Indian Journal of Transport Engineering (IJTE)
ISSN: 2582-9300 (Online), Volume-1 Issue-1, May 2021

A Study on Conversion of Waste Food Generation into Useful Resources

Mrugank Trivedi, Parth Modi, Srusti Marfatia

Abstract*: *Biofuel possesses high biodegradability and lubricating property which improves engine efficiency also to reduce our dependence on fossil fuels and to lower emissions of greenhouse gases(particulate matter and carbon dioxide emissions). As renewable biofuels generally contain carbon fixation. Biofuel can be carbon-neutral because all biomass crops sequester carbon to certain extent basically distinctive promise is, in combination with an emerging technology called carbon capture and storage. Biofuels which can be produced from renewable domestic resources offer an alternative to petroleum based fuels. The main contribution of this work lies in comparative study of different methods which are processed by different researchers. This study shall help the policy makers to choose the best criteria out of these methods while formulating newer edition method.

Keywords*: *Biodegradability, Lubricating, Carbon Capture, Sequester, Domestic Resources

I. INTRODUCTION

Overall we see that global consumption of fossil energy has increased more than 1300 fold. The theory which formalize fossil fuels is from remains of dead plants by exposure of heat or pressure. As generation goes on this fuels goes to crises to human beings because it creates hazardous impact on day to day lifestyles in different forms. Some like polluting environment, increasing global warming, coal mining operations wash acid runoff into streams (rivers, lakes, etc), fossil fuels emits harmful pollutants etc. Hence its being a great responsibility to increases demand for renewable sources. As the renewable sources not only helps to alternate the energy issues due to consumption of fossil fuels to worldwide economic evolution but also reduces outpouring of greenhouse gases and assist to support eco-friendly balance and ameliorate personage livelihood environment.

Now deliberation has been attentive on the thermal methods for transformation of biomass to biofuels (biogas, bio-oil , biochar). Throughout previous ten years some methods has been studied.

Manuscript received on 05 May 2021 | Revised Manuscript received on 10 May 2021 | Manuscript Accepted on 15 May 2021 | Manuscript published on 30 May 2021.

***** Correspondence Author

Mrugank Trivedi*, Chemical Engineering, Parul Institute of Engineering and Technology, Anand, India. Email: mrugankt31@gmail.com

Mr. Parth Modi, Chemical Engineering of Parul Institute of Engineering and Technology, Vadodara, India. Email: pmodi1994@gmail.com

Srusti Marfatia, Chemical Engineering, Parul Institute of Engineering and Technology, Vadodara, India. Email: srusti.marfatia@gmail.com

II. PROCEDURES

A. Procedure 1

In association with them one method has been focused that is hydrothermal carbonization technique (HTC) is considered as specific because of its high versatility (Gai et al.. 2015; Yu et al.. 2011). By figuring it the product named hydrochar had increased its heat of combustion (calorific value), desiccation and homogenous properties. Along with this also the fuel properties like the carbon content ratio is perfectible and fixed also much dependency on hydrothermal frameworks like temperature, residence and time (Reza et al.. 2012; Simsir et al.. 2017; Wang et al.. 2018a). In accompaniment to increase fuel properties pelletization process with HTC is introduced. The attention is given to energy density and mechanical strength of hydrochar fuel(Lie et al 2014). As the process begins with heating woody mass under 250 ℃ to produce pellets and the in which the carbon fixation has increased up to 20 to 30 % and calorific values (4-6 Mj/kg) as compared to raw material (biomass) and liquid connection increased tensile strength.(Liu et al.. 2014)

According to previous examine outcomes the heating of hydrochar from 250 ℃ formed pellets is with lower tensile strength also at 200 ℃ the lignin which cant form rigid(solid) bridge and also energy utilization was high. (Wang et al. 2017)

Another nearly recent study shows that hydrochar pellet has very poor mechanical strength because the lignin content was limited as food waste must content of protein, carbohydrate(starch, glucose) and unalterable ways in hydrochar pellets depends on attraction forces.(Zhai et al.)

Nevertheless current studies shows mainly on the hydrochar pellets. Thus it has been concluded that the main dependency of fuel properties and mechanical properties of hydrochar pellets hangs on constituents of raw materials and formulating conditions of HTC.

