Frequently Asked Questions:

1. What are enzymes?

Ans : Enzymes are proteins made by cells in our bodies. They are specialized proteins that do the work, such as synthesizing chemicals and compounds, rearranging molecules, adding elements to compounds, and breaking down compounds. There are many types of enzymes, and each type does a specific function. For an enzyme to work, it must have access to its substrate, the material upon which an enzyme work.

2. How do enzyme work?

Ans : Enzymes work as catalysts of biochemical reactions. A catalyst increases or accelerates the rate of a chemical reaction. The thousands of chemical reactions that occur in our body every second could not happen without enzymes to speed up these reactions. For example a protein can be broken down into amino acids in the lab without the use of an enzyme, but to do so it requires extreme temperatures, high pressure, and very strong acids. Conditions not compatible with life. Even with these conditions, it requires hours to complete the reaction in the lab. With enzymes, in this case, a mixture of proteases, the reaction can be completed within minutes in water at normal temperatures.

3. What are the advantages of using enzymes in fruit juice industries?

Ans : Enzymes are used in the food industry for upgrading quality and byproduct utilization, for preparing synthetic foods, for achieving higher rates and levels of extractions, for improving flavor, and for stabilizing food quality.

Enzymes are used in food manufacturing for various reasons. Important being among them are :

- a. To improve the specific quality characteristics of food products.
- b. To improve storage stability.

c. To provide greater convenience in recipe preparations

The advantages of using enzymes for food processing include:

1. They are natural, nontoxic substances;

- 2. They catalyze a given reaction without causing unwanted side reactions;
- 3. They are active under very mild conditions of temperature and pH;

4. They are active at low concentration;

5. The rate of reaction can be controlled by adjusting temperature, pH, and the amount

of enzyme employed; and

6. They can be inactivated after the reaction has proceeded to the desired extent.

4. Which are the main enzymes used in food manufacturing ?

Ans : Amylases, Protease, Catalase, Glucose oxidase, Lipase, Cellulase, Hemicellulase, Pentosanase, Lactase are some of the main enzymes used in food manufacturing.

5. Which are the enzymes that are helpful in fruit processing?

Ans : The most widely used enzymes in fruit processing are mainly, Glucose oxidase, **Pectic enzyme complex, Narnginase etc.**

6. How can the nutrient value of the fruits maintained while processing?

Ans : Fruits should be carefully prepared using a delicate low temperature drying process to preserve maximum freshness, nutritional value and total enzyme activity.

7. Write a note on catalytic efficiency of enzymes.

Ans : The catalytic efficiency of enzymes is very high, whereby one molecule of enzyme can transform as many as 10,000-1,000,000 molecules of substrate per minute. It is this catalytic efficiency of enzymes at low temperature which makes them important. This means that foods can be processed or modified by enzymes at moderate temperature, say 25-50°C, where food products would not otherwise undergo changes at significant rate. It also means, however, that endogenous enzymes are active under these conditions as well, and this can be beneficial or deleterious.

8. Explain the pH effects on fruit processing.

Ans : Extremes in pH will generally inactivate enzymes. Enzymes usually exhibit maximal activity at a particular pH value, termed the pH optimum. Most enzymes show maximum activities in the pH range of 4.5-8.0, and maximum activity is usually, but not always, confined to a rather narrow pH range. There are however, enzymes with extreme pH optima, such as pepsin, which has a pH optimum of 1.8.

Control of pH as it relates to enzymatic activity is important to the food scientist. In an industrial process, where enzymatic activity in desirable, the pH should be controlled to maximize that activity. However, the food scientist may wish to prevent or inhibit an enzymic reaction. For example, unwanted phenolase activity can be avoided by reducing the pH of the system well below (<3.0) the optimum pH of 6.5. This is frequently accomplished in fruits by adding natural acidulants, such as citric, malic, or phosphoric acids.

9. How temperatures influence the enzymes involved in the processing of fruits.?

Ans.: High temperature Effects : When the temperature is raised, two major apposing factors are to be considered.

- 1. Increasing rate of enzyme reaction
- 2. Increasing rate of enzyme destruction

For enzyme reaction – rate of reaction doubles with 10° C raise in temperature. Temperature coefficient =2 optimal activity =30 to 40° C. After 45° C denaturation occurs. Time – temperature relationship for total inactivation of enzymes is very important.

Low temperature Effects : Although some enzymes are denatured at subfreezing temperatures, most remain quite active after freezing and thawing. In addition, many enzymes exhibit significant activity in partially frozen systems. As the temperature of an enzyme solution is decreased for 0° to about 10° below its freezing point, enzymic activity can either increase or decrease, depending upon the enzyme and the system. A further decline in temperature almost always results in decreased activity.

