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Biofuels: Status quo and future challenges – a review

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Abstract
The major international agencies that check the development of society warn about the energy model of the current world, pointing the need of substitution by renewable sources of energy. This condition becomes even more worrying when perspectives point to a world population of 9 billion people in the next decades and the demand for food that will need. Therefore, competition for fertile land to nutrition and energy ends is already clear today. Bioethanol, a biofuel capable of partially replace gasoline for the high productivity reached, uses mostly renewable sources of energy as sugar cane and corn, increasing the price of these raw materials. New sources for ethanol production are being researched to make it a second-generation biofuel, competitive but not affecting the food production, like animal fatty wastes and inedible oilseeds. This applicability of using wastes and effluents to produce second-generation biofuels is gaining strength in the scientific community and they conduct researches to optimize and expand the scale of production of biofuels from these sources. In this review, we approach the processes used today to produce biofuels, the problems and the new possibilities to break the barriers that hinder this large-scale sustainable production.

Biocombustíveis: Status quo e futuros desafios – uma revisão

Palavras-chave: sustentabilidade, valorização de resíduos, biocombustíveis de primeira geração, biocombustíveis de segunda geração.

Resumo
As principais agências internacionais que verificam o desenvolvimento da sociedade alertam sobre o atual modelo energético mundial, apontando a necessidade de substituição por fontes de energia renováveis. Esta condição torna-se preocupante quando as perspectivas apontam para uma população mundial de 9 bilhões de pessoas nas próximas décadas e sua demanda por alimentos. Portanto, a competição por terras férteis entre produção de alimentos e energia torna-se clara. O bioetanol, um biocombustível capaz de substituir parcialmente a gasolina pela alta produtividade alcançada, demanda principalmente fontes de energia renováveis como cana-de-açúcar e milho, aumentando seus preços. Novas matérias-primas estão sendo pesquisadas para tornar o bioetanol um biocombustível de segunda geração, que seja competitivo, mas que não afete a produção de alimentos, como resíduos de gordura animal e de óleos vegetais. Este uso dos resíduos e efluentes está ganhando força na comunidade científica, que conduz pesquisas para otimizar e expandir a escala de produção a partir destas fontes. Nesta revisão, abordamos os processos mais usados para produção de biocombustíveis, as dificuldades e as novas possibilidades que tentam quebrar as barreiras que impedem esta produção sustentável em larga escala.

1. INTRODUCTION

The past decades were marked by the increasing world population, which demands more natural resources, especially food and energy, which is used basically for all the transformation processes in industries, to attend the life quality desired by a society increasingly globalized (GODFRAY et al., 2010).

The base of the current world energetic model is the use of fossil fuels as primary source of energy, which has prospects that point a cut of these resources stock around the world in the future, increasing the extraction costs. International Energy Agency (IEA) estimates that in 2030, there will be a cut in the known stock of oil and gas to 40% and 60% of the current amount (IEA, 2014).

Nevertheless, even if the reservations of fossil raw material in the planet were far from over, humanity should course to substitute this sources for renewable ones, to control the climatic changes that the emission of greenhouse gases causes, since the current energy sector contributes with an average of 66% of the releases (SCOVRONICK; WILKINSON, 2013).

As measurement of control for this situation, different countries – highlighting Brazil, United States and a part of European Union – traditional agricultural potencies, have invested in developing different biofuels (CRAGO et al., 2010), which are less pollutant, since their combustion produces a lower rate of carbon monoxide, aromatic hydrocarbons and sulfur compounds (KNOTHE, 2010; MANZETTI; ANDERSEN, 2015). As an additional benefit, these fuels may be obtained from resources as biomass (sugar cane, corn, and oilseeds), waste and fatty wastes.

The world nowadays live in an era where the search for sustainability is at stake in the main reunions of world authorities and current scientific and technological events (SOBRINO et al., 2011). As long as occurs technological improvements in all systems involved, to increase their efficiency, lowering their obtaining costs and therefore enabling their generation on large scales, the "green energies", also known as energies that do not comprise future generations needing's nor causes significant environmental impact, could provide all fossil energy currently used (VERGRAGT et al., 2011).

Approaching these aspects, this revision has the aim to bring together the major scientific and technological advances researched in the last years in the renewable energy produced by bioprocess area, showing the tendencies that the current researches are taking relating this subject.

