Print ISSN: 0976-2876 Online ISSN: 2250-0138

Available online at: http://www.ijsr.in

INDIAN JOURNAL OF SCIENTIFIC RESEARCH

DOI: 10.32606/IJSR.V11.I1.00009

Received: 17-02-2020 Accepted: 18-06-2020 Publication: 31-08-2020

Indian J.Sci.Res. 11 (1): 45-56, 2020 Review Article

A STUDY ON THE IMPACT OF ENERGY CONVERSION TECHNOLOGIES ON FOOD WASTE FROM MACROMOLECULES ON THE ENVIRONMENT

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ABSTRACT

Now days declining resources, increasing consumption, and inaccurate in energy consumption have led to global environmental crises. One of the best solutions is to use alternative fuels. Food waste can be used to supply alternative fuels. These wastes have degradable organic materials, which their releasing into the environment into the environment can cause many problems. The three major macro molecules in food, i.e. sugars, lipids, and proteins, can influence the production of clean energy through conversion processes. Starch, cellulose, hemicellulose and pectin from sugars, fatty acids from lipids and released amino acids from protein can be used from suitable raw materials in food processing to produce energy. Biogas, bioethanol and biodiesel energy processes are performed by anaerobic digestion, fermentation and chemical conversion processes, respectively. Food processing lines use a lot of energy to convert raw materials into final products, so the food industry is one of the seven most energy consuming industries. In this industry, in addition to high energy consumption, a large amount of solid and liquid waste is also produced. These wastes mainly contain biodegradable organic materials, the discharge of which causes significant environmental problems in the environment. Normally, a large amount of food waste is buried in a landfill, but liquid waste is dumped into rivers, lakes or oceans, or discharged into sewage. Recently, strict environmental regulations have severely restricted the discharge of solid and liquid wastes from food processing into the environment. Therefore, the disposal of these wastes is one of the major problems in the food industry, increased fuel prices and high energy consumption costs in the food industry, has strengthened the use of waste from these industries to produce cheap and clean energy in the form of biodiesel, biogas, bio-oils and synthetic gases. This article reviews the most important methods of converting waste and food waste into various forms of Energy and the impact of energy conversion technologies from waste of food macromolecules on the environment.

KEYWORDS: Food Waste, Macromolecules, Energy Processing, Waste Processing, Food Production, Modern Energy Production Techniques

One of the most important management issues in today's society is to prevent environmental pollution. Environmental issues and the need to pay enough attention to its preservation are currently not limited to a specific region or country, but have spread globally. Neglecting environmental issues has adverse consequences, the most obvious of which are environmental degradation and the spread of pollution and the spread of disease. One of the main environmental problems of today's society is the continuous production of waste containing organic materials. Today, waste disposal methods such as waste dumping are not acceptable, and even hygienic land filling and incineration are not suitable and sustainable methods. Nowadays, due to the stricter environmental standards, the issue of energy recovery and recycling of waste has been considered as a goal [DehghanSorond *et al.*, 2015].

Food wastage and its accumulation are becoming a critical problem around the globe due to continuous increase of the world population. The exponential growth in food waste is imposing serious threats to our society like environmental pollution, health risk, and scarcity of dumping land. There is an urgent need to take appropriate measures to reduce food waste burden by adopting standard management practices. Currently, various kinds of approaches are investigated in waste food processing and management for societal benefits and applications. Anaerobic digestion approach has appeared as one of the most ecofriendly and promising solutions for food wastes management, energy, and nutrient production, which can contribute to world's ever-increasing energy requirements. Here, we have briefly described and explored the different aspects of anaerobic biodegrading approaches for food waste, effects of substrates, effect of environmental factors, contribution of microbial population, and available computational resources for food waste management researches [Pratyusha *et al.*, 2012]

Food waste represents a significantly fraction of municipal solid waste. Proper management and recycling of huge volumes of food waste are required to reduce its environmental burdens and to minimize risks to human health. Food waste is indeed an untapped resource with great potential for energy production. Utilization of food waste for energy conversion currently represents a challenge due to various reasons. These include its inherent heterogeneously variable compositions, high moisture contents and low calorific value, which constitute an impediment for the development of robust, large scale, and efficient industrial processes. Although a

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considerable amount of research has been carried out on the conversion of food waste to renewable energy, there is a lack of comprehensive and systematic reviews of the published literature. The present review synthesizes the current knowledge available in the use of technologies for food-waste-to-energy conversion involving biological (e.g. anaerobic digestion and fermentation), thermal and thermochemical technologies (e.g. incineration, pyrolysis, gasification and hydrothermal oxidation). The competitive advantages of these technologies as well as the challenges associated with them are discussed. In addition, the future directions for more effective utilization of food waste for renewable energy generation are suggested from an interdisciplinary perspective. Therefore, factors such as rapid population growth, declining common energy resources, and rising costs are forcing many countries to look for new resources and renewable energy.

Studies have shown that energy demand increases by a factor of two to three during this century, and at the same time, the concentration of greenhouse gases in the atmosphere is rapidly increasing. The most important of these gases is the emission of carbon dioxide from fossil fuels. Another major global challenge to energy security is the location of oil and gas reserves, which are mainly concentrated in unstable political areas. Accordingly, today, energy recovery from various sources has become an important and significant issue [Jahed *et al.*, 2017].

Figure 1 summarizes the roadmap for renewable energy production in this section.

