Biyani Girls College

B.Sc. II year Biotechnology

I Internal Examination, 2019-20

Food and Dairy Technology

Set- A

Time: 1.30 Hours **Maximum Mark: 30**

All Questions are Compulsory

1. Answer the following questions in very short 1x8

(i)Mention the organism used for production of vinegar?

(i)Acetobacter is a genus of bacteria that oxidise ethanol and produce acetic acid. When acetobacter begins the transformation of alcohol into vinegar.

(ii)What is fermentation?

(ii) Fermentation is a metabolic process that produces chemical changes in organic substrates through the action of enzymes. In biochemistry, it is narrowly defined as the extraction of energy from carbohydrates in the absence of oxygen.

(iii)Write the definition of Single cell Protein?

(iii) Single-cell proteins or microbial proteins refer to edible unicellular microorganisms. The biomass or protein extract from pure or mixed cultures of algae, yeasts, fungi or bacteria may be used as an ingredient or a substitute for protein-rich foods, and is suitable for human consumption or as animal feeds.

(iv)Mention the role of enzyme catalytic action in food processing?

(iv)Enzymes are used in the food, agricultural, cosmetic, and pharmaceutical industries to control and speed up reactions in order to quickly and accurately obtain a valuable final product. Enzymes are crucial to making cheese, brewing beer, baking bread, extracting fruit juice, tanning leather, and much more.

(v)What do understand by the term brine.

(v)Brine is a high-concentration solution of salt in water. In different contexts, brine may refer to salt solutions ranging from about 3.5% (a typical concentration of seawater, on the lower end of solutions used for brining foods) up to about 26% (a typical saturated solution, depending on temperature).

(vi)Give any two examples of fermented food products.
(vi) Yogurt and sauerkraut are two examples of fermented food products.

(vii)What is the role of protease in cheese production?
(vii)Proteases are enzymes that are added to milk during cheese production, to hydrolyze caseins, specifically kappa casein, which stabilizes micelle formation preventing coagulation.

(viii)What do you mean by chill haze.
(viii)Chill Haze occurs when a beer is chilled below approximately 1.6°C (about 35°F) and constituents can aggregate to form relatively large colloidal (gel-like) particles. These become visible to the naked eye as a cloudiness or haze.

2. **Short note on:** 4x2
(i) Single cell proteins and their production
(i)Single-cell proteins or microbial proteins refer to edible unicellular microorganisms. The biomass or protein extract from pure or mixed cultures of algae, yeasts, fungi or bacteria may be used as an ingredient or a substitute for protein-rich foods, and is suitable for human consumption or as animal feeds.
Single Cell Protein Production from Algae- The algae are a diverse collection of chlorophyll-a-containing organisms that includes many divisions of the plant kingdom, including seaweeds, and a number of single-celled and multicellular 1microscopic forms. Broad assemblages of microalgae are grouped into major categories together with macroalgae (seaweeds) on the basis of pigmentation, cell wall composition, chemical constitution of food reserves, presence and kind of flagellation and features unique to different groups. Microalgae are important constituents of many ecosystems ranging from marine and fresh water environments to desert sands and from hot springs to snow and ice. They account for more than half total primary production at the base of the food chain worldwide. Comprehensive analysis and nutritional studies have demonstrated that the algal proteins are of high quality and comparable to conventional vegetable proteins. However, due to high production costs as well as technical difficulties to incorporate the algal material into palatable food preparations, the propagation of algal proteins is still in its infancy.
Single cell proteins from Yeast and Mushroom: Consumption of baker's yeast *(S. cerevisiae)* as Foodin Germany during World War I increased its importance. Since then, rapid development took

place in biotechnological applications of *S. cerevisiae,* as far as culture development, process optimization and scale up of products are concerned. World production of yeast biomass is of the order of 0.4 million metric tonnes per annum including 0.2 million tonnes baker's yeast alone.

Yeasts synthesize amino acids from inorganic acids and sulphur supplemented in the form of salts. They get carbon and energy sources from the organic wastes, *e.g.* molasses, starchy materials, milk whey, fruit pulp, wood pulp and sulphite liquor.

Mushrooms and other macromycetes are the oldest microbial (single cell protein) food for man.Mushrooms are fungi belonging to the classes basidiomycetes (Agaricussp, Auriculariasp, Tremellasp) and ascomycetes (Morchellasp, Tuber sp). Majority of edible mushrooms are the species of basidomyces. It is estimated that there are around 4,000 species of basidiomyces. Of these, around 200 are edible, and a dozen of them are cultivated on large scale.

