IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

BIOETHANOL FROM POTATO PEEL WASTE

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Abstract: Green plants and factory by-products containing carbohydrate are often a source of a product like bioethanol. The main problem of those raw materials is that the content of the sort of carbohydrate. During this study, potato peels was chosen as a carbon source. The PPW contains sufficient quantities of starch, cellulose, hemicellulose, lignin and fermentable sugars to warrant use as an ethanol feedstock. Starch may be a high yield feedstock for ethanol production, but its hydrolysis is required to supply ethanol by fermentation. Starch was traditionally hydrolysed by acids, but the specificity of the enzymes, their inherent mild reaction conditions and the absence of secondary reactions have led to the wide-spread use of amylases as catalysts in this process. Starch processing may be a technology utilizing enzymatic liquefaction and saccharification, which produces a comparatively clean glucose stream that's fermented to ethanol by Saccharomyces yeasts. However, a pre-treatment process is required to convert starch of potato to fermentable sugar by hydrolysis. Potato is ranked amongst one among the leader vegetation generating international. Potato skin is zero value waste produced by potato processing plant or industry. For the assembly of bioethanol, starch residues were converted into glucose by a-amylase and glucoamylase. To research the saccharification process of the pre-treated starch residues. Yeast fermentation is employed simultaneously with the saccharification process for 72 hours. Then after the centrifuge the compound. An effort was made to supply ethanol from potato skin waste. There was a substantial yield of sample of 35-40 ml using pH 6.0, an at a substrate concentration of 5% (W/V).and we get ethanol and methanol present in the sample.

Key words: food waste, bioethanol, potato peel waste, simultaneous saccharaification and fermentation.

1. INRODUCTION

Food waste is the ultimate made from numerous meals processing industries that has now no longer been recycled and discarded as meals waste. Food waste or losses are not really financial. It moreover has a first rate effect on weather distraction, food production uses resources such as water, fertilisers, pesticides, seeds, energy, and labour. The true cost of food waste in terms of economic, environmental, and social costs is USD 2.6 trillion per year, which is larger or less than the GDP of France or the United Kingdom. Another research published with the help of the Food and Agriculture Organization of the United Nations (FAO) first examined the effects of global food waste from an environmental standpoint, focusing on the effects on the climate, water, land, and biodiversity. [(4)] This analysed overall that food produced but now no longer eaten guzzles up an amount of water same to the as soon as a 12 months waft of Russia's Volga River and is liable for inclusive of three. Three billion hundreds of carbon dioxide consistent with 12 months, making food wastage the 1/three top greenhouse gases (GHG) emitter after USA and China. "Food wastage cut price would possibly now no longer satisfactory avoid pressure on scarce natural property but moreover decrease the need to raise food production with the useful resource of the use of 60 percent on the way to fulfil the 2050 population demand," the FAO said.[(2)]

Worldwide, the generation of huge amount of food waste due to the increasing population. Globally, 931million plenty of garbage were generated in 2019, 61% of which may from households (nearly 570 million tons), 26 to stand proud of food service and 13% from retail. Indian households wasted around 68.7 million tons of food waste in 2019.

The file similarly provides that the global common of 74kg/capita of meals wasted yearly stays comparable throughout lower-middle-profits to higher-profits international locations – belying the general perception that meals wastage is essentially constrained to the advanced nations.

While sure international locations like Slovenia and Austria produce much less waste in line with capita (34 kg and 39 kg/capita/year), international locations in which the weight of starvation is extraordinarily high, like Rwanda (164 kg/capita/year) and Nigeria (189 kg/capita/year) generate massive amounts of garbage. (3)

What is most astonishing is that, while many millions of meals rot in landfills or are thrown away while in transit, three billion people did not have access to safe and nutritious food in 2019. This is most noticeable in countries such as India. According to the Global Hunger Index 2020, India is rated 94th out of 107 countries, with a 'severe hunger crisis.' The assessment placed India well below its neighbours in the area - Bangladesh (75th), Pakistan (88th), and Nepal (89th). (3)