Lastly the in this study the formation of hydrochar from various food wastes at 180-260℃ for production of fuel pellets was done by also evaluating the basic properties of fuel , mechanical strength , storage attribute , heating characteristics , energy consumptions, etc were determined for solid biofuel manufacturing. (Tangfei Wang, Yumbo Zhai, … 2018)

The challenges to overcome are:-

1. Carbon Fixation
2. Calorific (heating) values
3. Issues on tensile strength
4. Energy Consumptions

B. Procedure 2

As the other method which had been focused after this is for the production of bio-ethanol. Some recent studies and researches had focused on the second-generation biofuels in which the waste food used as raw material. As first-generation biofuels were made to consume sugar and starch content. (Matsakas L , Cristakopoulos P…. 2013) (Moon HC, Song IS… 2009)

This method contains lignocellulosic biomass derived from woody material and agricultural left over residues (corn cobs, wheat, straw, bagasse etc) as reason behind this raw material would be due to large quantity of produced in year as waste(Zhang M, Wang F, …2010). The main challenges faced in deploying the lignocellulosic biomass effective mostly from cellulose (Silva VN, Arruda P, Felipe MA, Gonclaves A, Rocha..2011). Straight to attain this briefing a method followed by enzymatic hydrolysis process appealed. An possible substitute of raw material for production of this kind of biofuel used is household food waste (HFW) because the annual HFW produced according to EU-26(European commission) in 2006 evaluated is 37.7 Mt means 76kg per capita and further increases up to 126.2 in 2020.

The main target of this study is to consume the source detached HFW for the production of bio-ethanol at dry material grade (DM) to accomplish high amount of bio-ethanol. But here only solid state development applied so it creates a viscous pulp. Hence its an major issue for processing and recovery of bioethanol. To conquer this barrier an process named enzymatic liquefaction/saccharification is applied advance to compare with fermentation.(L and Novozym 188)

One of recent research shows another method named gravimetric mixing system along with liquefaction which has also claim auspicious and it was applied for pre-treatment of lignocellulosic feedstock similarly at DM content. (Jorgensen , Larsen J Petersen)

Throughout this process the viscosity of solid state pulp has quickly decreases, however conceal with fermentation also introduced. Eventually at the end the enzymatic liquefaction/saccharification along with fermentation is applied.(Leonidas Matsakas,…2014)

The challenges to overcome:-

1. To efficiently consume sugar
2. To form low viscous pulp

Similarly one another study has made by another researcher by utilising of kitchen waste to produce biodiesel. According to studies regularly the development of the urbanization and industrialization has increased which means the generation of solid waste increased and provoke the handling of its disposal and a major deliberation has done by humans because it creates catastrophic effect in environment(Goel S..2008) . An report has made on municipal solid waste generation (MSW) like :-

In India during 2015 an average MSW generation was 700 tons per day. In common particularly billions gallons of food waste generated(Pandey SK, and Gupta AK.. 2007) . Not only it causes environment but also affects water bodies , ecological diversity , also hazardous impact on animals.(Karmee SK .. 2016)

To overcome this problems the methods for production of biodiesel are implemented some methods are:-

1. Thermal cracking
2. Pyrolysis
3. Micro- emulsion
4. Transesterification

C. Procedure 3 (Transesterification)

In this study mainly on transesterification method has been focused. In this method the oil or fat is reacted with alcohol (methanol or ethanol) in presence of catalyst namely sulphuric acid to produce esters of alkyl and glycerol. This study has made to identify free fatty acids (FFA) which is present in lipid also it is extracted from kitchen waste. This study ensures that this method will definitely reduce the energy and disposal crisis. After that a fatty acid methyl ester (FAME) analysis had done also lastly to purify the production, the gas chromatography flame ionisation detector (GC-FID) to also determine concentration of FAME. (S Barik, KK Paul, D Priyadarshi.. 2018)

Now not only the solid food waste or kitchen waste came in market but also during five years the food industrial waste also useful in production of biofuel. Also the wastes from food industry has better composition and stratum for basic processes like fermentation. They have barely a precise elements and configuration which is suitable for production of biofuel as compared to other wastes. Also the usage of diesel engines is increasing day-by-day and usage of fossil fuels are more costly, so its necessary to produce biofuel.(Antoni D, Zverlov VV, .. 2007)