10. How Hydrolases help in food industry as an enzyme?

Ans : Hydrolases are classified into α - Amylase , β - Amylase, and Gluco –Amylase. These Hydrolases help in internal random hydrolysis. Successive maltose units are removed and Successive glucose is also removed under process.

These hydorlases help in liquefactaion of starch. They produce maltose in bread fermentations and high maltose syrups. These hydrolases also produce glucose from starch.

11. What is the role played by Pectic enzyme in fruits

Ans : Pectin is a complex carbohydrate polymer which serves a structural role in plants. The major building blocks of pectin are units of galacturonic acid linked by α -1, 4-glycosidic bonds. Approximately two-thirds of the carboxylic acid groups are esterified with methanol. These are used in clarification of apple juice before membrane filtration by adding them to bulk juice. Food grade pectic enzymes contain mixture of enzymes including pectinase, polygalacturonase, pectin esterase, pectin lyase, cellulase, protease and amylase. Cell walls of each cell are thickened due to deposition of pectin and cellulose on the walls. This prevents the fruit juice to be released and hence remains as pulpy mass. Action of enzymes softens and rupture the cell wall enabling the release of juice. Depending on the type of juice, pectin is either an impediment to clarification (eg. Apple juice has to be clear) or a desirable component to retain (Orange juice must be cloudy).

12.What are amylases? And what are the advantages of them by adding them to foods.?

Ans : Enzyme that hydrolyze starch are termed as amylases.

 α - amylases : Endo enzyme which hydrolyses α 1-4 glucan linkage. Results in rapid decrease of viscosity

β - amylases

Exo-enzyme, it attacks only the end units of starch chains. It results in increase of sweetness. "Saccharifying" enzyme. Amylases are important in fruit ripening, potato processing and Corn syrup manufacture, etc.

Advantages :

Rapid and simple extractions of juice with decreased pressure build up

- Increase in free-run and total yield
- Increase in extraction capacity due to faster filtration rate.
- Fast viscosity reduction

13. What is Liquefaction in fruit juice manufacturing mean?

Ans : Liquefecation refers to a process in which the entire fruit is subjected to enzymatic treatment. As a practical matter, liquefying the entire fruit is not possible because of the skin, seeds, stems. In practice the use of term "total liquefaction describes the action of enzymes on fruit pulp after seeds, skin and stems are removed.

14. What is the role played by enzymes in Apple juice production?

Ans : The extracted apple juice from the presses are always cloudy due to the presence of a wide range of natural colloidal polysaccharides, cellulosic fragments from skin and pulp and other small particles like protein fragments or polyphenols and tannins with protein. During crushing of the fruit and dejuicing process, these constituents enter the juice in solubilized

and unsolublized colloidal form. The most important of these molecular substances is pectin. Hot clarification process is the most frequently used for the production of clear apple juice concentrate worldwide. In this process, the enzyme treatment and subsequent fining are carried out in the juice coming from the aroma recovery where, the juice has been heated up briefly in order to remove aroma and solubilize starch. The aroma has to be removed before concentration and stored separately. Due to quality reason, the dearomatized juice has a temperature of 50-55°C after passing through heat exchanger where it is cooled down by preheating the juice coming from the press. This temperature range is almost ideal for enzyme activity which takes almost 2-3 hrs. for clarification.

Compared to the fining procedures, ultrafiltration is a relatively new technology in fruit juice industry. In respect to the enzyme application, both the fining process and ultrafiltration process require complete enzymatic breakdown of pectin and starch or other polysaccharides. The practical application of enzymes for apple juice clarification is fairly simple. Liquid enzymes, which are by far the most widespread in fruit juice technology, are simply poured into the juice tank while filling up the tank with the juice. The correct dosage is usually determined with the help of pretest in the laboratory. A mechanical stirrer in the tank leads to good distribution of the enzyme. After the enzyme reaction the juice is ready for clarification, filtration and concentration

15.How can you tell an enzyme is good for human health by looking at its label?

Ans : There are three things to lok for the label. pFirst, to make sure that the enzymes are plant enzymes. Aspergillus oryzae and niger (these are the most effective digestive enzymes avialble). Second is to look for ionic minerals within the formulation. These minerals help the digestive enzymes become two to three times more active and effective. Third, to look closely at the amount of protease, amylase and lipase within the formulation. 75,000 HUT for protease, 15,000 SKB for Amylase and 5,000 LU for Liase. These amount are very important for digestion and cleaning of blood.