(ii)Use of fermentation as method of preparing and preserving food
(ii)Fermentation As method of preparing and preserving food:
Food fermentation is the conversion of sugars and other carbohydrates into alcohol or preservative organic acids and carbon dioxide. The production of carbon dioxide is used to leaven bread. The production of organic acids is exploited to preserve and flavor vegetables and dairy products.

Fermentation is the controlled decay of material using special bacteria which results in a more desirable product. Although desirable anaerobic bacteria convert carbohydrates to acetic acid that “pickle” and preserves the food, the brine protects the vegetables from aerobic organisms.
Food fermentation serves five main purposes: to enrich the diet through development of a diversity of flavors, aromas, and textures in food substrates; to preserve substantial amounts of food through lactic acid, alcohol, acetic acid, and alkaline fermentations; to enrich food substrates with protein, essential amino acids.For example, fermentation is used for preservation in a process that produces lactic acid found in such sour foods as pickled cucumbers, kimchi, and yogurt, as well as for producing alcoholic beverages such as wine and beer. Fermentation occurs within the gastrointestinal tracts of all animals, including humans.

There are many different types of fermented foods consumed around the world, including:
Kefir.
Sauerkraut.
Tempeh.
Natto.
Cheese.

Kombucha.
Miso.
Kimchi.

The two most common types of fermentation are (1) alcoholic fermentation and (2) lactic acid fermentation. (1) Alcoholic fermentation : the type of fermentation in which ethyl alcohol is the main end product .This is very common in yeast (unicellular fungus) and also seen in some bacteria

3. List the different steps involved in Mushroom cultivation, explain them? 7
3.The six steps are Phase I composting, Phase II composting, spawning, casing, pinning, and cropping. These steps are described in their naturally occurring sequence, emphasizing the salient features within each step.

1. Making Mushroom Compost

Phase I composting is initiated by mixing and wetting the ingredients as they are stacked in a rectangular pile with tight sides and a loose center. Normally, the bulk ingredients are put through a compost turner. Water is sprayed onto the horse manure or synthetic compost as these materials move through the turner. Nitrogen supplements and gypsum are spread over the top of the bulk ingredients and are thoroughly mixed by the turner. Once the pile is wetted and formed, aerobic fermentation (composting) commences as a result of the growth and reproduction of microorganisms, which occur naturally in the bulk ingredients. Heat, ammonia, and carbon dioxide are released as by-products during this process. Compost activators, other than those mentioned, are not needed, although some organic farming books stress the need for an “activator.”Compost provides nutrients needed for mushrooms to grow

2. Finishing the Compost

There are two major purposes to Phase II composting. Pasteurization is necessary to kill any insects, nematodes, pest fungi, or other pests that may be present in the compost. And second, it is necessary to remove the ammonia which formed during Phase I composting. Ammonia at the end of Phase II in a concentration higher than 0.07 percent is often lethal to mushroom spawn growth, thus it must be removed; generally, a person can smell ammonia when the concentration is above 0.10 percent.

3. Spawning

Mushroom compost must be inoculated with mushroom spawn (Latin expandere = to spread out) if one expects mushrooms to grow. The mushroom itself is the fruit of a plant as tomatoes are of tomato plants. Within the tomato one finds seeds, and these are used to start the next season's crop. Microscopic spores form within a mushroom cap, but their small size precludes handling them like seeds. Fungus mycelium is the white, thread-like plant often seen on rotting wood or moldy bread. Mycelium can be propagated vegetatively, like separating daffodil bulbs and getting more daffodil plants. Specialized facilities are required to propagate mycelium, so the mushroom mycelium does not get mixed with the mycelium of other fungi. Mycelium propagated vegetatively is known as spawn, and commercial mushroom farmers purchase spawn from any of about a dozen spawn companies.

5. Pinning

Mushroom initials develop after rhizomorphs have formed in the casing. The initials are extremely small but can be seen as outgrowths on a rhizomorph. Once an initial quadruples in size, the structure is a pin. Pins continue to expand and grow larger through the button stage, and ultimately a button enlarges to a mushroom. Harvestable mushrooms appear 18 to 21 days after casing. Pins develop when the carbon dioxide content of room air is lowered to 0.08 percent or lower, depending on the cultivar, by introducing fresh air into the growing room. Outside air has a carbon dioxide content of about 0.04 percent.