As bioethanol and biomethane frequently produced by different methods at large scale but it cant be useful for the source of transportation. Hence in this study fuel name biobutanol is produced. The main motive of industries behind production of biobutanol is to use in future as additives for gasoline, diesel and kerosene. Moreover all bio-based alcohols can be used as solvent as basic chemicals. Biobutanol can supply biological productions like butyl-t-butyl-ether (BTBE) as similar as bioethanol supplies ethyl-t-butyl-ether (ETBE).(Lujaji F,… 2011).

The ordinary contentment in vegetable oil is triglycerides, which are genetically viscous. Also the major problems are high viscosity and poor volatility.

The challenges to overcome:

1. High viscosity
2. Poor volatility
3. Contamination of enhanced water (Sarathy SM , Thomsona MJ,.. 2009)
4. Its adaptability of present fluid in different outcomes through pipelines (Van bashyusen R, Schafer F,.. 2007)

D: Different Processes

Similarly one another study has made by another researcher by utilising of kitchen waste to produce biodiesel.

According to studies regularly the development of the urbanization and industrialization has increased which means the generation of solid waste increased and provoke the handling of its disposal and a major deliberation has done by humans because it creates catastrophic effect in environment(Goel S..2008) . An report has made on municipal solid waste generation (MSW) like :-

In India during 2015 an average MSW generation was 700 tons per day. In common particularly billions gallons of food waste generated(Pandey SK, and Gupta AK.. 2007) . Not only it causes environment but also affects water bodies , ecological diversity , also hazardous impact on animals.(Karmee SK .. 2016)

To overcome this problems the methods for production of biodiesel are implemented some methods are:-

1. Thermal cracking
2. Pyrolysis
3. Micro- emulsion
4. Transesterification

Now not only the solid food waste or kitchen waste came in market but also during five years the food industrial waste also useful in production of biofuel. Also the wastes from food industry has better composition and stratum for basic processes like fermentation. They have barely a precise elements and configuration which is suitable for production of biofuel as compared to other wastes. Also the usage of diesel engines is increasing day-by-day and usage of fossil fuels are more costly, so its necessary to produce biofuel.(Antoni D, Zverlov VV, .. 2007)

As bioethanol and biomethane frequently produced by different methods at large scale but it cant be useful for the source of transportation. Hence in this study fuel name biobutanol is produced. The main motive of industries behind production of biobutanol is to use in future as additives for gasoline, diesel and kerosene. Moreover all bio-based alcohols can be used as solvent as basic chemicals. Biobutanol can supply biological productions like butyl-t-butyl-ether (BTBE) as similar as bioethanol supplies ethyl-t-butyl-ether (ETBE).(Lujaji F,… 2011).

The ordinary contentment in vegetable oil is triglycerides, which are genetically viscous. Also the major problems are high viscosity and poor volatility.

The challenges to overcome:

5. High viscosity
6. Poor volatility
7. Contamination of enhanced water (Sarathy SM , Thomsona MJ,.. 2009)

Its adaptability of present fluid in different outcomes through pipelines (Van bashyusen R, Schafer F,.. 2007)

E: Different Reactions

As the demand for biofuels are increasing also production of biofuels are occurring through different methods by researchers.(Some technologies came into existence which produces gaseous fuels and not liquid fuels. Hence in this direction another process named valorization. (Luque R, Clark JH,… 2013)

In this process evolution of green catalytic process are set off captivating method. With this different chemicals and enzymatic processes are involved some are as follows:-

1. Cascade Reactions
2. Chemo-enzymatic reactions
3. Multistep-chemocatalytic
4. Multistep-enzymatic

As this reactions has set better potential without any separation and purgation on ingredients in single solvent. (Garcia J..2011, Karmee SK 2014)

After that different methods came turn over in order to produce different types of biofuels for different applications.

In running of this period the biofuel with its best characteristics has came in market. But still some process has its own limitations. Another research has been made named as microbiological conversion of synthetic food waste to lipids production.

