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AGROFUELS: BIODIESEL AS A SUSTAINABLE ALTERNATIVE ENERGY

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RESUMO - A busca intensiva por biocombustíveis como uma alternativa ao petróleo apresenta grande importância principalmente para os países emergentes, como o Brasil, uma vez que sua produção colabora com a conservação do meio ambiente, mediante a redução dos gases responsáveis pelo efeito estufa. Mediante esta problemática, a presente pesquisa visa à realização de uma levantamento bibliográficos sobre a produção de biodiesel como uma alternativa energética sustentável. O Brasil é considerado pela comunidade mundial como um país privilegiado, por ser de grande biodiversidade e muito rico em plantas oleaginosas, cujas culturas, em sua grande maioria, são restritas a fins alimentícios. Há um enorme potencial a ser explorado em relação ao aproveitamento energético de culturas oleaginosas, foco de nosso estudo. O biodiesel é um biocombustível que, como o nome sugere, provêm de fontes renováveis e naturais como os vegetais, geralmente obtido do processamento de sementes de girassol, soja, mamona, algodão, dendê, dentre outros, como também podem ser obtidos de óleo de origem animal e óleos vegetais já utilizados em frituras.

Palavras chave: Biocombustível, sustentabilidade, efeito estufa.

ABSTRACT - The intensive search for biofuels as an alternative to oil has great importance especially for emerging countries like Brazil, since its production contributes to the conservation of the environment by reducing greenhouse gases. With this issue, this research aims to develop a bibliographic survey on the production of biodiesel as an alternative sustainable energy. Brazil was considered by the world community as a privileged country, would be very rich in biodiversity in oil plants, whose cultures, for the most part, are restricted to food purposes. There is enormous potential to be explored in relation to the energy use of oil crops, the focus of our study. Biodiesel is a biofuel that, as the name suggests, come from natural and renewable sources such as vegetables, usually obtained from the processing of sunflower seeds, soybean, castor, cotton, palm oil, among others, as can also be obtained from oil Animal and plant oils used as in fried foods.

Keywords: Biofuels, sustainability, greenhouse gas emissions.

1. INTRODUCTION

The concept of sustainable development has its beginnings in 1983 when it was created by the General Assembly of the OUN World Commission on

Environment and Development (WCEND), chaired by Prime Minister of Norway Gro Harlem Brundtland. This committee had the task of proposing new rules for international cooperation that could guide policies and international action in order to promote the changes that were needed. In the work appeared from this Commission, appeared for the first time, the concept of Sustainable development (GAUSS, 2008).

The actions arising from the economic and industrial activities have caused changes in the biosphere, resulting in almost doubling the concentration of greenhouse gases, which is a major carbon dioxide (CO_2), whose emissions in Brazil, from the use of various types of fuels, increased dramatically in the past 40 years. However, it should be stressed that developed countries are the main contributors to the increased concentration of greenhouse gases (ROCHA, 2003).

Since the last century, fuels from oil have been the main source of energy worldwide. However, predictions that this feature should come to an end, added to growing concerns about the environment, have prompted the search for renewable energy sources (GHASSAN et al., 2003).

Being a renewable source of energy and its use does not cause harm to the environment, biomass has attracted much attention in recent times (BRAZIL, 2012). Among the readily available sources of biomass, vegetable oils have been widely investigated as candidates for renewable energy programs, as they provide a decentralized generation of energy and support to family agriculture, creating better living conditions in poor areas, and enhancing regional potential offering alternatives to economic, social and environmental problems difficult to solve (RAMOS et al, 2008).

In this context, the intensive search for alternative fuels to oil, such as biodiesel, is quite important especially for emerging countries like Brazil, since its production helps to conserve the environment by reducing the gases responsible for global warming and contributes to social development through the creation of jobs (OLIVEIRA et al., 2006).

Before this problem, this paper aims to conduct a literature review on the use and benefits of biodiesel compared to petroleum-based fuels.