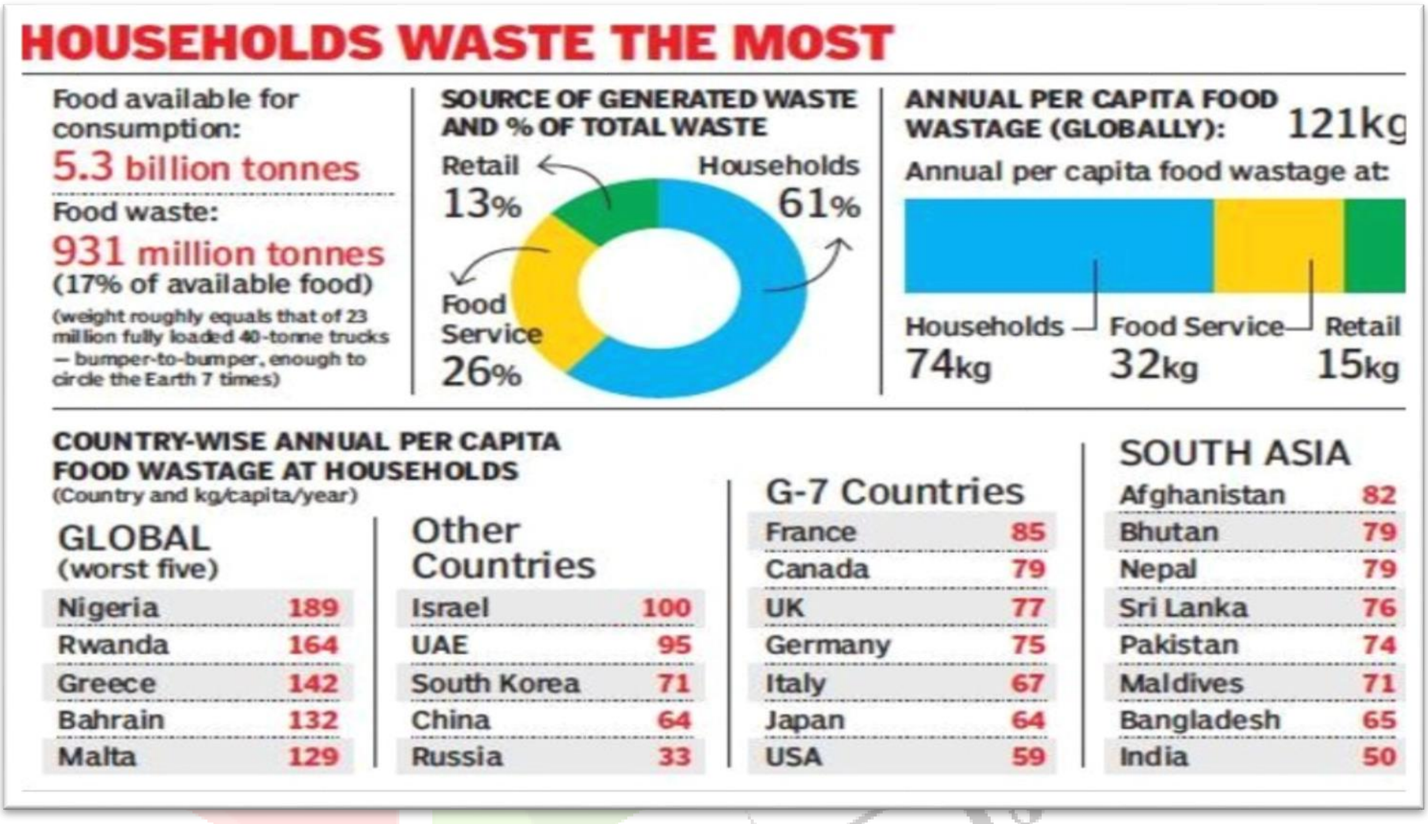


Fig.1.1 food waste index of 2021

Food waste is taken under consideration due to the fact the biggest class of municipal strong waste it is disposed in landfills. This is inflicting world's mounting rubbish disposal trouble that's in addition recommended with the aid of using throwaway culture. This exercise of disposing rubbish in landfills is growing many issues publicly existence like terrible odour, all environments phase pollute. Landfills are regarded to get CO2, methane and different poisonous gaseous substances. (5) The special one, methane gas is that the maximum considerable greenhouse emission create on landfills. Rainfall occasion ends in filtrate of unwanted leachate that sufficiently chance to local people body health. Furthermore, landfills take up a lot of space, which is a problem in urban areas where property is expensive and needed for infrastructure development. To dodge those issues of recycling meals waste is necessary.

To an oversized extent, improvement of sustainable rubbish valorisation is needed to get to the bottom of the waste disposal and environmental problems. There are now numerous conventional waste Valorisation processes available to recycle food scraps. Such as cremation, anaerobic digestion, and processing for fish and animal feed. Nonetheless, the conversion of waste to capable liquid biofuels is critical, and it is now being researched by many researchers since they will be utilised as fuels in natural form or as a blend in current diesel engines. Presently, biofuels are made from fit for human consumption feed shares. Feed shares make a contribution significantly (round 80–90%) toward the full price of biofuels. Thus, use of fit for human consumption feed shares make biofuels costly. . Alternatively, non-fit for human consumption feed shares are being extensively researched in academia and industry for biofuel manufacture. There is also a burgeoning food vs. gas argument among certain concerned civil society members and others. Many critics also argue that increased land usage for producing biofuel vegetation would result in a lack of land, water, and various assets for cultivating meals vegetation, therefore contributing to food scarcity. However, biofuels are frequently produced in different methods with the aid of using the use of wastes as non-fit for human consumption assets.