Therefore it is evaluated that the use of volatile fatty acid is subsequent and advantageous for lipid production by different microbiological enzymes (oleaginous) which can convert carbon sources in to different lipids productions. It collects 65% of the dry cell mass. This types of microorganisms are has wide implementations with carbons sources including glucose, xylose, (Hansson and Dostalek 1986a) sucrose((Li et al …2010), starch, lactose(Papnikolaou et al..2010) etc. But none of this procedure proved applicable for the market valuable biodiesel production due to its high cost(Fei et al. .. 2011). Infect another conventional method is applied through methanogenesis bacteria by treating waste water.

The main objectives of this study is to yield more efficient lipid production which can also treated with another nitrogen source and lastly market value biodiesel production.(Shashwat Vajpeyi,…. 2015)

The challenges to overcome:

1. More lipid extraction
2. Combine with efficient carbon sources

To give more potential which can easily viable in market value

III. EXPERIMENTAL WORK

As per the introduction of first method the different types of food and other kinds of waste are collected over worldwide with varying composition values some are as follows:-

raw and cooked vegetables, noodles, meat, some paper cups. From this food wastes the bones and plastics are separated because of operation restrictions. As per above discussion the process named hydrothermal carbonization was implemented in suitable conditions like:-

Equipment:- Reactor

Material:- 316 stainless steel

Capacity:- 500ml

In a fixed feedstock taken and done in trial forms like (food waste were taken in different concentrations 0% , 25% , 50% , 75% , 100%) than it goes further in autoclave with addition of 200ml of deionised water. After that the reactor was heated at different temperature values 180°C , 220°C and 260°C for about one hour.

Published By:
Lattice Science Publication (LSP)

The rate of stirring was commanded by an electromagnetic agitator at rate if 100rpm. After an hour when the reactor itself gets cooled down at the suitable room temperature in which solid remnant(residue) was separated by process of vacuum filtration. From that hydrochar put to dry at 105℃ for one day in drying oven , after than grinded in powder through mesh size of 40.(Jiang et al 2014)

Including this pelletization process is done as individual pellet was pressed during hydrochar process in equipment named cylinder piston along with heating tape which is applied around cylinder and temperature is maintained by thermocouple. (Jiang et al 2014).

As the pelletization process occurs alternately before pressing pellet about 10% (w/w) extra amount of water is added in-order that waste may be act as lubricant during pelletization process. For single trial about 0.6 gm of hydrochar was added after that when compressing force reached to its limits i.e. 4kN and was operated for 30 seconds of time and temperature maintained at 90℃ under this condition lignin forms a natural binder along with pellets.(Reza et al .. 2012)

The energy consumption of pelletization process is evaluated online including compressive force and displacement by suitable considerations of pellet measurement like mass, length, diameter, and this type of solids are stockpile at 4℃ for seven days. Hence the expansion in length is calculated by given equation

Expansion length= (Li-Lo)/Lo

Where Lo = Initial length of pellet

Li= Length of pellet after seven days

Also to measure tensile strength(Ts) the pellet was placed horizontal in middle of compressive force and anvils was given extent up to it may broken and in that the maximum amount of force is observed. Hence the tensile strength was calculated by given equation(Liu et al. .. 2014, Wang et al… 2017)

$Ts = 2f/\pi ld$

Here, f = Maximum force applied

L= Length of pellet

D= Diameter of pellet

Its proved that high temperature allows decarboxylation and dehydration processes. Also with increase in temperature 180℃ to 260℃ there is increase in carbon content continuously but due to hydrochar seems more trust on food waste blend than accordingly the nitrogen ratio varies. Therefore we can say that the content of nitrogen in hydrochar was increased by increase in temperature and this enables for more hydrochar production form food waste. (Wang et al 2018). As it is known that the nitrogen can easily absorb due to different carbonization reactions which mainly happens between protein and sugar(Kang et al.. 2012)

From this research it has been concluded that the content of food waste blended for carbonization process with HTC mainly seems the decreasing value of hydrogen to carbon ratio(H/C) from 0% to 50% also decreasing value in oxygen to carbon ratio (O/C) from 75% to 100%. From results it can said that during pelletization process the decrease in consumption of energy would lead to increase in ratio of food waste , hence the pellets of hydrochar which was made by high content of food waste at low ignition and high temperature range was obtained. In alternative to this instead of pelletization another process named co-hydrothermal carbonization was applied with the content of food waste from 50% to 75% at 220℃ temperature to produce solid biofuel for future practical purposes (Tengfei Wang….2018).