2. Biodiesel History

In the late nineteenth century, Rudolph Diesel, inventor of the diesel engine, used in their essays crude oil and peanut oil. He believed that this engine could be fueled with oil or fat and contributes to the development of agriculture in countries that use them. However, due to its low cost and high availability of oil at the time, this became the preferred fuel in these engines (SUAREZ & MENEGHETTI, 2007).

To Gazzoni (2009), the fuel specified as "diesel" only arose with the advent of motors direct injection diesel, without pre-chamber. The spread of these engines was made in the 50s, with the strong motivation of much higher yield, resulting in low fuel consumption. In addition to the low levels of specific consumption, the modern diesel engines produce emissions in a way acceptable, within established standards. Historically, the direct use of vegetable oils as fuel was quickly overcome by the use of diesel fuel derived from oil for both economic and technical factors. At that time, environmental issues, which currently favor the renewable fuels such as vegetable oil, were not considered important.

With the end of World War II and the normalization of the global oil market, biodiesel has been temporarily abandoned. From the 1970s, with the successive crises in the international oil market, biodiesel returns as the main alternative to diesel. Today, in countries like Brazil, France, Germany, Austria and the United States, production and commercial use of biodiesel is a reality (EBB-EU, 2006).

In 1991, was produced the first batch of 10 tones of biodiesel in Germany, from rapeseed oil. The alcohol used in Europe is methanol, which can be purchased ask very competitive due to the installation of several factories in the Middle East. The other oil used in Europe for the production of fuels is sunflower. Other countries which have been producing biodiesel in Europe are especially Belgium, Italy, Austria and Czechoslovakia. In the U.S A., the biofuels program has been developing intensively since the first oil crisis. The emphasis of these programs was placed in the use of ethyl alcohol produced from corn, oriented mixed with gasoline. From the late 90s, has been developing the program for promoting use of biodiesel obtained from soybean and rapeseed (PIA, 2002).

In Brazil, in 60 years, Matarazzo Industries sought to produce oil from the coffee grounds. To wash the coffee in order to remove impurities, unfit for human consumption, it was used alcohol from sugar cane. The reaction between alcohol and coffee oil resulted in the release of glycerol, which resulted in ethyl ester, a product that is now called biodiesel. Since the 70s, through the INT, the Institute for Technological Research - ITR and the Executive Committee of the Plan of Cocoa Farming - ECPFAC, projects has been developed from vegetable oils as fuels, with emphasis on the DENDIESEL. In the 70s, the Federal University of Ceara - FUCE carried out research in order to find alternative sources of energy. The experience ended up revealing a new fuel originating from vegetable oils and oil with properties similar to conventional diesel, biodiesel (GAZZONI, 2009).

Parente (2003) cites the use of liquid fuels derived from crops grown was again remembered as an interesting alternative for Brazil, with a chance of the oil crises of 1973-74 and especially 1979-80. Several Brazilian universities have dedicated themselves to study the production of diesel fuel substitute, to make use of various raw materials of plant origin. Experimentation with the transesterification in Brazil was initiated at the Federal University of Ceará, in

1979, with the goal of developing the proposals of Professor. Melvin Calvin (Nobel Prize in Chemistry) presented in the International Seminar on Biomass, in Fortaleza, in 1978.

Brazil is a country with emphasis on the use of biomass since the 20s when it began using alcohol as fuel. Since then, has been gaining momentum with respect to the use of biomass such as crushed from sugar cane, timber reforestation, forest residues and animal waste. In addition, several species of oilseeds such as castor oil, cactus pear oil (palm), sunflower, palm, groundnut, jatropha and soybean, among others, have great prominence in the production of biodiesel. Since present high yield producing vegetable oils can be used for this purpose. Another potential feedstock for biodiesel production in the country consists of residual oils and fats, the result of domestic processing, commercial and industrial (DELATORRE et al, 2011).