6. Cropping

The terms flush, break, or bloom are names given to the repeating 3- to 5-day harvest periods during the cropping cycle; these are followed by a few days when no mushrooms are available to harvest. This cycle repeats itself in a rhythmic fashion, and harvesting can go on as long as mushrooms continue to mature. Most mushroom farmers harvest for 35 to 42 days, although some harvest a crop for 60 days, and harvest can go on for as long as 150 days.Air temperature during cropping should be held between 57° to 62°F for good results.

4. Give a detailed account on beer production? 7

4. Steps involved in beer production are:

1. Malting:

- Beer is produced from barley grains.

- Barley grains are first cleaned and then soaked in water for about 2 days. Then excess water is drained away and the barley are incubated for 4-5 days to allow germination
- The germination steps allow the formation of highly active α-amylase, β-amylase and proteases enzymes as well as various flavor and color components.

2. Kilning:

- The germinated seed are then killed by slow heating at 80° This process is called kilning.
- The kilning temperature must not harm amylase enzyme. Furthermore, if kilning temperature is higher, darker will be the beer produced.

3. Mailing:

- The dried barley grains are then crushed between rollers to produced coarse powder called grist

4. Mashing:

- Grist is mixed with warm water and the resulting materials is maintained at 65°C for about 1 hour.
- In doing so, starch is hydrolyzed by amylase enzyme to produce single sugar, maltose, dextrose etc. similarly, protein is hydrolyzed by proteolytic enzymes into small fragments and amino acids.
- The degree of enzymatic hydrolysis is strongly depends on pH and temperature. β-amylase has optimum activity at temperature 57-65°C whereas α-amylase has optimum activity at temperature 70-75°

5. Boiling of wort:

- The filtrate is then bolied with stirring for 2-3 hours and hop flowers are added at various interval during boiling.

6. Hops:

- Hops are dried female flower of hop plant Humuluslupulus. Approximately one quarter pound of hop flower is added per barrel of beer and up to 2 pound per barrel of ale.

7. Fermentation:

- Beer production utilize strain of Saccharomyces carlsbergens and S. varum which are bottom yeast and S. cerevisiae which is a top yeast.
- Fermentation is usually carried out at 3-4 °C but it may range from 3- 14° Fermentation usually completes in 14 days.

8. Finishing, Ageing, Maturation and Carbonation:

- The young and green beer is stored in vat at 0°C for several weeks to several months. During this period, precipitation of protein, yeast, resin and other undesirable substances take place and beer become clear.

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1.Answer the following questions in very short: 1x8

(i)Define chill proofing?

(i)Chillproofing is a term used when a beer undergoes a process to protect its clarity or brightness when it is cooled to very low temperatures approaching 0°C (32°F).

(ii)What is beer mashing?

(ii)Mashing is the term given to the start of the brewing process, where crushed grains are mixed with water to form a porridge-like mixture called the "mash."

(iii)Give any two examples of feremented beverages?

(iii)Kefir, beer are two examples of fermented beverages.

(iv)What is fruit vinegar and give its example?

(iv)Apple cider vinegar is the most common fruit vinegar.It is the acetic acid is produced by the Fermentation of ethanol or sugars present in fruit by acetic acid bacteria.

(v)Write the name of 2 algal proteins used as source of food?

(v)*Spirulina* and *Chlorella*

(vi)Define dextrose equivalent?

(vi)Dextrose equivalent is a measure of the amount of reducing sugars present in a sugar product, expressed as a percentage on a dry basis relative to dextrose. The dextrose equivalent gives an indication of the average degree of polymerisation for starch sugars, it is another word for gelatin.

(vii)What is glucose oxidase enzyme, give its role in food preservation?

(vii)Glucose Oxidase. Glucose oxidase (GOX) is an enzyme commonly used to stabilize liquid egg- white by converting glucose to D-gluconic acid, thereby limiting the potential for Maillard browning reactions and color deterioration during storage of the dried material.

(viii)What is DE sugar?

(viii)**Dextrose equivalent** (**DE**) is a measure of the amount of reducing sugar present in a sugar product, expressed as a percentage on a dry basis relative to dextrose.. The dextrose equivalent gives an indication of the average degree of polymerisation (DP) for starch sugars, it is another word for gelatine. As a rule of thumb, DE × DP = 120.

2. Short note on: 4x2

(i)Vinegar Production

(i)Vinegar is the product made from the conversion of ethyl alcohol to acetic acid by a genus of bacteria, Acetobacter. Vinegar is a solution of acetic acid produced by a two-step bioprocess. In the first step, fermentable sugars are transformed into ethanol by the action of yeast.Vinegar is the product of a two-stage fermentation. In the first stage, yeast convert sugars into ethanol aerobically, while in the second ethanol is oxidized to acetic (ethanoic) acid aerobically by bacteria of the generaAcetobacter and Gluconobacter.