IV. METHODS

In this type of method the production of bio-butanol has done as a form of bio-fuel. This method includes two main categories first in fermentative step and another in combustion on oil mixtures. In this method food waste along with different types of chemicals are utilised in different compositions. The first step includes table of compositions which are as follows:-

Composition and chemicals	Amount in g/l
1. Meat extract	10.0 g/l
2. Peptone	10.0 g/l
3. Yeast extract	3.0 g/l
4. Soluble starch	1.0 g/l
5. Cysteine Hydrochloric acid	0.5 g/l
6. Natrium chloride	5.0 g/l
7. Natrium acetate	3.0 g/l
8. Lactose	45 g/l

In this step a solution of media is prepared in an anaerobic type which mainly consist of

Nitrogen :- 95% (v/v)

Hydrogen:- 5% (v/v)

Then the sterilization of media has done at temperature 120℃ for twenty minutes with the spore cultures are added and this experiment is done in an 50ml batch(culture) fermenter. After 24 hours the sterilized media was inoculated in the ratio of 1:50. Also this experiments were done in serum bottles which has butyl stoppers of 100ml temperature at 30 ℃ . By using the gas chromatography the solvent concentrations has been measured. (Perkin Elmer)

The another step includes combustion of oil mixtures in which blending of fuel has been done in oil of rapeseed refined(Brokelmann oelmuehel) and with n-butanol (Carl roth GmbH) which are prepared on weight basis. After that the kinematic viscosity of blended fuel has been measured by viscometer. Further different types of tests has done like

1. Flame ionisation detector EuroFID (Sick Maihak)
2. CI- mass spectrograph (Messtechnik GmbH)

In this apparatus the consumption of fuel was recorded through scale. In equipment there are three types of loads are running at different powers (4.6kW, 3.7kW, 2.7kW) for blending of each fuel.

For this kind of production mainly the food waste are collected from food industries and different chemicals which can be used as energy source as also carbohydrates.

For fermentation the food waste should contain water content for production of bio-butanol. Here two types of strains are used sweet strain as well as acid strain.

Published By:
Lattice Science Publication (LSP)

By combustion experiments it shows different emissions like CO-, THC- as well as acrolein emissions at different loads with different levels. (Xiaoyan SHI .. 2008). On the lower level of engine running on load there are more NOx – emission.

A. By Chemical Oxygen Demand (COD)

As another method is studied for production of bioethanol. The present sugars like glucose, sucrose and fructose has highest content of cellulose which can further readily converted in to bioethanol. Therefore according to previous study of researchers in literature are that they measures food waste by chemical oxygen demand (COD), volatile solids(VS) and (BOD) biological oxygen demand(et cetera 2013).

To apply most applicable and efficient method for production of bioethanol it is important to know the basic proportions of insoluble and soluble sugars also which type of insoluble polysaccharides are use for most efficient type of enzymatic hydrolysis process(Zhang and Richard.. 2011). The compositions of waste food is provided in expanded variety which is shown in tabular form which should be present in food waste

The above tabulated composition was given by (Moon et al 2009)

Compositions	w/w
1. Starch	34.80%
2. Reducing Sugars	23.30%
3. Amylases(Moon et al..2009)	1.60%

Another composition was given by other researcher (Yan et al. 2011)

Composition	w/w
1. Starch	30.1%
2. Fiber	14.9%
3. Reducing Sugars	17.6%
4. Amylases	63.5%

As after the equivalent amount of composition taken from above than process named liquefaction/saccharification is performed for eight hours from DM material which is allowed previous for fermentation process content at 45% w/v with other DM contents are fermented at 35 and 45% w/v. Now it has been found out that the maximum yield of bioethanol after 15 hours is from