In the twenty-first century, the global technological currents with solutions in view of the shortage of fossil fuel and to minimize negative impacts to the environment, sensitized the major agricultural producers, researchers and concomitantly the Brazilian government decided that the creation of the National Program of Production and Use of Biodiesel (NPPB), increasing the competence of the National Petroleum Agency (NPA) for monitoring the production and marketing of biofuels (NPA, 2008).

The Social Fuel Seal is a major support mechanisms provided for under NPPB. Regulated by Provisional Measure 227/04 and Decree 5.297/04, the issuance of the stamp is made to the producer of Biodiesel enrolled in the Unified Registration System Suppliers – URSYS that promote social inclusion of family farmers and small farmers organized into agricultural cooperatives, squarely within the scope of the National Program for Strengthening Family Agriculture – NATPFA (SANTOS, 2008).

The creation of the Social Fuel Seal is an innovative attempt of the government to create "conditions for the supply of important raw material for an industry to come from production units that without this intervention would hardly have significant participation in the market" (ABRAMOVAY, 2007). This is a differentiated form of state intervention that does not include direct allocation of resources to a specific audience, as is done with the NATPFA (SANTOS, 2008).

The greatest barrier to the commercialization of biodiesel is the high price of manufacturing associated with the price of vegetable oils. The residual oils and fats are a good alternative for the production of biodiesel as a lower cost vegetable oils traditionally used. Nowadays, many cooperatives are being formed in various municipalities in order to perform the collection of waste oil for biodiesel production.

3. BIODIESEL AS ALTERNATIVE ENERGY

According to Dantas (2006), the use of biodiesel results in a number of environmental benefits, economic and social. Several studies show that the substitution of mineral diesel by biodiesel results in emission reductions of 20% sulfur, 9.8% of carbon dioxide, 14.2% of unburned hydrocarbons, 26.8% of particulate matter and 4, 6% of nitrogen oxide. The environmental benefits can also generate economic benefits.

The country could fit biodiesel in agreements in the Kyoto Protocol and the guidelines of the clean development mechanism, as there is the possibility of selling carbon quotas through the Prototype Carbon Fund, by reducing emissions of greenhouse gases and also credits of "carbon sequestration" through the Bio carbon Fund, administered by the World Bank (FERRARI, 2005 cited in Dantas, 2006).

According to Hinrichs et al, (2003), biodiesel is a diesel fuel characteristics and come from natural and renewable sources such as vegetables, usually obtained from the processing of sunflower seeds, soybeans, peanuts, soybeans, castor beans and other vegetables, as well as can be obtained from animal and vegetable oils as used in frying. It is considered one renewable energy source based on biomass and provides several environmental benefits, such as reuse of agricultural and industrial waste, as well as the minimization of solid waste sent to landfills, complying with the aspect of minimizing pollutants in relation to Resolution RDC 306/2004 of ANVISA and reducing the atmospheric pollution, especially in large urban centers.

The raw material for the production of biodiesel can be any vegetable oil, the most common types, such as soybean oil, cinnamon or the cactus pear. Could also be used oils and fats from animal such as fish oil or beef fat. The great advantage of using biodiesel is that its use eliminates many forms of aggression to the environment, which are inevitable with the use of petroleum fuels. Firstly, it avoids using a fossil fuel, with limited reserves. Secondly, biodiesel reduces the release of various harmful substances normally found in vehicle exhaust (PIA, 2002).

Jordão Filho (2004) cites that biodiesel can be produced from any raw vegetable oil, that is, without going through major refinements. In general, it is to extract the oil, followed by separation procedures by centrifugation and filtration, resulting in crude vegetable oils. Therefore, an industrial plant for the extraction of vegetable oil with the required quality control for initial purification of the product is sufficient for the production of oil. The extraction of the vegetable oil can be done by physical process (pressing) or chemical (solvent). The solvent extraction produces better results, but the more traditional way is physical extraction, which uses mechanical and hydraulic presses to crush the grains.