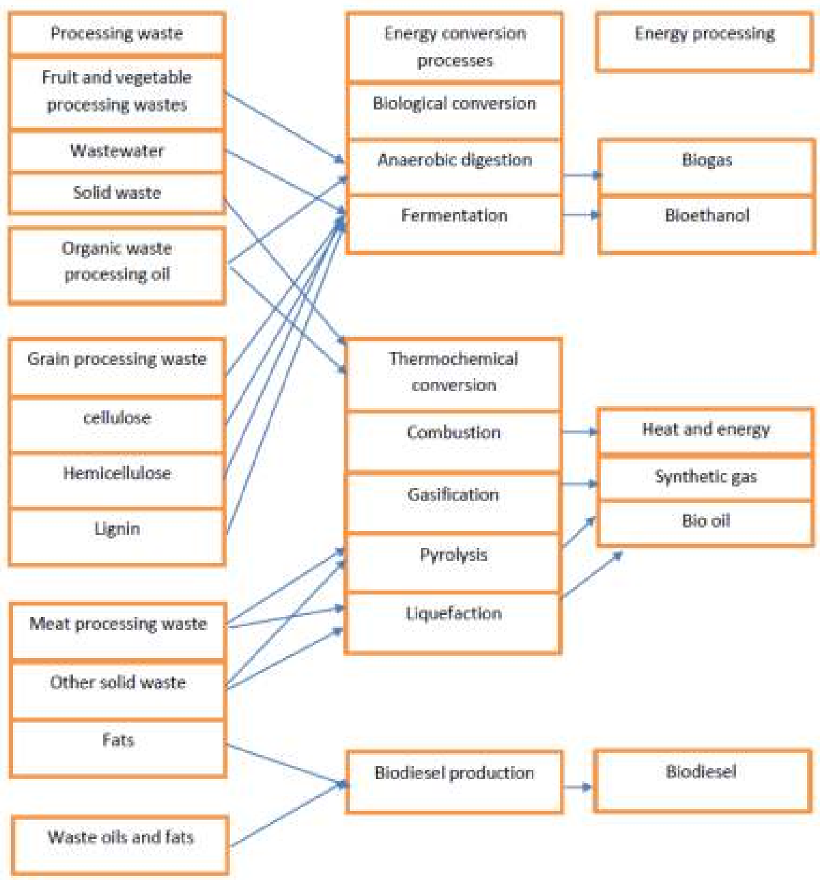

Figure 1: Overview of energy conversion for food factories waste

The construction and development of industries for socio-economic development pursues goals such as increasing domestic production, job creation and, consequently, increasing the quality of life. It should be noted that any type of production activity cannot be free of contamination and pollution, and the production of waste materials in industries is an inevitable phenomenon.

In this regard, sustainable development will be achieved only if we turn to methods in the production of industrial products that the amount of waste and pollutants resulting from them is less than conventional industrial processes, and also by modifying the strategy of the production system. Reduced waste [Ferronato and Torretta, 2019].

Reducing the amount of waste produced, in turn, means reducing production costs, as it prevents waste of raw materials. The food and pollution industry due to its production and conversion processes is no exception of this issue. Food production and its processing produces a large amount of solid and liquid waste annually. These wastes mainly contain organic and macromolecular materials that are degradable and their discharge into the environment can cause significant environmental pollutions problems. Also, high energy consumption in the food industry, limited fossil fuels, increased greenhouse gas concentrations and, most importantly, cheaper industrial waste can be good options for renewable energy production [Jalali *et al.*, 2014]

Currently, there is a rise of the impelling need in recycling and energy saving due to present environmental and economic condition. Various diverse technologies were exploited and developed to utilize waste to produce bioenergy. The conversion technology of waste to energy involves the transformation of waste matter into numerous form of fuel that can be utilised to supply energy. In the recent years, environmental-friendly exploitation and conversion of biomass waste into chemical fuels is considered as one of the effective approaches developing renewable energy.

There are several technology and process options that are available for biomass energy conversion. Apart from transesterification technique, transformation of waste biomass to energy is carried out using these two general techniques which are thermochemical and biochemical conversion. Conversion by means of thermochemical is the decomposition of organic components in the biomass using heat whereas biochemical conversion utilizes microorganisms or enzymes to convert biomass or waste into useful energy [Kebriti *et al.*, 2012]

Conversion by means of thermochemical technology comprises pyrolysis, gasification, liquefaction, and combustion. Biochemical conversion, on the other hand, encompasses three process options known as anaerobic digestion, alcoholic fermentation and photobiological reaction. The following sections review recent studies about the techniques entailed in the conversion of waste to energy systems.

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According to the above said issues, the researcher in this research seeks to review the A Study on the Impact of Energy Conversion Technologies on Food waste from Macromolecules on the Environment.

OBJECTIVES

This article, while listing the types of waste produced by food products that are discarded as waste that has no result other than wasting national capital and environmental pollution overviews of biogas, bioatanel and biodiesel energy processes based on the three organic macromolecules in food and its wastes, namely carbohydrate, lipid and protein structures, and the impact of waste from this technology, ie the conversion of food waste into non-fossil and pure energy.

Research Methodology

The research method used in this paper is a review based method that in the relation to the Impact of Energy Conversion Technologies on Food waste from Macromolecules on the Environment, studied the background of past research and examines most of the articles that have worked on the subject of this article. The researcher has gained a general understanding of the Energy Conversion Technologies from Food waste and its importance and situation.

