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Production of Bioethanol Using Waste of Food Products

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Description

The source of ethanol is corn and other sugar-based crops, which has increased the pressure on food industries. The crops produced for consumption are now utilized in the formation of ethanol. The food processing industry is the second most waste-producing industry after household sewage. The solid and liquid waste released from the fruit industries can pose a vital contributor to land pollution. Processing of fruits can yield residues, which are in the form of pods, peels, pulp, stones, and seeds. Disposal of these residues without processing in landfills can further aggravate the situation by causing environmental pollution. Besides, the fruit wastes contain bioactive compounds which, can be converted into handy products by anaerobic digestion and thermochemical treatments. One of the organic compounds that can be converted into a useful by-product is carbohydrates. Bioethanol can be manufactured using anaerobic fermentation of the carbohydrates present in the fruit residues.

Fermentation refers to a process, where the degradation of glucose or other organic molecules produces energy in the form of ATP in anaerobic conditions. It was a widely used mechanism in ancient times as the organisms lived in an anaerobic environment then. The basic scheme of fermentation involves two steps:

1. Degradation of glucose or other sugar molecule to yield 2 molecules of pyruvate, 2 molecules of ATP and two molecules of NADH via Glycolysis.

2. Oxidation of pyruvate to end products like lactate or ethanol with a concomitant release of 2 molecules of NAD+. This process of fermentation enables the cells to regenerate NAD+ since, in anaerobic conditions; the NADH cannot be oxidized to NAD+. According to the enzyme catalyzing in the oxidation of pyruvate different products can be formed. The products obtained are ethanol and lactate in alcoholic and lactate fermentation.

Organisms like yeast can oxidize glucose or other sugar to ethanol and carbon dioxide in a reaction catalyzed by two enzymes Pyruvate decarboxylase and alcohol dehydrogenase. This type of fermentation is known as alcoholic fermentation. Alcoholic fermentation is carried out in two steps:

1. Pyruvate is irreversibly decarboxylated to yield acetaldehyde and carbon dioxide in a reaction catalyzed by pyruvate decarboxylase.

2. Acetaldehyde is converted into ethanol in a reaction catalyzed by alcohol dehydrogenase. This reaction requires NADH as the reducing equivalent which, is oxidized to NAD+ while acetaldehyde is reduced to ethanol. Also, yeast can stimulate the conversion of insoluble phosphorus ions into soluble phosphorus, which increases the uptake of phosphorus by plants by enhancing its availability in soil. Yeast also contains Trehalose 6- phosphate synthase, which catalyzes the formation of Trehalose. Trehalose improves stress tolerance in plants and promotes their development. Also, the solid residue left after juice extraction from kiwi and banana peels can be utilized as manure for promoting plant growth. Carbon dioxide released as a by-product can be directed to greenhouses where it promotes plant growth. It can prevent the combustion of natural gas usually, used to increase the yield of greenhouse crops.

Conflict of Interest

None

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