Barnwal & Sharma (2004) emphasize that the transesterification is the most widely used to obtain Biodiesel occurring in three consecutive and reversible stages, yielding 3 moles of methyl or ethyl ester per mole triglyceride reacted with 3 moles of alcohol. As byproduct it has obtained a mole of glycerol. The molar ratios of alcohol / oil have been studied in several countries, considering the diversity of existing raw materials and the alcohol used for the production of biofuels.

Parameters such as temperature, reaction time, degree of refining of vegetable oil used and the effect of the presence of moisture and free fatty acids are also investigated and evaluated and directly influence the levels of conversion. At temperatures above 30 ° C the process may achieve 99% yield in a reaction of about 4 hours of alkaline catalysts base (NaOH, NaOMe or KOH). The reaction time can be reduced considerably the temperatures above 60 ° C, using refined vegetable oil (KNOTHE, 2006).

According to Ramos (2008), biodiesel is a natural substitute for diesel oil, which can be produced from renewable sources like vegetable oils, animal fats and oils used for cooking foods (fried). Chemically, it is defined as monoalquílico ester of fatty acids derived from naturally occurring lipids and can be produced together with glycerine, by reaction of triglycerides (or triglycerides) with ethanol or methanol in the presence of an acid catalyst or basic.

Nogueira & Pikman (2002) pointed out that in relation to the economic point of view, the viability of biodiesel is related to the establishment of a favorable balance in the Brazilian trade balance, since the diesel is the most consumed oil products in Brazil, and that a growing fraction of the product is being imported annually.

The major motivations for the production of biodiesel are the social and environmental benefits that can bring new fuel. However, due to the different levels of economic and social development of countries, these benefits must be considered differently. The economic benefit resulting from the reduction or elimination of import of diesel has also been advocated. It should be noted, however, that the issue of import could also be resolved with the construction of a new oil refinery or increase the capacity of existing refineries (LIRA, 2004).

Also according to Lira (2004), the consumption of fossil fuels derived from petroleum has a signifier impact on environmental quality. The air pollution, changes. Air pollution from large cities is probably the most visible impact of the burning of petroleum products. In the United States, the fuel consumed by cars and trucks are responsible for issuing 67% of carbon monoxide - CO, 41% of nitrogen oxides - NO_x, 51% of reactive organic gases, particulate matter of 23% and 5% of sulfur dioxide - SO_2. Moreover, the transportation sector also accounts for almost 30% of emissions of carbon dioxide - CO_2, a major contributor to global warming. The Intergovernmental Panel on Climate Change - IPCC, 2001 showed that the total level of CO_2 emissions in 2000 was 6.5 billion tons.

4. RAW MATERIAL FOR THE PRODUCTION OF BIODIESEL

Brazil, for being the holder of a large territory with a wide variety of raw materials for biodiesel production, such as soybean, sunflower, castor bean, corn, jatropha, the cotton seed, the canola, babassu, buriti, palm oil, the macaw, groundnut, among others. Oil disposal, animal fats and oils used for cooking food are also used as alternative raw materials. However, it is important that the chemical and physical properties of the raw materials are directly related to technology and the yield of the conversion process and therefore the final product quality for fuel (RAMOS, 2006).

4.1. Soybean (*Glycine Max*)

According to data from EMBRAPA SOJA, (2011), soybean (*Glycine max*) is considered a major source of protein and vegetable oil in the world. Although the soybean originated in temperate climate, nowadays, after extensive breeding, the soybeans are produced under conditions of subtropical and tropical climates. Brazil is the second largest producer of soybeans after the U.S.A. In 2009/2010 harvest, the crop occupied an area of 23.6 million hectares, which totaled a production of 68.7 million tons. The average productivity of Brazilian soybeans was 2941 kg per hectare.

