INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY ADVANCED RESEARCH TRENDS
ISSN : 2349-7408
VOLUME IV, ISSUE 1(3) JANUARY, 2017

STUDY ON UTILIZATION OF FOOD WASTE FOR PRODUCTION OF BIOETHANOL BY USING MICROBIAL ENZYMES

A. RAVINDER
Dept. of Food Technology,
Loyola Academy Degree And Pg College, Alwal, Secunderabad,T.S

ABSTRACT

Food waste is difficult to be utilized by ethanol producing micro organisms. Pretreatment of food waste using two different enzymes 1) carbohydrase and 2) glucoamylase may be used for saccharification. These microbial enzymes can able to hydrolyse and produce glucose required for ethanol fermentation. The amount of carbodydrase added to food waste is depending on the saccharification rate which needs to be determined. The following study is required to isolate micro organisms for enzyme production, involved in saccharification and also for fermentation. All parameters like pH, temperature, salinity, substrate concentration, media optimization will be studied for optimal production of bioethanol. Separate enzymatic hydrolysis and ethanol fermentation, for simultaneous saccharification is to be studied by increasing glucose concentration.

Most of green plants produce starch as a mean of energy source and deposit it as small granules in special organelles such as chloroplast and amyloplast in various parts of plants such as cereals and grains roots and tubers. Starch is a polymer of glucose units primarily linked by alpha 1,4 glycosidic bond with some additional alpha 1,6 linkage. Alpha amylase is capable of cleavaging alpha 1,4 linked glucose unit and glucose amylase can hydrolyse sacharide polymer. The prevailing method of bioethanol production is from molasses of cane sugar/ beet sugar which contains less glucose units than food waste. In the first stage amylase liberated malto dextrins by liquefaction process which contains dextrin and oligosaccharide. In the second stage the enzymes such as glucoamylase and pullulanase are used for further hydrolysis of dextrins and oligosachharide through process known as saccharification.

During the fermentation of glucose, maltose and isomaltose which degraded by micro organisms to convert it into bioethonol. The ratio of biomass and production of ethanol will be studied during the fermentation process with analytical and statistical techniques.

INTRODUCTION:

Food processing wastes are those by products of various food processing industries that have not been recycled or used for other purposes. They are the non-product flows of a raw material whose economic values is less than the cost of collection and recovery or reuse and therefore discarded as wastes. These wastes could be considered valuable by-products, if there were appropriate technical means and if the value of the subsequent by products were to exceed the cost of reprocessing.

OBJECTIVE:

Food waste residues cannot be regarded as wastes but become an additional resource to augment existing natural food materials. Recycling, reprocessing and utilization of food processing residues offer excellent potential for beneficial uses rather than their discharge to the environment, which may causes detrimental environmental effects. Bio ethanol production by using microbial enzymes on food waste is one of the technique. Bio ethanol has an excellent potential to be used in food and non food industries and economical significance and saving valuable foreign exchange. Successful food waste reprocessing involves (a) rendering recovered by-products suitable for beneficial use, (b) promoting marketability to ensure profitable operating, (c) employing reprocessing technology, and (d) creating an overall enterprise that is acceptable and economically feasible.

If effective utilization of food residues to occur, food manufacturers should invest in specialized secondary industry to utilize these residues. Efforts are needed to develop new technologies and to institute suitable measures to promote waste reclamation. This can only be achieved if food residues are considered as complementary resources rather than as undesirable wastes. Food industry produces large volumes of wastes, both solids and liquids, resulting from the production, preparation and consumption of food. These wastes pose increasing disposal and severe pollution problems and represent a loss of valuable biomass and nutrients. Beside their pollution and hazardous aspects, in many cases, food processing wastes might have a potential for conversion into useful products of higher value, as a by-product or even as a raw material for other industries or for use as a food or feed after biological treatment.