2. BIOFUELS

2.1 General conceptions

Biofuels, which are all the fuel from renewable biologic sources of energy, mostly important are biodiesel, bioethanol and biogas. However, liquid fuels currently assume the most important part in the bioenergetic sector, because other alternative renewable sources are still behind in research and technology, mostly in the inland, marine and air transport area, which uses mostly propellants fueled by liquid fuels (BRASIL, 2005; SANTORI et al., 2012).

Allied to this factor, liquid biofuels may also directly enter in energetic chain by mixture of fossil fuels, which each country establish different standards by their laws, reducing emission of pollutants that they produce when burnt (MANZETTI; ANDERSEN, 2015).

In Brazil, concentration of diluted ethanol in gasoline ranges from 20% to 25%, while in petrodiesel it is stipulated a 5% dilution in biodiesel (BRASIL, 2011). In the United States, the maximum concentration allowed to bioethanol is 15%, while for biodiesel in petrodiesel has a common rate between 5% to 20% (USA, 2007).

Biofuels are classified in two groups. First generation biofuels are those originated from vegetables as corn, canola, sugar cane, palm, among others. The use of all of them is directly in human feed, what would cause competition for cultivation areas, so that fertile land would be used to energetic endings, and not with the purpose to feed the population, causing an increase in food prices (NAIK et al., 2010).

Second generation biofuels are those produced from inedible vegetables or biotechnologically modified vegetables adapted to adverse conditions to cultivation, which do not compete with food production, while regions with unfavorable conditions may cultivate plants for energy production, and ideal lands for food.

It is also included in the second generation, fuels obtained from microalgae and wastes from other process, as the fatty wastes from slaughterhouses of cattle, pigs and poultry (NAIK et al., 2010; HAVLÍK et al., 2011), which are an abundant source, promising raw material in agricultural potencies as, for example, United States and Brazil; the last has about 45 million head of cattle, besides being the largest exporter of chicken meat in the world (COELHO et al., 2012).

2.2 Bioethanol

In the last decades, Brazil developed and applied the process of obtaining ethanol from sugar cane (*Saccharum officinarum*), converting in the end product by alcoholic fermentation of sucrose by anaerobic east (*Saccharomyces cerevisae*), through glucose excess in the fermentation broth, being the only ethanol around the world which has a competitive cost to fossil fuel (GUO et al., 2015). In the United States, where ethanol is considerably more expensive, the raw material is corn, the major agricultural product (CHEN; KHANNA, 2012). Condon et al. (2015) reports that when a region produces a great amount of feedstock for food, usually, the impact in food price is lessened when transforming it into energy since the supply in that location is high. In the US for instance, a corn ethanol expansion of one billion gallons in 2015 would increase the price of corn by four percent.

In a comparative of gases emission from greenhouse in ethanol burning of both sources, sugar cane emit about 50% less carbon dioxide than corn (in kilograms of CO_2), due to corn use about twice more fertilizers. While corn ethanol emits 1415 kg of CO_2 per burnt m^3, sugar cane ethanol emits 474 kg.CO_2/m^3 (CRAGO et al., 2010). In most cases, especially in light vehicles (equipped with spark ignition direct injection engine), ethanol is blended with gasoline, up to 30% v/v, receiving the label E30, for 30% ethanol and 70% gasoline (LI et al., 2015). The percentage of ethanol mixed in gasoline varies from country to country. According to Cho et al. (2015), blending ethanol into gasoline improve the emission characteristics of the latter, lowering especially the particle number emissions. Furthermore, these blends allow the use of lower amounts of fossil fuel, helping the fuel to be cleaner. This phenomenon can be explained by the chemical composition of ethanol, whereas having more oxygen in the chains leans the exhaustion to a full combustion of the fuel into CO_2, reducing the particular matter emissions.

In sugar cane processing, separation of sucrose-rich broth is by pressing, producing bagasse as a byproduct, which has been reintroduced in fermentation to increase efficiency in the process and consequently enhance the quantity of bioethanol produced per planted area unity (TSIROPOULOS et al., 2014; CAPECHI et al., 2015). After that, the end destination given to this waste is the burn in thermoelectric, to generate electric energy (DANTAS et al., 2013). In countries were farms are spread through a wide area, a study of polygeneration uses of agricultural wastes is a smart choice. As reported by Jana and De (2015), a great variety of products as electricity, refrigeration, utility heat and ethanol may be feasibly produced from rice straw, sugarcane bagass and coconut fiber dust, showing that as a promising alternative for an efficient decentralization option for rural people.