The grain is very versatile, as it gives rise to products and byproducts widely used by agribusiness, food and chemical industries. In food, soybeans in the composition of several embedded, in chocolates, salad dressings, among others. Soy protein is the basis of bakery ingredients, pasta, meat products, cereals, prepared mixes, and beverages, food for infant and dietetic foods. Soybeans are also widely used in the adhesives industry and nutrients, animal feed, fertilizers, formulator of foam, fiber manufacturing, coatings, and paper water emulsion paint. Its use more commonly known, however, is refined oil as obtained from crude oil. In the process, is also produced lecithin, an emulsifying agent, widely used in the manufacture of sausages, mayonnaise, chocolate, among other products (SLUSZZ & MACHADO, 2006).

The soybean oil can be used as fuel for vehicles with diesel cycle - blending soybean oil and diesel fuel in amounts ranging from 5 to 50%. This process is increasingly present in locations away from oil refineries, where the cost of diesel is high. Biodiesel can be produced by mixing soybean oil with ethanol, in a chemical reaction known as transesterification. Biodiesel replaces in part or in full, diesel and can be mixed in various proportions. This will be mandatory biofuels added to diesel fuel used in vehicles, the amount of 2% from 2008 and should rise to 5% in 2013. The shell and soybean molasses can also be used as fuel for generating steam or power. In 2007, a company called IMCOPA pioneered the world in developing technology in their boilers, to accept these two soy products as fuel (IMCOPA, 2012).

PRYOR (1983) cited in Machado (2003) points out that the volume of vegetable oil produced worldwide is soybean oil and is therefore the most suitable as fuel. The soybean oil is suitable candidate for use in engines, because it is inexpensive, available in large amounts, has the highest overall energy ratio and has a good energy yield per hectare.

4.2. Sunflower (*Helianthus annuus* L.)

According Carrão-Panizzi & Mandarino (2005), sunflower (*Helianthus annus* L.) is a plant with very special characteristics, particularly with regard to their potential for economic exploitation. Its main products are produced from oil seeds and animal feed, and is widely used as food in the form of flour, concentrates and isolates protein.

Sunflower has good tolerance to drought and heat, may become an important alternative for the Brazilian semiarid. As this region does not have a good agricultural infrastructure, and most of the population lives on family farms, the planting of oil can help to increase income and stimulate the permanence of the population in rural areas (VENTURA et al, 2010).

According to Saiz (2009), the main interest of agricultural production is for sunflower oil extraction, considered among the vegetable oils such as oils of a higher nutritional quality and organoleptic (taste and aroma). In addition, the resulting mass of oil extraction yields a highly protein cake, used in the production of animal feed. The sunflower is still used in silage for animal feed and its cultivation can also be associated with beekeeping. According Maziero et al (2006), using ethyl ester of sunflower oil caused a significant loss of mechanical performance of the engine. However, reduced significantly, the levels of pollutant emissions, carbon monoxide, carbon dioxide, hydrocarbon and particulate material, with no significant increase nitrogen oxide.

4.3. Castor bean (*Ricinus communis* L.).

According to Azevedo and Beltran (2007) castor bean (*Ricinus communis* L.) is a xerophytic and heliophile plant with probable origin in Asia, its introduction was made by Portuguese colonization, due to the arrival of slaves from Africa, fits easily and can be found in Brazil, from Rio Grande do Sul to the Amazon, but found better service to their basic needs (sun, drought) in the Northeast, one example is the state of Bahia is responsible for 90% of national production. According to Embrapa (2008) after a study of ricinocultura by geographic area it was found that each hectare of cultivation of castor oil absorbs ten tons (10 tons.) Of carbon dioxide, in comparing it to other oil crops this value is four times larger than the others to absorb.

Long ago, castor oil was used for power generation and for medicinal purposes, like, purging and ointment for the diseases of the joints, inflammation in general, ear pain and rash. In the 1970s and 1980s, the castor was highlighted by the possibility of use as a substitute for petroleum fuels. From that period, were discovered numerous industrial applications for castor oil, such as paints, varnishes, waterproofing surface, hydraulic fluids, cosmetics, lubricants for aircraft and spacecraft, bullet proof glass, fiber optic cables, lenses contact, plasticizers and plastics etc. In recent years, the first applications of castor oil evolved and gained new approaches. With regard to advances in medicine today is derived from an oil polymer used in the manufacture of cement and prostheses of various body parts (FREITAS & FREDO, 2005).