Using this research method, relatively rich information is provided for the researcher. Using a review method, this paper examines, analyzes, and evaluates each article related to the subject Energy Conversion Technologies on Food waste in such a way that the information and related articles that have been published before are summarized and studied carefully.

In this review method used in this article, it has been tried to be very citation, although in this method it is not necessary to mention all the details, but nevertheless the details of all the works have been paid to the same extent, such as the importance of the subject of the Energy Conversion Technologies on Food waste and its position, express problems and goals and ....etc.

In this research method, it has been tried that every article or book and research done by others used, even if something is mentioned in the article of others, has been indicated to it in this article as its source.

The researcher has tried to find and use review articles related to the relevant topic, and has tried to use new articles that are easier for the researcher to understand and to use valid journals, conference papers, and reference books. Finally, in the discussion and conclusion section, researcher has expressed Impact of Energy Conversion Technologies on Food waste from Macromolecules on the Environment well and specified its importance and position for managers and decision makers in this field.

Waste From Food Products

One of the barriers to food supply and security for the people of the world is waste and losses of food products. The waste of these products can be seen in the pre-production, production, supply and sale and consumption stages. In other words, there are food supply and product wastes in different supply chain links [DehghanSorond *et al.*, 2015]

According to the FAO, part of the produced food in the world is turned in to waste, that to provent this food waste and its optimal use can be an important way to feed the growing population. In the literature of waste food, waste and loss occur at different stages of the supply chain. At the end of the supply chain, food waste is formed by consumers who throw away and do not consume more food than they consume. Food waste is reffered due to the inefficiency of food production and processing, in which food loses its nutritional value or is discarded before it reaches the consumer. Both of these are considered food waste. According to FAO studies, it is estimated that the world's annual waste and food waste for cereals and legumes is about 30%, 40-50 percent for root crops, fruits and vegetables, 20% for oilseeds, meat and dairy products, and 35%is for fish. More than 40% of food waste occurs in developing countries in the post-harvest and processing stages, and in developed and industrialized countries more than 45% of waste occurs at retail and consumer levels. (FAO, Global Initiative on Food Loss and Waste Reduction, 2015).

Food Waste and losses are highly dependent on the local and cultural conditions of each country. There are food production at present, and only half of the food that is turned into waste or wasted can only provide food for the world. In the meantime, food production management and distribution management, optimal and correct consumption, are ways to deal with waste reduction and food waste is another important issue is recycling waste and turning it into another product and most importantly, converse this waste into energy and eventually economic value creation [Didar, 2018]

In the meantime, waste and losses of organic products and food has recyclability for other uses.

Organic food products not only affect ensuring the health and food standards of the world's population, protect the environment and basic resources, and solutions to reduce greenhouse gas emissions, but also its waste can also be used in form of recycle to produce other products; Therefore, the production of organic products is beneficial for both humans and the environment [Fardin *et al.*, 2018]

Also in the production stage due to the high capacity of food industries and factories, many wastes and loses are produced, which can cause an increase in COD& BOD in the sewage network and environmental problems due to the presence of nutrients in them, but these wastes can be used to produce value-added materials, for example the conversion of dairy industry waste in to whey, can be refered to which is used in the production of dry milk, biscuits, soft drinks, bakery industry, etc. [Ferronato and Torretta, 2019] dairy can be referred to as whey, which is used in the production of dry milk biscuits, soft drinks, bakery industries, etc. or from cereal waste In addition to animal feed, can be used in the production of compost fertilizer, soil cover fuel, etc or from meat organic Solid waste , Fertilizer from blood, Protein from skin and bone,…. Gelatin is produced or from seeds and skins from the waste of tomato paste factory, Natural lycopene pigments can be produced and also can produce Protein fortifying materials, etc. Also from grain-derived meal valuable sugarcane molasses residues of citrus, grape pulp, date waste, valuable products can be produced. Here are some of the important wastes from food products caused by energy conversion technologies from waste from macromolecules [Fritsch, 1981]

LESIONS (WASTE) FROM ORGANIC MACROMOLECULAR MATERIALS

Waste From Sugar Materials

Among the various agricultural and livestock products in the world, garden products such as fruits and vegetables have a waste rate of about 40%. Among horticultural products, the most waste belongs to vegetables, followed by products such as grapes, apples, citrus fruits, pomegranates, peaches and cherries, with a rate of about 20 to 30 percent that most of this waste production occurs in the post-harvest stage, such as processing and packaging. It is even possible to produce valuable products from waste products such as dates, alcohol, vinegar, tea, kernel powder, kernel oil, dough and liquid sugar [Jalali *et al.*, 2014].

Cereals are one of the most important food sources in the world. Since the purpose of milling of many grains is to separate the endosperm from other parts, the outer shell of the inner layer of bran attached to the endosperm germinates and broken grains as by-products of the milling process or waste from the endosperm. Although these materials are a source of phenolic and antioxidant compounds of necessary protein amino acids and are content of high Fiber and diet and high in fiber and dietary content that less attention has been paid to their applications in the country. Recent paper on the various uses of waste in food and non-food industries such as biological fuels. Replacement of synthetic antioxidants produced by emulsifiers and natural flavorings of decomposable plant fertilizer films can be useful in providing solutions for optimal grain consumption and increasing the value of waste from grain production plants [Jahed *et al.*, 2017]

This paper discusses the various uses of waste in food and non-food industries such as biological fuels, natural antioxidants to replace synthetic antioxidants produced by emulsifiers and natural flavorings degraded by plant fertilizers, and its results can provide solutions for optimal grain consumption and increase value of waste factories produce grain products to be useful.