In this way, electric energy supply cannot be affected by changes in sugar cane production, because only 33% of thermoelectric in Brazil use sugar cane bagasse as fuel (BRASIL, 2008; DIAS et al., 2011).

Recent studies identified an increase in biodiesel production around the world, and consequently a raise in the synthesis of glycerol, a byproduct from transesterification of triglycerides in alkyl ester. Choi et al. (2011) used isolated strains of *Kluyvera cryocrescens*, fermenting raw glycerol in anaerobic and microaerobic conditions, obtaining an ethanol income around 80%, adding value to a byproduct from the energetic chain. A wide number of fungi are being deeply studied to produce ethanol from high organic carbon wastes, either from easily metabolized, like sugarcane bagasse, to the hardest (high lignocellulose and hemicellulose content), where strains of *Phlebia* sp., *Penicillium* sp., *Zymomonas mobilis*, *Schizophyllum* sp., (HE et al., 2014; KHONG et al., 2014; HORISAWA et al., 2015; JUNG et al., 2015)

Zhang et al. (2012) studies indicate that is possible to produce ethanol from food wastes, using they as substrate to anaerobic growth of yeast that produces ethanol, from an isolated inoculum and glucoamylases to brake amylaceous chains providing simple carbohydrates to microorganisms, however, these researches still suffer with the use of small-scale, and a high production still is not viable. Literature reports technology finesse when working on agricultural wastes for energy as reported by Li et al. (2014) where an enzyme cocktail was used to produce not only ethanol but monosaccharides as well. Another line of research that has shown promising results over the last years was the use of sugarcane bagasse hydrolysate, achieving more than $1 g.L^{-1}.h^{-1}$ in a continuous fermentation reactor (KUMAR et al., 2015; ZHANG et al., 2015).

Figure 1, below, shows a general flowchart of ethanol obtaining from vegetal raw materials.

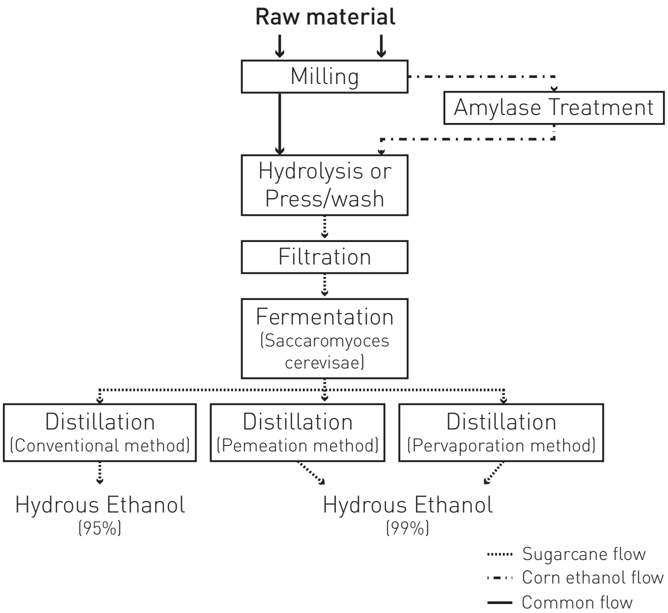

Figure 1. General flowchart of ethanol production from vegetal raw materials
Source: Balat; Balat, 2009; Frolkova; Raeva, 2010.

2.3 Biodiesel

Technically, Nation Agency of Petroleum (ANP) sets biodiesel as an ester alcohol (methyl or ethyl) produced through a reaction of transesterification with an alcohol and a chemical or enzymatic catalyst, from renewable energy sources as vegetable oil or animal fat, resulting in a mixture of fatty acid esters and glycerol as a byproduct. These biofuels are linked to the utilization of compression ignition engines, also known as diesel-cycle engines, and attend the specifications established by ANP (BRASIL, 2005).