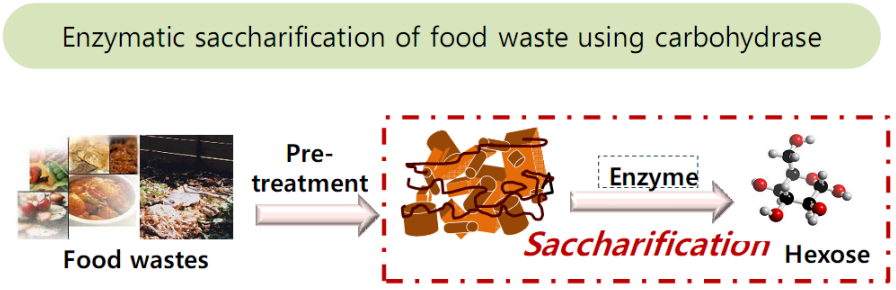
The composition of wastes emerging from food processing Industries is extremely varied and depends on both nature of the product and the production technique employed. For example, wastes from meat processing industry will contain a high fat and protein content, while waste from the canning industry will contain high concentrations of sugar and starches. The waste may also not only differ from site to site but also vary from different times of the year. Furthermore, the volume and concentration of the waste material will not be constant. Due to fluctuations in the nature, composition and quantity of food waste which may cause problems in managing a consistent working process.

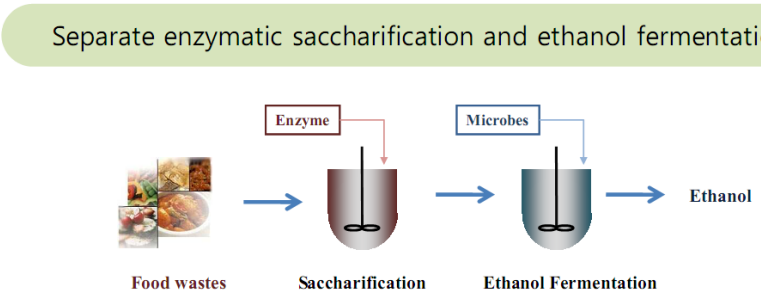
In general wastes from the food processing industry have the following characteristics (Litchfield, 1987): bibliography no.10

1. Large amounts of organic materials such as proteins, carbohydrates and lipids,
2. Varying amounts of suspended solids depending on the source
3. High biochemical oxygen demand (BOD) or chemical oxygen demand (COD).

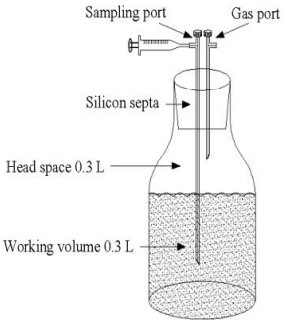
Large amounts of research have focused recently on the use of enzymes as a catalyst for the saccharification and fermentation studies of food waste. Researchers have found that very good yields could be obtained from crude and used food waste rich in carbohydrate concentration. The use of carbohydrases makes the reaction less sensitive to high content which is a problem with the standard bioehanol process. In addition to food wastes, food industry also uses a large amount of water for cleaning and processing. A proportion of water used may leave as part of waste discharge. For example in beer manufacturing, much of the process water is discharged as effluent in a bad state and a large volume of discharged processed water contains surface substances which may cause pollution.

. The same is explain in following fig.





Enzymatic saccharification & ethanol fermentation



Enzymatic saccharification

MATERIALS AND METHODS

MATERIALS

a. Food wastage

b. Kitchen refuse

c. Waste from industries like biscuit, meat, milk ,and substrate rich in glucose concentration,

d. Organic sludge

e. Canning industry waste

f. Fermenter system for sacchrification and ethanol fermentation.

g. Micro organisms

METHOD:

Micro organisms involved in saccharification, and fermentation can be isolated with corresponding study.

Significance and impact of study- this plate assay enable a quick survey of extra cellular carbohydrase and amylase producing micro organisms as well as to screen those producing proteases with overlaping carbodydrase and amylase activity and also study the influence of nutrient supplement required for enzyme production.