This paper addresses the various uses of waste in food and non-food industries, such as the biological fuel of natural antioxidants, to replace synthetic antioxidants produced by emulsifiers and the natural flavorings of decomposed plant fertilizers. And its results can be useful in providing solutions for optimal grain consumption and increasing the value of waste from factories producing grain products.

One of the structures used in the production of renewable energy is polysaccharides. Polysaccharides are compounds that have more than 10 monosaccharide units in their structure they have no regenerative properties. If only one type of sugar is formed by the hydrolysis of a polysaccharide, it is called hemopolysaccharide, and if more than one type of sugar is formed, it is called heteropolysaccharide. Among among the types of hemopolysaccharides can indicate to Styrofoam, cellulose and glycogen are. However, gallstones, hemicellulose and pectin are among the types of heteropolysaccharides [Kulkarni *et al.*, 2012]

The starch structure consists of two different parts, including the linear part of the amylose and the branched part of the amylopectin. The linear section of the amylose in the starch structure consists of glucose units with α (4 1) bonds. During the amylose linear structure, one helix is formed for every 6 glucose molecules. Therefore, in general, amylose has a helica (Helix) l-like structure.

In general, the number of glucose units in an amylose linear structure varies from 2000-400 molecules. But amylopectin contains a branched chain that may contain 106 glucose molecules. Glucose molecules are bonded by α (4 1) bonds, but about 4% to 5% of bonds are also of α-t (1---6) type. The α (1---6) bonds in the amylopectin structure is forming sub-branches. amylopectin has a spiral structure like amylose, [Kulkarni *et al.*, 2012].

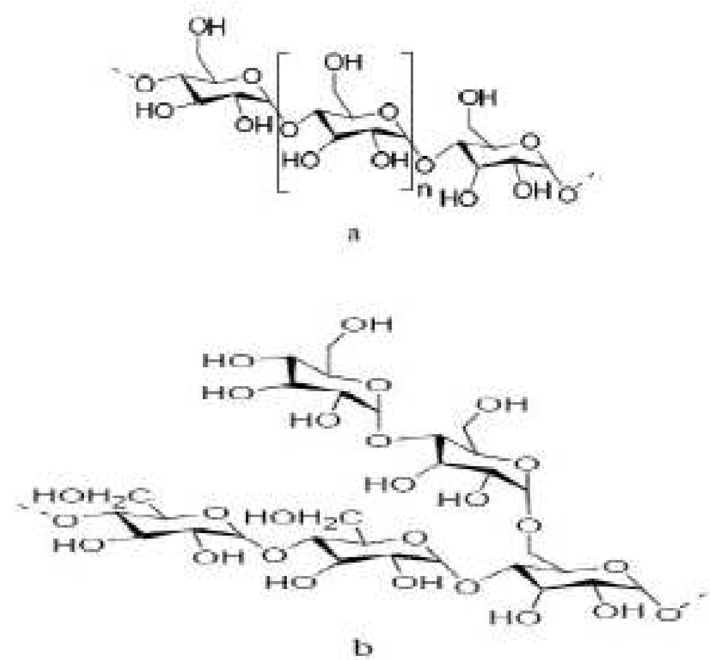

Figure 2: Starch structure (a) Amylose (b) Amylopectin

Cellulose strengthens plant tissues and is abundant in wood and cottonseed. It lacks a spiral and side branch building and consists of glucose units with β (1 4) connections. The degree of cellulose polymerization is between 300-3000 glucose units. Hemicellulose is composed of D_ Xylopyranose units with α (1 4) bonds, which have arabinose lateral branches. This compound accounts for about 43% of wheat bran carbohydrates [Kulkarni *et al.*, 2012].