Global transesterification of triglycerides to biodiesel production is a sequence of three reversible and consecutive reactions, where each step has monoglycerol and diacyglycerol as intermediaries. Are necessary three moles of alcohol to each mol of triacyglycerol, this way, it is usual the use of alcohol in excess to increase the reaction yield and allow to separate the formed glycerol (OTERA, 1993).

The alcohol in transesterification is aliphatic, presenting only primary or secondary hydroxyl and its main chain containing from one to eight carbon atoms, whereas the most important in this process are methanol and ethanol (MENDOW et al., 2011).

The use of methanol to transesterification is propelled by economic and operational reasons of the process, because it has a lower cost, is water-free, has lower chain and is more polar than ethanol, favoring methyl ester separation in formed glycerol. However, this alcohol has a higher toxicity and flammability, limiting its use in large scales (STAMENKOVIC et al., 2007).

The use of ethanol in the production of biodiesel has as advantage a higher index of cetane and lubricity than methyl ester, besides its application being encouraged for being a renewable fuel and having toxicity lower than methanol. As counterpoint, methyl ester has azeotropy with water, needing to dehydrate, raising costs of production and reducing the competitiveness of the product (BRUNSCHWIG et al., 2012).

The catalytic process of biodiesel production can be accomplished by the use of homogeneous (H_2SO_4, HCl, H_3PO_4) or heterogeneous acids (resins containing sulfur), homogenous (NaOH, KOH) or heterogeneous bases (MgO, CaO). Alternatively, it is possible to use microbial lipases to accelerate the transesterification of triacyglycerols (DOSSIN et al., 2008; LIU et al., 2008; MENDOW et al., 2011; JANG et al., 2012).

Table 1. The sources of raw material and their results of transesterification

Source (raw material)	T (°C)	t (min)	Yield (%)	Catalyst	Alcohol	Reference
Waste cooking oil	200	180	98	Acid	Methanol	Jacobson et al. (2008)
	66,5	60	92,76	Alkali	Methanol	Kawentar; Budiman (2013)
	60	60	95,65	Alkali	Methanol	Ullah et al. (2015)
	115,5	169	79,7	Alkali	Methanol	Omar; Amin (2011)
	200	600	81	Acid	Methanol	Jacobson et al. (2008)
Jatropha curcas	100	180	99	Acid	Methanol	Jain; Sharma (2010)
	25	30	84,5	Enzymatic	Methanol	Kumar et al. (2011)
	150	240	93	Alkali	Methanol	Nizah et al. (2014)
	240	10	93	Alkali	Supercritical Methanol	Teo et al. (2015)
	60	1440	99,8	Acid	Methanol	Shuit et al. (2010)
Animal fat waste	65	20	97	Alkali	Methanol	Jeong et al. (2009)
	335	15	89,91	None	Supercritical Methanol	Shin et al. (2012)
	60	2880	89	Acid	Methanol	Encinar et al. (2011)
	60	480	99,6	Alkali	Methanol	Dias et al. (2012)
Triolein	35	65	83	Enzymatic	Supercritical Methanol	Fukuda et al. (2001)
	100	480	81	Na_2MoO_4	Methanol	Nakagaki et al. (2008)
Palm oil	60	60	88	Alkali	Methanol	Ali; Tai (2013)
	60	60	76,62	Alkali	Methanol	Hayyan et al. (2010)
Soybean oil	180	90	99	Alkali	Methanol	Nasreen et al. (2015)
	110	300	79,2	Acid	Methanol	Xie; Wang (2013)
Castor bean oil	65	480	74,1	Alkali	Methanol	Dias et al. (2013)
	30	90	86,32	Alkali	Ethanol	Cavalcante et al. (2010)
Sunflower oil	200	300	84,9	Alkali	Methanol	Sun et al. (2010)
	51,7	65,5	83,4	Alkali	Methanol	Amini-niaki; Ghazanfari (2013)

In the process of acid catalysis, esterification is accomplished by strong acids, usually sulfuric acid, obtaining efficiency next to 99%, in counterpoint, requiring temperatures around 100 °C for about three hours, besides using alcohol in excess being the only way to ensure the reaction (JAIN; SHARMA, 2010).