In this sense, waste cooking oil and food wastes may be used to produce biofuels without the need for more space for growing food plants. Furthermore, reusing food waste for biofuel production will keep the current meal vs. gas argument at bay. Food waste is primarily made up of rotten fruits and vegetables, fish and rooster organs, fruit and vegetable peelings, meat trimmings and other residues, intestine, meat, fish, shellfish shells, bones, meals fats, sauces, condiments, soup pulp, espresso grounds, bread, cakes, biscuits, desserts, jam cereals of all kinds, e.g. rice, noodles, oats, plate scrapings, and leftover cooked Food waste is seen as a 0 cost valuable resource since it is dumped without being used. Meal wastes contain fat, carbohydrate, amino acid, phosphate, nutrients, and other carbon consist compounds. [(2)]

Biodiesel is commonly made from lipids obtained from food waste. Furthermore, complex carbohydrates such as cellulose and starch in food waste are commonly hydrolysed into tiny sugars such as glucose and fructose. These sugars are then commonly fermented to produce bioethanol. There are additional reviews on the pyrolysis of waste into bio oil. Liu et al. examined the biotechnological production of ethanol, methane, and hydrogen from waste. Pham et al., on the other hand, examined the utilisation of different technologies such as biological, thermal and thermochemical pyrolysis, gasification and hydrothermal oxidation for conversion of meals waste is covert in energy.

Food is out of place or wasted at some undetermined point in the future of the complete food supply chain, from original agricultural production to ultimate own circle of relatives eating. Although its miles balance part of the upstream and downstream of the supply chain on average, the quantity of food waste in the FSC phase varies greatly from place to place. Thousands of different food products are wasted internationally, yet it is difficult to determine how many of them are squandered. The FAO, on the other hand, separates FW into eight commodities: cereals (other than beer), starchy roots, oil plant life and pulses, fruit (other than wine), meat, fish and shellfish, milk (other than butter), and eggs. [(4)]

Food waste disposal is more and more becoming challenging. Every day, the majority of these food wastes are deposited in landfills without delay. The biochemical breakdown of food waste results in an unpleasant odour and the production of a horrifying degraded products. To live far far from this problem, several global places have formulated destiny plans to “use much less” and “waste much less” to increase a green society thru manner of manner of minimizing food waste generation. [(2)]