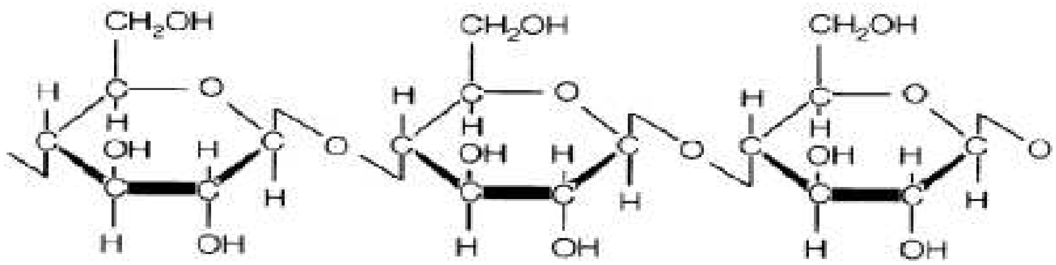

Figure 3: Cellulose structure

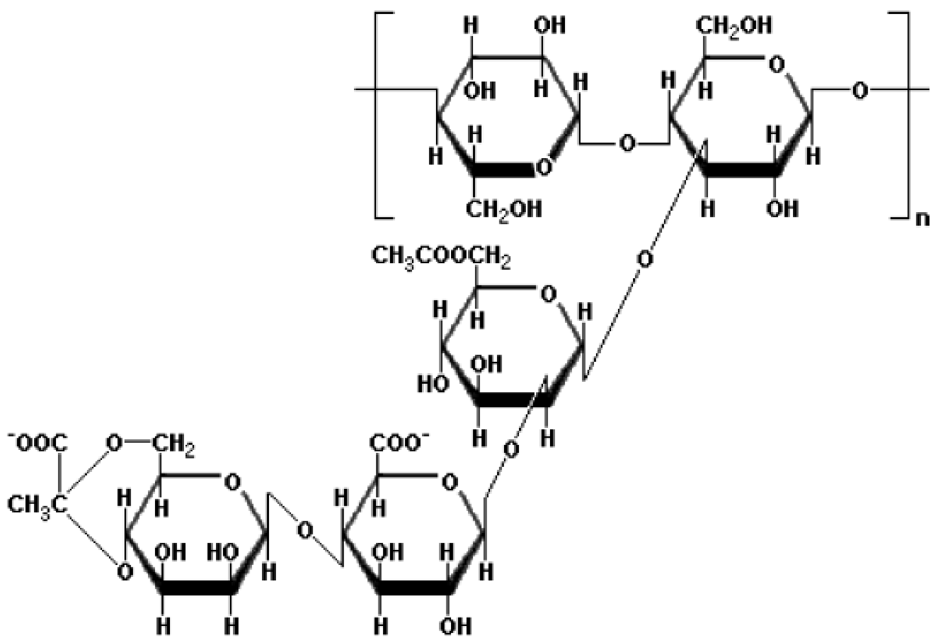

Figure 4: Hemicellulose structure

Pectin is a plant polysaccharide that is located within the distance of the cell wall, plant cells, and strengthens the tissue of fruits and vegetables.

This compound is in the form of protopectin and is insoluble in water, but gradually with the Fruit ripening and as a result of enzymatic activities, protopectin converts to pectin, which is a water-soluble substance. As a result of polymerization, α-D-Galacturonic units are obtained by combining α (1 4) A compound is obtained called Pecticacid. If some carboxylic groups in Pecticacid are replaced by methoxyl groups, they are called pectin. Depending on the degree of pectin metaxalization, different types of pectin with different properties are obtained [Kulkarni *et al.*, 2012].

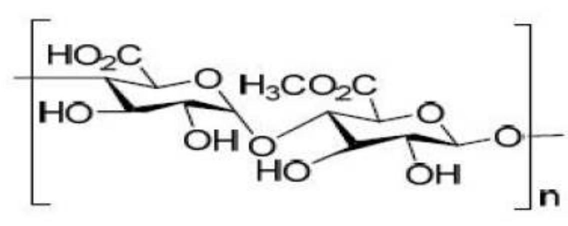

Figure 5: Pectin structure

Lipid Waste

Another source of energy is fat waste. For example, cooking oil waste, waste, restaurant oil, and animal fats can be raw materials for biodiesel production.

The use of waste oils and fats, in addition to being a good way to solve the problem of burying these wastes, significantly reduces the cost of biodiesel production. In addition, the use of waste oils may improve oxidative and stagnant stability compared to primary vegetable oils. Problems with the use of these sources for biodiesel production include high concentrations of free fatty acids and high moisture content, which prevents the use of alkaline esterification. Under these conditions, acidic precursors can be used to reduce the amount of free fatty acids [Didar, 2018].

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Fats are compounds that are soluble in non-polar solvents such as ether, chloroform, and benzene. They are divided into two categories in terms of composition,: soapy fats and non-soapy fats. There are fatty acids in the structure of soapy fats, so they produce soaps due to the hydrolysis reaction with alkalis such as soda or potash, also called compound fats. However, there are no fatty acids in the structure of non-soapy fats, so they do not produce soap due to their reaction with alkaline compounds, they are also called simple fats [Fritsch, 1981].

Equiation(1):
$R\_CooH + NaOH \leftrightarrow RcooNa + H2O = Soap$

One of the most important issues in the oil industry is the reduction of waste in the production process in order to produce more and reduce costs. Among the processes that have a good effect on waste generation in this industry can point to the storage of crude oil in tanks, gum and neutralization, discoloration, hydrogenation, discoloration, deodorization and filling and packaging [Kebriti *et al.*, 2012]. In the case of oilseeds, from the point of view of the Food and Agriculture Organization of the United Nations and the United Nations Environment Program, any change in the quality of agricultural products that makes them non-edible, inaccessible, unsafe and makes agricultural products inedible for humans is considered waste.

The waste in the processing of oilseeds and crude oil treatment is both quantitative and qualitative. Low waste, oil weight loss that can be measured. Qualitative waste, reduction of oil quality, the method of valuation of which is different from quantitative waste. Waste, waste products along with grain and crude oil, and waste products produced at different stages of the process are extracted as much as possible during the various stages of processing and treatment [Kebriti *et al.*, 2012].

Protein Waste

The Proteins production unit are amino acids that are linked together by peptide bonds. Polymers containing 10_2 amino acids are called oligopeptides, polymers that contain 10-50 amino acids are called polypeptides, and polymers that contain more than 50 amino acids are called proteins. In total, 20 different amino acid acids have been identified, called standard amino acids. There are other types of amino acids that are standard derivatives of amino acids and are found in small amounts in the structure of peptide compounds. One of the types of waste as a raw material for the production of renewable energy is the protein in meat [Toldrá, 2011].

