops of the metal cans with alcohol, flame and puncture. If the containers show evidence of gas pressure, carefully release gas by puncturing the sanitized top with a famed ice pick. Containers under heavy gas pressure prior to sampling.

Brine samples from actively fermenting material should be examined as promptly as possible after collection to prevent changes in the microbial flora. The same is true for samples of packaged pickle products. If it is necessary to ship or store samples, this should be done so under refrigerated conditions; the elapsed time from collection to examination should not exceed 24 hours. When shipment by air is required, samples are collected in sterile, 16×105-mm tubes fitted with plastic screw caps having rubber liners. Pulp and oil liners, or plastic liners such as Teflon, may leak because of changes in air pressure.

Brine samples may be preserved for subsequent chemical determinations by the addition of one to two drops of toluene per 10ml of sample. Samples preserved with the above chemicals are unfit for human consumption and should be so marked.

Many techniques have been developed for sample preparation and storage for ascorbic acid analyses. For fermented and acidified vegetables, quickly mixing a sample with at least four volumes of 3% wt/vol metaphosphoric acid is a good sample preparation procedure. Little or no ascorbic acid is lost after 24 hours of storage in the refrigerator. Metaphosphoric acid stabilizes ascorbic acid much better than sulfuric acid or oxalic acid.

MICROSCOPIC EXAMINATION:

Microscopic examination of brine and vegetable samples for bacteria and yeast is helpful at times, particularly when carried out in conjunction with plate count observations.

BACTERIA:

Make direct counts for bacteria according to following procedures:

1. Place 0.01ml amounts of liquid on slides using a calibrated pipette or loop and spread evenly over a $1cm^2$ area; fix with heat.
2. Stain and count the colonies.
3. Report results as “number of different morphological types of gram-positive and gram-negative bacteria cells per ml of brine”.
4. To determine the number of bacteria within brined vegetable tissue, blend the tissue to homogeneous slurry and filter through coarse filter paper. Bacteria within the filtrate are then enumerated with a Petroff-Hauser counting chamber at a magnification of about $500x^{25}$.

YEASTS:

Use the microscopic technique for determining yeast populations in fermenting vegetable brines and various types of finished pickle products undergoing gaseous spoilage by the organisms, particularly where populations are in excess of 10^4 cells per ml of sample and where yeast colonies are not required for isolation and study. The use of a vital stain permits differentiation of yeast population into viable and non-viable cells and increases the usefulness of the direct counting technique.

1. Add 1ml of brine or pickle liquor sample to 1ml of 1:5,000(0.02%) erythrosine stain.
2. Shake the sample stain mixture to obtain an even suspension.
3. Using a 3-mm diameter platinum loop, transfer enough of an improved Neubauer double- ruled hemacytometer to fill the chamber in one operation.
4. Allow cells to settle for approximately 5 minutes and count the yeast cells using a microscope equipped with a 4-mm objective and 15×oculars.
5. Record cells stained pink as “dead yeast cells” and unstained cells as “live yeast cells”.

The number of yeast cells per ml of brine or pickle liquor may be calculated thus:

$$\frac{\text{Number of yeast cells counted} \times \text{dilutions} \times 250{,}000}{\text{Number of large squares counted}} = \text{Number per ml}$$

If only one side of the hemacytometer counting chamber is used (25 large squares), the lowest yeast count obtainable is 20,000 per ml, while, if both sides are counted (50large squares), a population as low as 10,000 per ml can be counted.

Report yeast count as “total yeast cells,” and dead yeast cells per ml of sample.

In addition to these procedures certain alternative methods such as Petri Film microbiological methods for laboratory use as follows

ISOLATION OF MICROORGANISMS BY SERIAL DILUTION AGAR PLATE TECHNIQUE:

The serial dilution agar plate technique was used for the isolation of microorganisms (bacteria and fungi) from bakery products. The Plate count agar (PCA), Potato dextrose agar (PDA) supplemented with 2% wheat flour and Yeast extract glucose agar (YGA) were used for bacteria, molds and yeasts respectively. In the serial dilution agar plate technique, 1 g of a bakery product was suspended and agitated in 9ml water blank (to make the total volume to 10ml) to form a microbial suspension. Serial dilutions of 10^{-2}, 10^{-3} and 10^{-4} were made by pipetting 1 ml into 9 ml water blanks (in triplicate for each dilution). To each of these inoculated plates, 15ml of sterile and cooled molten (45^0C to 50^0C) media (PCA for bacteria and PDA, supplemented with streptopenicillin for fungi) were poured and incubated at 37^0C for 24 hrs for bacteria and 25^0C for 3 to 7 days for fungi, in an inverted position. The plates were observed for the appearance of colonies and number of colonies produced on each plate of different dilutions was recorded. Number of colonies (CFUs/g) was calculated by multiplying plate count with the dilution factor as given below:

$$\text{CFUs/g} = \frac{\text{Number of colonies (mean) X Dilution factor*}}{\text{Volume plated (0.1ml)}}$$

*Dilution factor: Reciprocal of the dilution (e.g. $10^{-3}=10^3$)

Bacteria were purifies by streak plate method a PCA and incubated at 37^0 for 24 hrs and transferred to PCA slants and maintained in refrigerator at 40c. Molds were purified by needle inoculation and disc transfer on PDA plates and incubated at 25^0C for 5days and transferred to PDA slants and incubated at 25^0C for 5 days and transferred to PDA slants and incubated at 25^0C for 5 days and maintained in refrigerator at 4^0C

IDENTIFICATION OF MICRO FLORA OF BAKERY PRODUCTS

Fungal colonies were grown on PDA, CDA and MEA media at 25^0C for 7 days and following characteristics : colony characteristics (i. e. colour, exudates produced, growth of the colony), sporulating structures (conidial head, types of conidiogenous cells, arrangement of conidia,

sporangial head, types of spores, pycnidia, accervuli, sporodochia, ascocarps etc.) were recorded and identified.

REFERENCES:

1. Frances Pouch Downes and Keith Ito. Compendium of methods for the microbiological examination of foods. 4th edition. 2001