Recently, there has been a large generation on hand for the utilisation of meal trash. Until now, conventional techniques for meals waste valorisation have included I composting of meals waste, (ii) teaching of animal feed, and (iii) teaching of biogas manufacture. However, this technique is utilised to convert food waste to gaseous fuels rather than liquid fuel. Cutting-edge valorisation generation is necessary for the novice production of liquid biofuels from food waste. In this context, the development of novice catalytic methods is becoming appealing. In this vein, outstanding chemical and enzymatic methods for food waste valorisation can be employed. Additionally, cascade reactions such as chemo-enzymatic, multistep-chemo catalytic, and multistep-enzymatic may be explored for food waste valorisation. These cascade reactions are particularly promising since the intended product may be done in addition to lengthen excluding separation and purification of intermediates in a single solvent solution. In this context, researchers are converting a wide range of food wastes, including bread, vegetable peelings, wheat, meat, rice, and blended meal wastes, into liquid biofuels. Furthermore, food waste can be treated to pyrolysis to produce bio-oil. [(2)]

There are the various type of bio biofuel we can produce by food waste. Bio diesel is used as fuel Europe, US, Asia and many other country. Biodiesel is alternative for of diesel fuel generated from plants or animals that is made up of long chain fatty acid esters. It is often made by chemically interacting lipids such as animal fat (tallow), soybean oil, or other vegetable oil with an alcohol, yielding a methyl, ethyl, or propyl ester via the transesterification process.

2. LITRETURE REVIEW

Yang et al. extracted oil from noodle waste. They have been immediately noodle production waste used as feedstock to transform it into products, bioethanol and biodiesel. They had staple pre-handled to split it into capacity feed stocks, starch residues and vegetable oil, for conversion to bioethanol and biodiesel. For the meeting of bioethanol, starch residues have been transformed into glucose with the aid of using alpha-amylase and glucoamylase. Research the saccharification system of the pre-handled starch residues, that they'd top of the line pre-remedy situations have been determined. The bioethanol conversion reached 98.5 you appearance after the theoretical most with the aid of using baker's yeast K35 fermentation after saccharification benea thneath optimized pre-remedy situations. Moreover, palm oil, remoted from the instant noodle waste, turned into transformed into precious biodiesel with the aid of using use of immobilized lipase (Novozym 435). The results of four classes of alcohol, oil-to-methanol ratio, reaction time, and lipase attention and water content material at the conversion system have been investigated. The utmost biodiesel conversion turned into 95.4 %. (5)

D. Pleissner et al. that they would generate feedstock the potential of fungal hydrolysis in submerged fermentation with the help of Aspergillus awamori and Aspergillus orate as a food waste treatment technique and for the education of fermentation feedstock has been studied. By fungal hydrolysis, 80–90% of the original waste has been reduced and digested within 36–48 hours into glucose, free amino nitrogen (FAN), and phosphate. Experiments revealed that 80–90% of starch is consistently transformed into glucose and the majority of FAN is absorbed, even when strong mashes of A. awamori and A. oryzae are consecutively introduced to fermentations at an interval of 24 hours. A maximum solid-to-liquid ratio of 43.2 percent (w/v) of food waste has been evaluated without a negative influence on glucose, FAN, and phosphate releases, and ultimate concentrations of 143 g/L, 1.eight g/L, and 1.6 g/L, respectively, are received within the hydrolysate. Furthermore, fungal hydrolysis is highlighted as a danger to traditional methods of using food waste. (6)