1. DM at 35%w/v → 34.85 g/l
2. DM at 45%w/v → 42.78 g/l

But when considered initial content of cellulose in obtained products then it is 0.443g/g at 35%w/v and 0.423g/g at 45%

Hence it is proved that the maximum bioethanol yield after fermentation process was from 35%w/v DM Which could be applicable for further treatment. After doing the main treatment i.e. liquefaction/saccharification it increases the efficiency of product and also cause reduction in viscosity (Kem et al. 2011)

B. Fermentation

To increase the content of DM it is also found out that by doing separate hydrolysis and fermentation instead using liquefaction/saccharification (Manzaneres et al. 2011) and resulted that this separate step increases the fermentation of hot water liquid (Hoyer et al. 200 9). The comparison was done between theories of these given researchers and concluded to work on previous method instead of Moon et al. As per previous theory the liquefaction process takes place for three hours of waste food with content of carbohydrases and amyloglucosidases in which the bioethanol production goes up to 29.1 g/l (Walker et al. 2012).

The fermentation of process done at 35% and 45% (w/v) DM liquified process for pre-treatment which is done at flasks name Erlenmeyer 100ml. The microorganisms used during fermentation is bakers yeast added in DM 15mg/g. Now to understand importance of liquefaction/saccharification process the different types of trials are made with different intervals of time. After completion of fermentation process the broth has been filtered out through vacuum , which is further washed with the distilled water to remove solid content from it. Afterwards the solids are dried in drier at 60℃ till weight becomes constant and lastly used for bioethanol production which is hydro thermally pre-treated.

In an laboratory for this experiment about 2kg of food is collected in different compositions and from that some amount of moisture content from it are removed. Moisture content removed from waste food at considerable temperature by different methods some are as follows:-

1. Oven drying :- Operated at Different temperatures (55℃ , 75℃ , 105℃)
2. Freeze Drying:- (-4℃)
3. Sun Drying:- 25-30 ℃

Important challenges facing during this process is to more lipid extraction along with water. After drying food waste, had been grinded into powdered form and this powder is useful in more extraction of lipid.

Extraction of lipid and Analysis based on that:-

An equipment named Soxhlet apparatus is use for lipid extraction by using solvent as methanol. After process of extraction the liquid and solid particles are filtered out by using whatman 42 filter paper of size 125mm diameter , after that the solvent which is used during lipid extraction by equipping rotary evaporator at 70℃ the recovered solvent methanol is stored in which can use for next process, so there is none any wastage of solvent. The lipid which was extracted was stored in dessicator through whole night and then it is weighted by weighting machine to evaluate the maximum yield of lipid. The test name gas chromatograph mass spectrometer (GC-MS) is introduce to analysis to determine how much fatty acids content are present which further indicates the potential of waste food for production of bio-diesel. Now after analysis the lipid content which was remain left as residue is can be reused in pharmaceuticals industries in preparation plant nutrients, medicines and drugs.

Hence now the process named transesterification was introduced for converting food waste into biodiesel by utilising acid catalyst. The process starts from here as the known quantity of lipid was taken in RB flask with solvent as methanol and catalyst as sulphuric acid put closed. Probably the excess amount of methanol is added in this solution so that a maximum conversion takes place of fatty acids in to fatty acid methyl ester [FAME]. (S Barik.. 2018)

Published By:
Lattice Science Publication (LSP)

C. FAME Test

After FAME for separation of glycerol and biodiesel is done in which suddenly the solution is kept for cooling and which was taken to separatory funnel for 24 hours and as talked the methanol was recovered using rotary evaporator at 70℃. The main key fraction of this process is removal of glycerol and glycerides because biodiesel mainly shows dependency on glycerol content and if high concentration of glycerol present in biodiesel it can cause many problems like emission of aldehyde and storage problems. (Faccini C S. 2011). Also an important step to wash biodiesel for removal of catalyst and impurities. Lastly the biodiesel which was purified was analysed from test named gas chromatograph flame ionisation detector (GC-FID). After that the different properties of biodiesel was compared with different standards. Composition of food waste taken are as follows:-

As it is known that food waste mainly consist of rice, pulses, peels of vegetables, paneer. Here it has been seen that the amount of fat content is more in non-vegetarian food as compared to vegetarian and it has been told that more fat content means more lipid content, hence more lipid extracted.