Using acid catalysis, Jacobson et al. (2008) observed an efficiency of 98% in converting kitchen oil wastes using temperature of 200 °C for three hours with constant agitation of 600 rpm. This reaction route becomes overly expensive, what is enough to hinder the production in superior scales than laboratory ones. This income was not obtained with other methods, which used alkaline catalyst, however in less time and in lower reaction temperatures (OMAR; AMIN, 2011; KAWENTAR; BUDIMAN, 2013; ULLAH et al., 2015), achieving incomes of 96%, 79,7% and 95,65%, respectively.

Alkalyne chemical process is less corrosive than the reaction with acid, and promotes a lower energy expenditure and shorter transesterification time. However, this method requires high quantities of energy, makes difficult the glycerol recovery, it is necessary to reduce the pollution potential of residual water by complementary treatment and still makes necessary the removal of the catalyst of the product (JUAN et al., 2011).

Jeong et al. (2009) promoted an alkaline catalysis with temperature conditions around 65 °C for 20 min and methanol in excess to transform animal fatty acid in biodiesel with conversion of 97%. From the same type of raw material and catalyst, and reaction temperature of 60 °C, Dias et al. (2011) obtained 99,6% of income, and this difference was due to the increase of reaction time to 480 min.

In other hand, the enzymatic transesterification is a promising method, although being slower than chemical methods, allow lighter operations condition, leading to reduction of energy costs and avoid corrosion of equipment (ANTCZAK et al., 2009).

Fukuda et al. (2001) used intracellular enzymes to catalyze and conduct the reaction of conversion of fatty acids in biodiesel, obtaining a maximum efficiency of 83%, and they also tested the alternative use of supercritical methanol to substitution of alkaline catalyst, relating that it was possible to obtain biofuel with reservations, because it was necessary the use of temperature around 350 °C to finalize the reaction. Kumar et al. (2011) used an enzymatic catalyst to convert *Jatropha curcas* in reaction with methanol in room temperature, obtaining a maximum income of 84,5%.

Two chemical routes are known to production of biodiesel. The chemical route itself, where occurs hydrolysis from ester bond of a fatty acid and glycerol linked by an acid or a base, in heating and addition of short chain alcohol. The second route is the enzymatic, where the catalyzation in the reaction of hydrolysis is by specific lipases, with the advantage of not generating aqueous, acid or alkaline wastes. These enzymes have a high specificity, resulting in less contaminant in the product and presents significant efficiency (KANSEDO et al., 2009; BASHA; GOPAL, 2012; KAPTUROWSKA et al., 2012).

On the other hand, utilization of pure enzymes makes the process impracticable in larger scales both by the high cost in the obtaining of pure enzymes in sufficient quantity as by the inconvenient of keeping the enzymes actives. This fact is an incentive of searching microorganism producers of lipases that could accelerate the reaction, reducing the operational cost (SRIMHAN et al., 2011; GOG et al. 2012).

Lipases from bacteria and fungus are a group of valuable enzymes of biotechnological application, mostly by their properties versatility, referring to the enzymatic performance and specificity of substrate (YUZBASHEV et al., 2012). In this sense, advances in the biotechnology sector enable the culture of microorganisms strain with capacity of genetic overexpression, increasing productivity of specific compounds, between them enzymes, making compound that were economically unviable of being used in large scales, capable of perform technological functions in industries, as example, Papanikolaou et al. (2011) converted wastes of cooking olive oil into lipid-rich biomass using *Aspergillus* and *Penicillium* strains, reaching substantial amounts of intracellular fatty acids composed mainly of oleic acid (C18:1).

Between the oilseeds cultivated in the world, the one that represents large part of the global market is soybean, producing around 20% of its weight in oil. Another sources as canola, sunflower and cotton do not present expressive cultivation areas, what limits the production of biodiesel from them, even having oil content of around 40% (RATHMANN et al., 2012).

An aggravating in the oil extraction to supply the energetic sector is, again, food security and the competition for fertile lands to produce energy instead of food. The price of soybean, therefore, can suffer adjustments not only by crop failures by natural phenomena, but also for the high demand of the energetic sector for fuels, setback of any first generation fuel (HAVLÍK et al., 2011).

In addition, the income of the reactions of seed oils transesterification as soybean, sunflower, castor beans and palm oil are lower than other raw material sources in a range between 74-88% (CAVALCANTE et al., 2010; HAYYAN et al., 2010; SUN et al., 2010; AMINI-NIAKI; GHAZANFARI, 2013; ALI; TAI, 2013; DIAS et al., 2013; XIE; WANG, 2013), except Nasreen et al. (2015) which reach 99% with soybean as raw material, using La/Mn oxide catalyst.