S. Papanikolaou et al. wish to look at the biochemical behaviour of Aspergillus sp. (5 strains) and Penicillium expansum (one strain) fungus grown on used cooking oil. Carbon-constrained cultures are administered on waste oil, given to the growth medium at 15 g/l), and moderate biomass amounts are generated (as much as c. 18g/l), with a conversion yield of c. 1 g of dry biomass fashioned preserve with g of fat ate or higher. Almost all cultures accumulate a large amount of cellular lipids. Aspergillus sp. ATHUM 3482 accumulated the highest lipid, accounting for 64.0 percent (ww) of the dry fungal mass. In parallel, extracellular lipase hobby was measured and shown to be stress and fermentation duration dependent, with a maximum amount of 645 U/ml obtained from Aspergillus Niger NRRL 363. During the sitting increasing phase, the storage lipid content of the cloth fell substantially. Some variations in the carboxylic acid content of both cellular and residual lipids are found when compared to the original substrate fat utilised; in many situations, cellular lipids that are more saturated and richer in arachidic acid are generated. Aspergillus strains generated up to 5g/l of oxalic acid. (7)

Type of waste	Microorganisms	Fermentation mode	Type of reactor	Fermentation Time	Productivity	references
Noodles waste	f S. cerevisiae K35	Batch Fermentation	250-ml flask	72h	95.4 % diesel	Yang et al.(2014)
Food and bakery waste	Fungal solid mash A. awamori or A. oryzae	Batch Fermentation	2.5 L bio reactor	48h	Glucose-143 g/ L FAN-1.8 g/L phosphate- 1.6 g/L	D. Pleissner (2014)
Waste cooking oil	Aspergillus and Penicillium fungal strains	Batch Fermentation	250ml flask	70-100h	oxalic acid 5g/l	S. Papanikolaou et al.(2011)

Table 2.1 literature summery table

3. EXPERIMANTEL SECTION

3.1 **Materials:**

Potato peel waste was get form house holding waste and local restaurant.

3.2 Enzymes:

Alpha amylase was obtained from microbiology lab of Parul University, Vadodara

Glucoamylse was obtained from Antozyme Biotech Pvt Ltd, Vadodara.

3.3 Microorganisms:

The backer yeast was get from local market of Vadodara.

3.4 Synthesis:

3.4.1 Milling:

Using a kitchen equipment, potato peel waste (PPW) was wash by clear water, sun dried, and pulverised. The flour and powder and the small particle powder is retained in is collected and stored in the air-tight condition in the bottle.

Fig.3.4.1 potato peel waste and milling powder

3.4.2 Liquefaction:

In a 250ml round bottom flask, 10g of potato peel waste was added along with 200ml of distilled water. Now this round bottom flask put in heating mantle. It cooked at 96-105’C for 30-35 minutes.

Fig.3.4.2.1 potato peel powder process of gelatinization

The gelatinized potato peel waste was then allowed to cool down and transfer the solution in clean beaker followed by the addition of alpha amylase enzyme is 0.794gm.The beaker was put on the magnetic stirrer with hot plate and stirrer for 2 hours at 80-85· C and no fixed rpm.

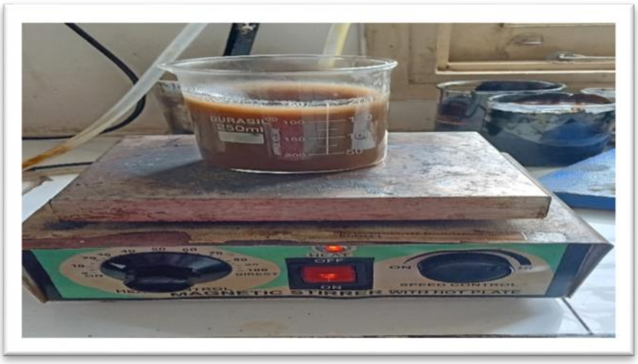


Fig3.4.2.2 the gelatinized potato peel waste on magnetic stirrer with hot plate

At this step the pH is not 6 so therefore the 0.1 N NaOH is add then pH maintain at 6 pH.

3.4.3 Simultaneous Saccharification and Fermentation:

Glucoamylase enzyme (150000U/ml) was added to the liquefied potato peel waste. Baker's yeast was added 1.49gm.The mixture was allowed fermentation time period 48 -96 hours at room temperature.