Also it has been evaluated the amount of lipid extracted

1. Maximum from vegetarian :- 32.5%
2. Combine Vegetarian and Non-vegetarian:- 37.3%

This is another method of conversion of waste food which usually contains volatile fatty acids in to lipids. Here some chemicals are used to create medium they are as follows:-

Chemicals	Amount
1. KH2PO4	3 gm
2. MgSO4. 7H20	1 gm
3. Fecl3. 6H20	15 mg
4. Znso4. 7H2O	7.5 mg
Cuso4. 5H2O	0.5 mg

Here the microbiological cultivation which contains all solutions and was sterilized at 121℃ for fifteen minutes at 15 psi pressure. Now to stay away from volatilization the feed than moves to autoclave where a cooling medium is inhibited. In inoculum the broth of culture growth has done at 23℃ temperature also the pH of autoclave has maintained at considerable conditions. (Shashwat Vajpeyi…2015)

Here the anaerobic fermentation of food waste has been done which provided jacketed vessels maintained heat at 37℃ in which the hot water is recirculated as well as the pH of fermenter maintained at 6.5 at automation. After this step finally lipid extraction is done in which there is determination of fatty acids had done. Therefore similarly as before methods the FAME test has been done with GC-FID at temperature 40℃ in which 6℃/min is maintained then slowly increase till 250℃ in which 15℃/min is maintained. The important effect on lipid production would be carbon to nitrogen ratio. In this experiment the nitrogen was considered as growth limiting. It has been observed that the addition of excess nitrogen in process would decrease the lipid extraction. (Kartik Chandran… 2015)

Sample Taken	Amount of Sample	Fat content in sample
1. Chicken	100gm	14gm
2. Mutton	100gm	21gm
3. Fish	100gm	12gm
4. Paneer	100gm	20.8 gm

From above test it has been evaluated that the production of biodiesel by transesterification process is somewhat alternative useful method from above given processes. But this process is very much time consuming which is the main factor responsible of not using it. In process the waste food was dehydrated for maximum lipid yield Therefore current trending technologies are finding solutions regarding production of biooil.

This is another method of conversion of waste food which usually contains volatile fatty acids in to lipids

V. CONCLUSIONS

A. Concluding Statement

As expressed from the above information several methods are been concluded in which different methods are been analysed by different researchers. This all methods are better but cant utilised due to limitations. According to me the vegetable oil should be utilised to produce biofuel it is economical process.

REFERENCES

1. Matsakas et al, Yu et al. Utilization of household food waste for production of ethanol at high dry material content , Biotechnology for biofuels pp. 1754-6834-7-4 (7:4) 2014
2. Reza et al, Simsir et al , Wang et al.. the effects of temperature of color value on hydrochars properties in hydrothermal carbonization, Bioresource Technology pp. 249, 574-581 2018
3. Zhai et al , Gai C An investigation of reaction on pathways of hydrothermal liquefaction using chlorella pyrenoidosa , Energy Convers, pp. 96 , 330-339 2015
4. Tangfei Wang, Yumbo Zhai, Production of fuel pellets via hydrothermal carbonization of food waste using molasses as a binder , waste manage ,77 185-194 2018
5. Reza M.T. , Yang X Hydrothermal carbonization and pelletization of Two Arid Land Plants bagasse for energy Densification , ACS sustainable Chem. Eng. 4 , 1106-1114 2015
6. Pandey SK, Gupta AK Municipal solid waste management in Ghazipur city , a case study journal of Agricultural and Biological science 2, pp. 41-43 2007
7. Karmee SK Liquid biofuels from food waste : Current trends , Prospect and Limitation, Renewable and sustainable Energy Reviews 53, 945-953 2016
8. Karmee S K ,Lin C S K , Valorisation of food waste to biofuel : Current trends and technological challenges , sustainable Chemical Processes 2 pp. (22) 2014
9. Garcia J, Karmee S K , Food waste recycle as biofuel , Journal of Standford Edu. , 2014
10. Walker K, Kem et al, Ethanol Fermentation From Food processing waste , Enviorn Prog Sustain Energ 32:1280-1283 2012