2.4 Animal fatty waste as biofuel

Animal fats are constituted by long chain fatty acids, more than ten carbons, possessing as major drawback to the synthesis of biofuels its presentation in solid form in room temperature, making the transesterification process in large scales much expensive due to the high energetic cost necessary to liquefy the fat, what would allow the transesterification (PÉREZ et al., 2010).

Overcoming the counter current that international organs of combat against hunger wield in first generation biofuels, biodiesel from fatty wastes, as second generation biofuel, becomes an excellent alternative those that use food stock for its production, given technical adjustments to correct problems that could be caused in the current diesel-cycle engine, which constitute the world fleet of heavy ground vehicles (HILL et al., 2006; FINDLATER; KANDLIKAR, 2011).

Accordingly, biodiesel has been the target of improvement in large part of research institutions in the world, in order to gradually replace diesel oil – or petrodiesel -, so that the current equipment may use this alternative source, without showing significant decreases in potency, avoiding major changes in its structure (AYDIN; ILKILIÇ, 2010; MANZETTI; ANDERSEN, 2015).

Currently it is known that the use of 20% of biodiesel in mixture with diesel oil can be applied to the current cycle-diesel engines without the need of structural changes. However, the laws that regulate how much biodiesel dissolve and use in the vehicles are different in each country and region (MCCARTHY et al., 2011).

Adaptations of vehicles that would be necessary for running with biodiesel may be minimized or even avoided, submitting fatty acids to chemical modification by transesterification, this way allowing simple dilution of biodiesel in petrodiesel (ENCINAR et al., 2011).

Another important factor that corroborates to advances in scientific and technological researches of biodiesel is the increasing search for renewable, clean and safe energies that happened in scientific and governmental communities in the last decade.

Studies demonstrate the significant decrease in greenhouse gases emitted from biodiesel when compared to petrodiesel, mostly in relation to carbon oxide and dioxide, besides not releasing aromatic or sulfur compounds, and shows a higher cloud point (ENWEREMADU; RUTTO, 2010; QI et al., 2011; JORGENSEN et al., 2012).

This last characteristic is given by temperature, in integer number, in which fuel release the first flammable vapors. The boiling point of biodiesel chains being higher, making fuel transport safer (LIDE, 2008).

It is also worth to notice that biodiesel from transesterification of animal fat has similar viscosity to petrodiesel (4-5 mm^2/s), what brings more benefits to biodiesel from vegetable oils that has viscosity around 28-40 mm^2/s, resulting in operational problems in the engines, as formation of deposit of wastes of combustion by the low capacity of atomization of the fuel (KNOTHE, 2010).

However, biodiesel presents as challenges to be overcome the high point of cold filter plugging, the lower oxidation stability, and crystallization of superior temperatures than petrodiesel, besides the high energetic cost if produced from animal fatty wastes. The first barrier to be broken to the use of this waste in the energetic chain is to work around the energetic cost necessary to liquefy the fat, only then to start the chemical process of transesterification. The high melting point of animal fat is given by the high content of saturated fatty acids in the carbon chain of triglycerides that compose it (BI et al., 2010; PÉREZ et al., 2010).

To improve the qualities of biodiesel from animal fat in low temperatures, have been studied the addition of additives which imply in a increase in the biodiesel flow characteristics in cold temperatures, by the disruption of capacity of macro crystals formation, this way preventing sedimentation in the interior of the engine and fuel tank lowering the point of cold filter plugging (PÉREZ et al., 2010; DE TORRES et al., 2011; KANNAN et al., 2011).

But it is noteworthy that the presence of unsaturated esters contributes both for the reduction of the fat fusion point, as for the behavior of biodiesel in low temperatures, but causes a negative impact in the stability to oxidation (CHEN; LUO, 2011; KIVEVELE et al., 2011).

Shin et al. (2012), Encinar et al. (2011), Dias et al. (2012) and Jeong et al. (2009) obtained incomes between 89-99,6% in different methods, with variations in the reactional time of 15 min to two days.

2.5 Oil wastes as biodiesel

Aiming to reduce costs in biodiesel production from wastes, other triglycerides can be transformed into biofuel by transesterification, as the wastes from kitchen oil (ZHANG et al., 2014).