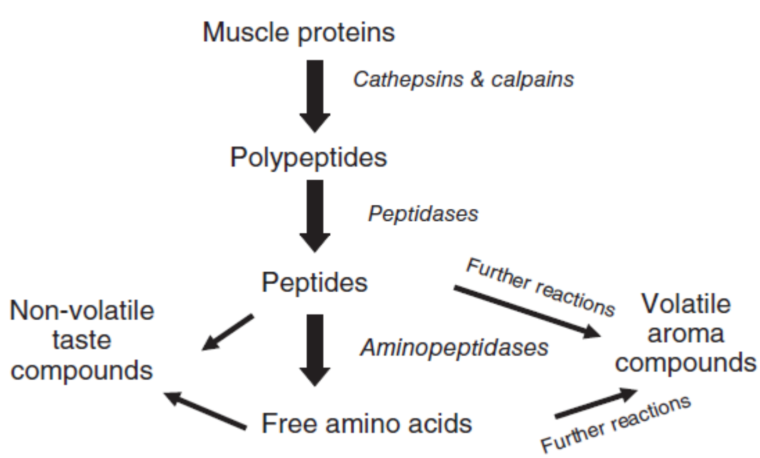

Figure 6: Meat protein

So far, various wastes have been used to produce biogas. Since the effluent from slaughtering animals and washing the carcasses of sheep, cows and chickens has fat, blood, fluids and the contents of the animal's viscera, which in general has a relatively high pollution load. This type of wastes is generally composed of organic materials and contains a lot of suspended and solids materials and also has a high BOD.

Due to the growing demand for meat in the world and the fact that about 20% to 50% of the weight of each slaughtered animal cannot be consumed and It is not edible, the production of organic solid waste from the meat industry is increasing. In some industrial slaughterhouses, slaughterhouse waste enters the wastewater treatment system, which causes many problems in the wastewater treatment system due to high BOD and COD. Slaughterhouse waste contains intestinal waste from livestock and other organic solids that have high levels of pathogenic microorganisms and are therefore dangerous to humans and animals. In the production of biogas from floating materials in lubrication units and other parts of poultry and livestock slaughterhouses can be used as a bed simultaneously with other materials. Joint digestion of slaughterhouse waste with other substrates can reduce organic load and reduce nitrogen and improve biodegradability [Bustillo-Lecompte and Mehrvar, 2015].

Also 4 million tons feathers is produced from slaughterhouses annually that allocate an important part of solid waste management to itself.

It is dedicated to itself. Feather is made up of 90% creatine, which is mainly b negative creatine, which is difficult to break down due to disulfide bonds.

Traditionally, feathers are either burned or disposed of at disposal sites, which is useless technique, and it is suitable to use to produce methane and biogas because it is from useful enriched amino acids. The classification of slaughterhouse waste as hazardous waste, as well as the tightening of relevant laws, has led to a sudden increase in the cost of disposing of these materials.

A proposed classification of hazardous waste is provided by UNEP. This classification is based on the type of waste and industry or the process in which hazardous waste is produced, in which slaughterhouse waste is classified as perishable organic waste. Slaughterhouse waste contains large amounts of organic material, which is mainly enriched in nutrients and can be used in agriculture to reduce the discharge of such waste in the environment and reduce the use of chemical fertilizers in agriculture. These wastes may pose health risks, odors, environmental pollution and affect the aesthetic aspects without the necessary procedures. Also processing of these substances can also improve the chemical and physical properties of waste and reduce their toxicity [Bustillo-Lecompte and Mehrvar, 2015].

ENERGY PROCESSING

Biogas

One of the energy conversion processes for biogas production is anaerobic digestion. Anaerobic digestion is one of the ways to reduce pollution and reduce the risk of pathogens, as well as a way to recover valuable materials from a variety of food waste such as fruit and vegetable processing waste (raw materials in the beverage industry), meat processing waste and slaughterhouse waste. Anesthesia digestion is a biological process in which organic matter is broken down in the absence of oxygen and produces biogas. Biogas, which is mainly composed of methane and carbon dioxide, can be a substitute for fossil natural gas as an energy source. Methane makes up 40 to 10% by volume of biogas.

If produced anaerobic biogas is used to generate electricity, the overall conversion efficiency to electricity is about 10% to 11%. The time that takes for waste to remain in the digestive tract during anaerobic digestion can be from several days to a month.

The produced gas can be used to generate electricity and the by-product heat also is recovered and be used as a heat source in anaerobic digestion systems or processing lines in anaerobic digestion systems or processing line.

Recycling organic waste to produce biogas for electricity and cooking, and the use of residual sludge, is common as an organic fertilizer in many parts of the world [Paritosh *et al.*, 2017]

Therefore, the production of biogas from waste and garbage will play a vital role in the future of energy resources. Biogas is the anaerobic digestion and decomposition of organic materials by microbial activity in the absence of oxygen and its conversion into living mass, which includes a mixture of methane (CH_4), carbon dioxide (CO_2) and some rare gases.