This second process is a common mechanism of spoilage in alcoholic beverages and the discovery of vinegar was doubtless due to the observation that this product of spoilage could be put to some good use as a flavouring and preservative.

Acetobacter spp. are the better acid producers and are more common in commercial vinegar production, but their ability to oxidize acetic acid to carbon dioxide and water, a property which distinguishes them from Gluconobacter, can cause problems in some circumstances when the vinegar brewer will see his key component disappearing into the air as CO_2. Fortunately over-oxidation, as it is known, is repressed by ethanol and can be controlled by carefulmonitoring to ensure that ethanol is not completely exhausted during acetification. Mostacetifications are run on a semi-continuous basis; when acetification is nearly complete and acetic acid levels are typically around 10-14% w/v, a proportion of the fermenter's contents is removed,replaced with an equal volume of fresh alcoholic vinegar stock.

(ii)Fermented beverages

(ii)Fermented beverages constitute one of the widely accepted drugs all over the world. Archaeological evidence indicates that fermented beverages are at least as old as the earliest civilizations and are legally consumed in most cultures. The Peruvian Central Andes is one of the

regions where a variety of fermented beverages are produced and consumed. One such beverage is molle beer produced from the berries of the molle tree (*Schinusmolle*). In contrast to maize beer, molle beer is relatively known, especially in comparison to maize beer. Molle beer is easy to prepare and its fermentation process is faster than maize beer. This is one of the reasons that this beverage is readily available in most Peruvian central highland households.Some of the fermented Beverages are: Probiotics, Lactobacillus, Lactic Acid Bacteria, Yogurt, Fruit Juice, Kombucha.Fermented foods are a hot health topic-and for good reasons. These good bacteria-particularly those in our gut-may improve digestion, boost immunity and help us maintain a healthy weight. Fermented foods, like yogurt and kimchi, are rich in probiotics. The good bacteria grow during the fermentation process.Fermented beverages have been produced and consumed all over the world and over a very long time span. Man discovered that sugar solutions of different origins, if left standing rather warm, will start fermenting spontaneously into an alcoholic beverage that often contains lactic acid. The requisite microorganisms, *Saccaromyces* yeasts and *Lactobacillus* bacteria, are abundant almost everywhere and will do their duty, producing alcohol and lactic acid. A similar fermentation process of animal and vegetable foods is thelactic-acid fermentation that yields, for instance, sauerkraut.Fermented beverages can be dividedinto two groups, wines and beers, broadly defined. Wines are fermented from various fruit juices containing fermentable sugars. Beers come from starch-containing products, which undergo enzymatic splitting by diastase, malting, and mashing, before the fermentable sugars become available for the yeasts and bacteria. The enzymatic splitting of the starch can also be performed either by human saliva, containing amylases, or by molds. Narrowly defined, beer is barley beer and wine is grape wine.

3. Give a detailed account on cheese production.7

3. Making cheese is both an art and a science. Cheesemakers rely as much on measurements of pH levels and inoculations of specific molds as they do their own senses of sight, touch, and smell.There are six important steps in cheesemaking: acidification, coagulation, separating curds and whey, salting, shaping, and ripening.

Acidification**:**The first step to making cheese is acidification. During this stage, a starter culture is added to milk that will change lactose (milk sugar) into lactic acid. This changes the acidity level of the milk and begins the process of turning milk from a liquid into a solid.

Coagulation**:**Coagulation is the process of transforming the liquid into a semisolid. When making cheese, an enzyme called rennet is added either as a liquid or paste to further encourage the milk to solidify.

Curds and Whey

As the milk solidifies, it forms curd and whey. The curds are the solid part and whey is the liquid. In this step, the curds are cut using a knife or a tool that resembles a rake.

Salting

Salt is added for flavor. It also acts as a preservative so the cheese does not spoil during the long months or years it spends aging and it helps to form a natural rind on the cheese.

Shaping

In this stage, each type of cheese takes its familiar form as a solid block or wheel. The cheese is put into a basket or a mold to form it into a specific shape. At the same time, the cheese is also pressed with weights or a machine to expel any remaining liquid.

Ripening

During this time, the temperature and humidity of the cave or room where the cheese ages are closely monitored.

4. Give a detailed account on production of new protein foods from mushroom and yeast.7

4.**1. Making Mushroom Compost**

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