Also according to Freitas & Fredo (2005), as the power generation, castor oil becomes suitable to deal with the National Biodiesel Program that in addition to social inclusion, aims to reduce both the Brazilian imports of petrodiesel as the burning of fossil fuels. In this sense, it is emphasized that in addition to the socio-economic advantages that this culture of castor oil seed has oil content above the rest and, according to EMBRAPA (2004), each hectare cultivated with castor oil absorbs ten tons of carbon dioxide, or that is, four times the average of the other oilseeds. The castor bean is a plant native to tropical and subtropical a fruit that provides a similar to a tick. For this reason, the ancient Romans put the name ricinus.

4.4. Jatropha (*Jatropha curcas* L.)

Jatropha belongs to the family Euphorbiaceae, the same castor bean and cassava. It is a large shrub, fast growing, whose average height is two to three meters, but can reach up to five meters under special conditions. The trunk diameter is approximately 20 cm; have short roots and little branched, stem smooth, rubbery wood and bone development, but little resistance; phloem with long channel that extends to the roots, which circulates the latex, milky juice flowing with abundance of any injury. The trunk or stem is divided from the base, on long branches, with numerous scars produced by the falling leaves in the dry season, which reappear after the first rains. The jatropha (*Jatropha curcas* L.) is also known as Paraguay pinion, jatropha, purge-pinhade, chick-crazy, nut-of-fence, mob, tartago, medicineira, carpet, siclité, the pinion-hell, pinion angry, prickly pear, top, of the pinion-bearded, sassi, etc.., probably originating in Brazil, having been introduced by Portuguese sailors in the Archipelago of Cabo Verde Islands and Guinea, where it was disseminated by African continent (ARRUDA et al, 2004).

The pinion is a pollinate plant, that is, cross-fertilization in which the pollination is made by insects, which increases the genetic variation in plant cultivation. The variability shown by the species allows the exploration of many characters that when improved can genetically interact with the environment thereby increasing the economic value of production (MARQUES, 2007).

Also according to Arruda et al (2004), the pinion, the use of oil and its possible use in biodiesel production, great hardiness, good adaptation to changes in the environment and the role it can play in protecting the soil and can be grown Furthermore, in consortium with other economically important crops such as peanuts, cotton, among others, has great importance for better utilization of agricultural semiarid region, with an option for the economy of this region. The increase in planting areas can assist in setting manpower in rural areas by generating employment and providing raw material for industry. However, the lack of scientific knowledge about this culture hinders its release, making it necessary, studies by research institutions to enable making technical recommendations about safe growing, harvesting and industrial use.

Because of its hardiness, the geographical distribution of culture is quite large, with good growth in both tropical dry and humid equatorial zones, as well as in arid and rocky, supporting long periods of drought (SATURNINO et al., 2005).

Nowadays, this species is very commercially exploited within the Brazilian territory, being a viable oilseeds to obtain biodiesel, to produce, on average, two tons of oil per hectare, taking three to four years to reach age production, which may extend to 40 years (CARNIELLI, 2003).

Nunes (2007) mentions that the State of Minas Gerais, the production areas are concentrated in regions of Mucuri, Jequitinhonha Valley, Minas Triangle and north of the state, with production targeted primarily to the production of seedlings, seeds and development of research, however, Jatropha is a plant where the technical and scientific knowledge is still very limited and there is a need for research and investments so that activities can achieve results economically viable.

In a comparative analysis of the direct application of Jatropha oil with diesel from fossil fuels, Silva (2006) noted that the use of Jatropha oil was 20% higher than diesel on a commercial internal combustion engine, but the engine noise was softer and smoke emissions 40% lower, contributing to the reduction of noise pollution and the environment.