That Between 50 and 75 percent of methane gas, 25 to 50 percent of carbon dioxide, 5 to 10 percent of hydrogen gas, and 1 to 2 percent of nitrogen gas are produced. Today, anaerobic digestion of organic materials has been reported as a widely used technology. In the efficient purification of organic waste and the simultaneous production of a renewable energy source through the use of biogas [Pratyusha *et al.*, 2012]

The process of anaerobic digestion takes place in four stages: hydrolysis, fermentation (acidogenesis), acetate production, methane production. To perform these four steps, different bacteria (eg fermentation, acidogenic bacteria, and methanogenic bacteria) are required. Because methane bacteria are absolutely anaerobic, anaerobic conditions must be applied. In different countries, according to climatic, cultural, economic and social conditions, a variety of biogas reactors have been built that be most compatible with the above conditions. Accordingly, several designs of biogas reactors have been developed today.

Biogas reactors can be classified according to various parameters, but in general, all biogas production reactors, both domestic and farm, are classified into one of the following three groups or a combination of these groups:

1. Vertical reactor
2. Horizontal reactor
3. Common reactor

The classification of reactors in terms of design and construction includes Chinese model reactor (fixed dome), French model reactor, leather pipe reactor, polyethylene tank reactor, Indian model reactor, Taiwan reactor, Nepal reactor.

Some important parameters affect the efficiency of the anaerobic digestion process. Therefore, it is very important to provide suitable conditions for anaerobic microorganisms. The growth and activity of anaerobic microorganisms is significantly affected by conditions such as lack of oxygen, constant temperature, pH, nutrient supply, mixing intensity, as well as the presence valume and amount of inhibitors (eg. ammonia) [Fardin *et al.*, 2018].

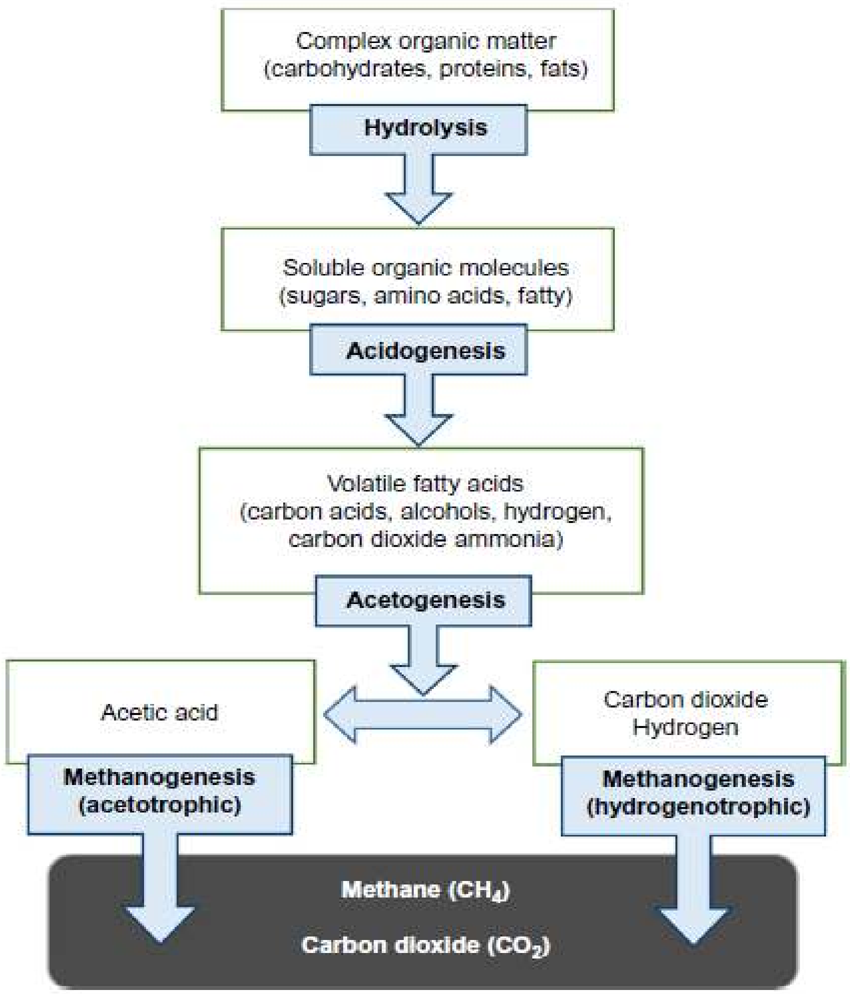

Figure 7: The main steps of anaerobic digestion processing

Bioatanel

One way to produce bioathanol is to use fermentation. Fermentation is a metabolic process that converts sugars into acids, gases, or alcohol. This process occurs in yeasts and bacteria, as well as in muscle cells when faced with a lack of oxygen as happens in the fermentation of lactic acid. In addition, the term fermentation is widely used to refer to the growth of microorganisms on Cultivated environment, often with the aim of producing a specific chemical product.

Fermentation occurs when the electron transfer chain is unusable (often due to the absence of a final electron receptor, such as oxygen). In these cases, fermentation is the primary source of ATP (cellular energy) production. In these cases, fermentation is the primary source of ATP (cellular energy) production.

The fermentation process converts NADH and pyruvate produced in glycolysis to NAD + and an organic molecule (depending on the type of fermentation).In the presence of oxygen, NADH and pyruvate are used to produce ATP in cellular respiration. This process is called oxidative phosphorylation and produces more ATP than glycolysis. For this reason, cells usually avoid fermentation when oxygen is available; Forced anaerobic bacteria that are unable to tolerate oxygen are an exception. The first step in glycolysis is common to many fermentation pathways:

Equation (2)

$$C_6H_{12}O_6 + 2NAD^+ + 2ADP + 2Pi \rightarrow 2CH_3COCO_2^- + 2NADH + 2ATP + 2H_2O + 2H^+$$

$-2CH_3COCO_2$ is pyruvate and Pi is a non-organic phosphate. The two molecules i.e. ADP and Pi are converted into two molecules, ATP and two water molecules, by phosphorylation at the surface of the substrate.