By this raw material substitution, in detriment of virgin vegetable oil, it is possible to reduce in half the cost of oil acquisition, besides recycling a waste that normally would be disposed in an incorrect way in the environment (NAIR et al., 2012).

Production of biodiesel from kitchen oil wastes present milder process conditions when submitted to alkaline catalysis. However, if compared to transesterification processes of fatty animal wastes, it is noted the need of reaction times for efficiency superior to 85% and 3 hours, besides temperatures varying between 50 °C and 65 °C, making this process last more time and energy, reflecting this costs in the final price for the consumer (BORGES et al., 2011; DEBNATH et al., 2011).

Kawentar; Budiman (2013) and Ullah et al. (2015) obtained incomes of 92.76 and 95,65% respectively, in processes with an alkaline catalyst, temperature and reaction time of 66.5 °C and 60 min for the first one, and 100 °C and 120 min for the second one. Lower incomes were obtained by Jacobson et al. (2008) and Omar and Amin (2011) with higher temperature and longer reaction time. This result probably has a connection with the kind of waste from kitchen oil and the choice of a less efficient catalyst.

Three factors contribute to increase the total cost in the production of these sources. The first is the glycerol purity, that through this process, it shows in a dark color by the presence of pigments and dispersed solids in raw material, what compromises its commercialization for third parts that search this byproduct with at least 95% of purity for other activities as antifreeze, thickening and inert in pharmaceutical industries and explosives (BEATRIZ et al., 2011).

The second factor is the need of doing a process of previous filtration, to separate coarse solids that may interfere, both in reaction and in the quality of the formed biodiesel (HO et al., 2014). The third bound is the dispersion of this source in urban areas, what demand time and financial resources in management and logistic of this waste (ARAUJO et al., 2010).

There are studies that use domestic sewage to biodiesel production, that despite the high production, mostly in large urban centers, this source have a low efficiency and high processing cost can even be converted in the final product, since only 0,1% of the effluent is composed by dry material, aggravating this fact, it is possible to explicit the low lipid concentration, that revolves around 14% (in dry material) of effluent, and only 35% of this can be converted in biodiesel (JACOBSON et al., 2008; SIDDIQUEE; ROHAMI, 2011).

3. CONCLUSION

In this article, diverse points about biofuels production were discussed, besides its importance and the effects in the research and development to contemporary society.

The population growth, combined with the growing search for a higher life quality, reflects in an increase in the demand of food and energy. Major agrarian potencies, as Brazil and United States, developed practices of ethanol production from agricultural raw materials with large productivity, and nowadays supply their energetic markets with partial substitutes of fossil fuels. However, this activity press the price of the food used as input, creating competitiveness between food and energy for fertile land.

Despite the large production and the important market achieved by first generation ethanol, as are known fuels from food straight from population, this activity do not have good perspectives in a long-term because of the international appeal in prioritize human nutrition than production of food for biofuel endings. For this aspect, politics of incentive for technical-scientific development of second generation ethanol is strongly growing in various countries around the world, as ethanol obtained by fermentation of glycerol from biodiesel production, inedible vegetables and organic wastes from food.

As first generation ethanol, new sources of raw material for biodiesel should be found and research to avoid the use of food for production. In this aspect, the use of wastes from other processes as animal fatty wastes, agricultural effluents rich in lipids and inedible oilseeds are promising prospects to supply the energetic market without affect the production of food for human nutrition in the next years, collaborating to reach sustainability in our society.

Besides being possible the production in a pilot scale of biodiesel from oil waste, an expressive production is far to be reached, mostly because the raw material for such process is extremely diverse for each collection point. The temperature used to fry, the number of reuses of this oil before discard and what food was immersed in the oil, negatively contribute to the quality of generated biodiesel and glycerol formed in transesterification, besides the pretreatment that must be applied to this waste before producing biofuel. All this factors prevents the scale-up of the process to industrial scales.

For all the reasons argued in this work, we reiterate the need of research and production of renewable and economically viable energies that ally the low-cost with the treatment and decrease of wastes generation, without aggravate the already existing problems, mostly those which threats the survival of populations in a medium and long term, contributing for the stability in productive and energetic sector, creating doors for the sustainability of the contemporary world.

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