In order to optimise synthetic bio catalytic transformation catalysed by carbohydrase , a large number of carbohydrases must be tested moreover. To isolate enzyme for an industrial application it is generally necessary to study the enzyme evolution to enzyme performances, for example thermal stability , activity or selectivity of enzyme. The crucial step is the screening of the optimal catalyst. As hydrolytic and synthetic activities are not always correlated, specific screening method for synthesis activity of enzyme is needed. In this work we report three sensitive and specific screening methods to measure synthetic activity of carbohydrates in vivo on an agar plate and in vitro, directly from cultural broth.

There is a technical advantage in producing enzymes via using micro organisms as they are capable of producing wide variety of enzymes, and have following advantages.They show genetic flexibility that is why they can be genetically manipulated to increase yield of enzymes

Method for commercial scale production of bioethonol by saccharifiction and fermentation is represented as follows

Food Waste – starch slurry - liquefied starch - saccharified liquid - bioethanol.

Method for commercial-scale bioethanol production, only the enzyme-catalyzed saccharification process and fermentation process have been described above

THE PROPOSED STUDY INVOLVE

1. Isolation of bacteria from food waste soil
2. Selection of micro organism
3. Screening of bacteria from food stuffs for morphological and biochemical study
4. Mass production of enzyme in various media that is aqueous and non aqueous and supercritical liquids
5. Purification of enzyme followed by ammonium sulphate precipitation, salting out and salting in, followed by fractionation of enzyme by use of Ion exchange chromatography and gel filtration chromatography
6. Assay of enzyme for carbohydrase and sacchrification activity
7. Studies of various parameters like pH, Temperature and Media Concentration
8. Optimization of enzyme production protocol
9. Application of enzyme on substrate to see the saccharification and fermentation process and estimation of bioehanol production and optimization of bioethanol production reactions.

BIBLIOGRAPHY

1. Benitez,T., L. Del Casttillo, A. Aguilera, J. Conde, E.C. Oimedo (1983). Selection of wine yeast for growth and fermentation in the presence of ethanol and sucrose, Appl. Environ.Microbiol. (45)5:1429-1436.
2. Brooks A.A. (2008).Ethanol production potential of local yeast strains isolated from ripe banana peels, African journal of Biotechnology, 7(20): 3749-3752.
3. Diwanya E. L. I, M.S. EL-Abyad, A.H.EL-Refai, L.A.Sallem, R.E. Allam (1992).Effect of some fermentationon ethanol production from beet molassesby S. cerevisiae, Bioresource technology, 42:191-195.
4. Eghafona N.O., HAS Aluyi, I.S. Uduehi (1999).Alcohol yield from pineapple juice: Comparative study of Zymomonas mobilis and Saccharomyces uvarum, Niger. J. Microbiol, 13: 117-122.
5. Essien J.P., E.J. Akpan, E.P. Essien (2005).Studies on mould growth and biomass production using waste banana peels, Bioresour. Technol, 19:361-363.
6. Hacking A.J., L.W.F. Taylor, C. M. Hamas (1984).Selection of yeast able to produce ethanol from glucoseat 400C, Appl. Microbiol. Biotechnol. 11:31-33.

7. Hueth, B. and T. Melkonyan (2004).Quality Measurement and Contract Design, Lessons from the North American sugar beet Industry, Canadian Journal of Agricultural Economics, 52: 165-181.

8. Jones R.P., N. Pamment and P.F. Greenfield (1981). Alcohol fermentation by Yeast, The effect of environmental and other variables, Process Biochemistry, 16:42.

9. Panchal C.J., I. Peacock, G.G. Stewart (1982).Increased osmotolerance of genetically modified ethanol producing strains of Saccharomyces sp., Biotechnol. Lett, 4 (10):639-644.

10. Anac, D., H. Hakarer and M. irget, 1993, Ege Univ. Ziraat Fak. Dergisi, 30: 3. Cooney, C, C. Rha and R. Tannenbaum, 1980, Adv. Food Res., 26: 1. Demirel N. and M. Karapinar, 2000, Blacksea and Central Asian Symposium Litchfield, J.H., 1987, Food Biotechnology, 1 (1): 29.