Two NAD^+ molecules are also reduced to NADH. In oxidative phosphorylation, the required energy is produced to form ATP by the electrochemical slope of the produced proton in the mitochondrial inner membrane (or in the case of bacteria in the plasma membrane) through the electron transport chain. Glycolysis has phosphorylation at the substrate level (ATP is produced directly at the point of reaction). Fermentation can even occur in the stomachs of animals and humans [Owens and Basalan, 2016].

Fuel bioethanol can be considered from two perspectives. First, from the perspective of a light alcohol (C_2H_5OH) that is produced from biological origin material (mainly plant) instead of petrochemical raw materials. From this perspective, we pay more attention to the aspects of used raw materials and production of this product and it is more considered the impact of extensive bioethanol production on the environment. Second, from the perspective of a renewable liquid biofuels, with non-fossil origin with a wide range of uses as an additive and substitute or a substitute for gasoline that from this perspective, more attention will be paid to its consumption in the car and its impact on the environment and public health is also possible to produce bioethanol from petrochemical raw materials (Ethylene or gas) (Synthetic Ethanol), but today a very small percentage of global Ethanol production (less than 5%) is made from non-biological raw materials, the same small amount is with decreasing process. Three generations of bioathanol can be defined, the first generation of bioathanol is produced from sugar raw materials such as beet and sugar molasses or starchy raw materials such as cereals, potatoes and cassava. Produced Biovatanol from plants, orlignosullose plant waste is called second generation biovatanol, and bioathanol produced from plants or waste, plant and industrial wastes composed of sugars, starch and cellulose is called third generation biovatanol. [Balat *et al.*, 2008]

Biodiesel

Chemically, biodiesel is a compound of methyl ester of fatty acids which is obtained in the presence of a catalyst (acid, Alkaline, or enzyme) during a process called trans-esterification (ester exchange) by the triglyceride reaction with alcohols. Biodiesel is more popular than petroleum diesel due to features such as renewability, reduction of polluting gases, high combustion efficiency, environmental degradability, improved lubrication, higher safety, etc. Biodiesel is considered a neutral carbon fuel, and other environmental benefits of biodiesel include the low emission of sulfur compounds. Biodiesel is made from biomass oils, which often include vegetable oils. The amount of carbon in the carbon chain of a diesel oil molecule is similar to that of 18-14 carbon vegetable oils [Shahid and Jamal, 2011]

The Impact of Energy Conversion Technologies from Food Waste on the Environment

Environmental pollution Industrialization, advancement of science, and modernization of technology, along with many benefits, are also harmful loses. The use of these benefits and the suppression or optimization of harms is a sign of human endeavor and ability to deal with the environment and the surrounding knowledge in a balanced way [Razavi *et al.*, 2014]

Environmental pollution is one of the most challenging issues of the 21st century. Every day, large volumes of various organic chemical pollutants, radioactive materials and other toxic compounds enter the environment. These pollutants have two effects on the environment: pollutants that are gradually and slowly released into the environment in the long run, and pollutants from industrial plants that enter the environment all at once and cause environmental pollution in a relatively short period of time, there is a link between diet and health. If there are more environmental pollutants, they will have a greater impact on human health through food chains [Mohammad Nabizadeh, 2012]

Environmental pollution caused by industrial waste is one of the most serious risks that the current trend of increasing its discharge into the environment puts additional pressure on ecosystems. Therefore, guiding the activity of industrial units, minimizing waste and reusing them in such a way that it has the least harmful effects on the environment which is one of the important goals of industrial development. In this regard, sugar factories with various wastes such as calcium carbonate flowers, beet molds, pulp, molasses, etc., which can be used in products such as organic acids, paper, animal feed, compost, yeast, ethanol, etc. has good potential to run recycling and reuse applications.

CONCLUSION

Environmental issues and the need to pay enough attention to its preservation are currently not limited to a specific region or country, and have spread globally. Among the cheap resources is the huge volume of solid and liquid waste that generated by the processing and production of annual food. Techniques such as anaerobic digestion, fermentation and trans-esterification are among the methods that can be used to produce energy sources such as biogas, fossil ethanol from food waste and biodiesel and observe their impact in reduction of cases such as environmental degradation and the spread of all kinds of pollution and also Outbreak of disease.

Awareness of this technology, gaining experience and ensuring the proper functioning of In the optimal use of determined waste from food products can create a good opportunity for energy production and significantly improve the quality of this type of technology, in coveration of energy from waste from food macromolecules in comparison with existing methods Minimize risk-taking (technical, economic, and environmental) in selecting and manufacturing large-scale digestions of this type in the country.

Examining and recognizing the processes of this type of energy conversion technologies such as anaerobic digestion at high concentrations, fully understanding dry air digestion digestion, designing and manufacturing a usable unit and developing energy production from food waste can open a new space for authorities. The results could pave the way for officials and decision makers, consulting engineers and contractors to design, build and develop biogas and environmental management plants.

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