3.4.4 Centrifugation:

After fermentation, the sample was centrifuged at 3000rpm for 20 minutes.

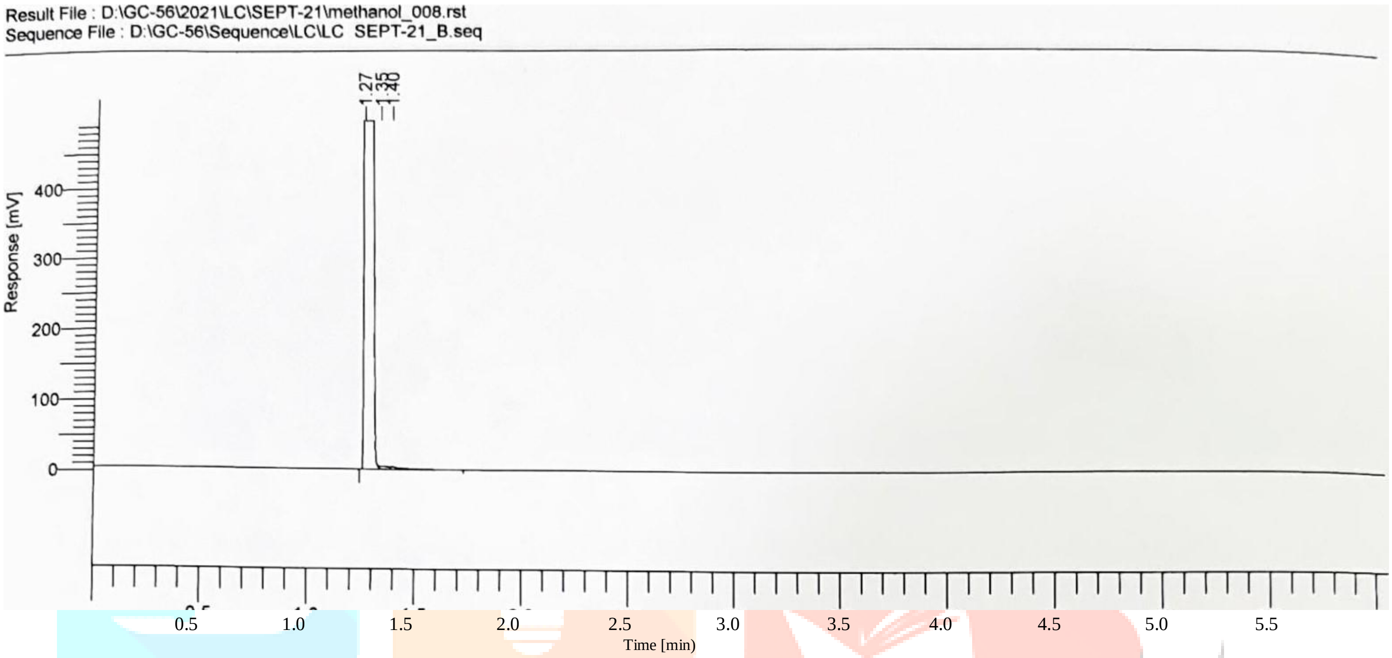
Fig 3.4.4.1 centrifuge the fermented potato peel solution

The supernatant was collected.

4. Result and Discussion

The gas chromatography analysis report:

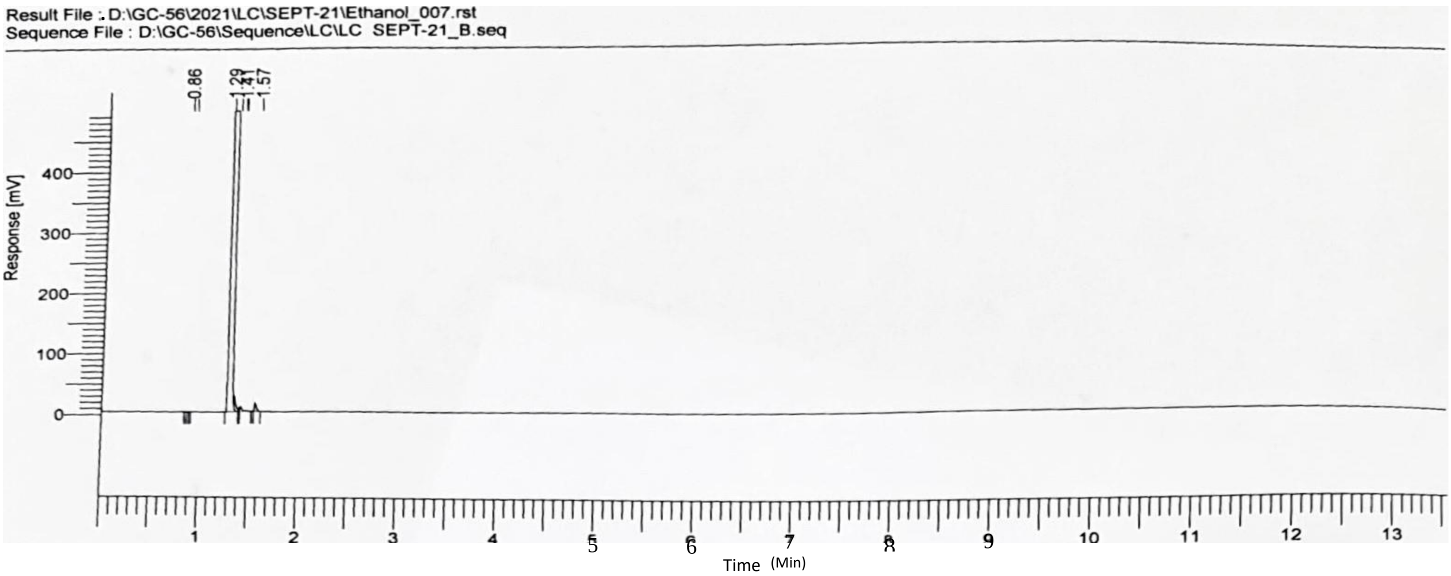
The result of GC (gas chromatography) there are two peaks is show in graph therefore sample containing two different chemical component. The result shows that the sample contain significant amount of ethanol, methanol and other impurities are present. This proves that potato peel waste is and effective substrate for the production of ethanol.



Graph 4.1 methanol present in sample

Peak	Time(min)	Area (uv*sec)	Area (%)	Compound name
1	1.272	17106226	99.823	
2	1.347	11804	0.069	
3	1.401	18566	0.108	
		17136597	100.000	

Table 4.1 the peaks of methanol



Graph 4.2 ethanol is present in sample

Peak	Time (min)	Area (uv*sec)	Area (%)	Compound name
1	0.862	142	0.000	
2	0.906	272	0.001	
3	1.294	30896034	99.773	
4	1.361	30150	0.097	
5	1.410	6087	0.020	
6	1.423	15089	0.049	
7	1.573	18458	0.060	
		30966232	100.00	

Table 4.2 the peaks of ethanol

The graph 4.1 is standard GC test of methanol. The study of graph 4.1 indicate peaks of the methanol is 1.272, 1.347and 1.401 and graph 4.2 is the standard GC test for ethanol. This is indicate that the peaks of ethanol is 0.906, 1.294, 1.361, 1.410, 1.423, 1.573.After analysing peaks of graphs of GC (gas chromatography) we conclude that ethanol and methanol present.

5. CONCLUSION

The capability of potato peel is as raw material that use for the produce the ethanol. We choice the substance, caltalicenzyme, microcells and the situation under that we performed and get that to the great the produce ethanol.in the improved situation of pH is 6.0 and substrate concentration 5% (W/V) , the sample yield is 35-40ml. corn also use as to produce, however the production is not higher than that of potato peel waste. The all methods that produce the sample is under go to GC (gas chromatography) analysis that contain the ethanol and methanol present respectively 41.622% and 18.325%.

6. Reference

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