According Bicudo et al. (2007), the seed oil of Jatropha can be extracted by two methods which are chemical or mechanical extraction. In chemical extraction, the seeds are peeled and ground, the cake is subjected to a solvent which is usually hexane, resulting in the 50% oil. In mechanical extraction is used a hydraulic press to crush the seeds and crushed after the pie is heated to 60 ° C. In this case, obtains only 35% oil.

Using the method of pressing and heating, and loss oils occurs, the resulting oil presents physical and chemical impurities, while extraction with hexane for obtaining greater efficiency in the oil, and oil result in a purer for addition to diesel oil (PENHA, 2007).

According Penha (2007) cited Araujo & Sousa (2008), Jatropha oil has a high degree of acidity which may cause corrosion in the engine ignition. After extracting the oil should be used the process of neutralization, which is the addition of aqueous Sodium Hydroxide 18% oil, is regulated by the percentage PNA.

According to Marques (2008) cited by Araújo & Sousa (2008), researchers from São Paulo Agency of Agribusiness Technology (PAAT), aimed at producing biodiesel, began research on different germplasm accessions of jatropha from various Brazilian states to collect data about the genetic variability of the plant. However, the research began in 2008 and as the jatropha plant is a perennial, the results are likely to be completed after several years of research.

4.5. Palm (*Elaeis Guineensis*)

The palm oil or cactus pear (*Elaeis guineensis*) is a palm tree originally from West Africa (Gulf of Guinea) and was introduced into the Americas from the fifteenth century, constitutes the greater productivity of oilseed known in the world. Its grain yield (kg / ha), compared to soy, is about eight times higher (CARVALHO et al, 1998).

Carvalho (2006) points out that despite having entered Brazil in the seventeenth century, brought by slaves from Africa, the production of palm in the country was never significant. National production now amounts to 0.1% of the world, currently estimated at 25 million tons, the second most produced vegetable oil in the world, second only to soybean oil. Pará is the main producing state, with an average yield of 3.32 tons per hectare and uses 69,000 hectares of palm.

The cultivation of palm (*Elaeis guineensis*) was introduced in Brazil by African slaves in the early seventeenth century, giving rise to dendezais subspontaneous in the coast of Bahia. Geared primarily to the livelihoods of poor families along the northeast coast, the first planned cultivation began in the 60s in the state of Para on the initiative of the Amazon Development Superintendency (AMDSU), in collaboration with the *Institut of Recherches pour les Huiles et Oleagineux* (IRHO), located in France (HOMMA et al., 2002).

According to Lima (2000) with respect to the agroclimatic point, the Palm requires for its cultivation, very specific conditions, including:

- Rain over 1.800/2.200 mm / year with good distribution and no pronounced dry season, failing to affect leaf emission, the average weight of bunches and oil yield;
- Insolation over 1800 hours / year well distributed. The optimal level of insolation is 2,000 hours/years may not be not less than 1500 hours;
- Temperature average between 25 ° and 28 ° Celsius. Low temperatures cause a slowdown in growth of young plants and fruit production of the oldest. It is estimated that radiation above the 19Mj/m^2/day are satisfactory for growing oil palm on complying with the other conditions.
- Relative humidity between 60% and 90%;
- Deep, well drained soils, with no physical impediments to root growth and low saturation of bases. In general, the soils of moderate slope or flat land is preferable to crops.

The palm can be exploited to 25-30 years and then the plants become too high for the extraction of fruit, resulting in high costs for the collection area. Most areas of planned cultivation in Brazil are in the intermediate state of exploration. In general, it's possible to define the main chronological steps for the implementation and maintenance of the culture of palm (SANTOS, 2008).

According Lofrano (2008), the global consumption of palm oil has increased to levels more elevated than the other oils. Between 1999 and 2007, the average annual growth in global consumption of palm oil was 12%, while consumption of soybean oil had an average consumption growth of 5.8% per year. This is explained by the significant change in the food manufacturing process, motivated by the search for oil more pure and free from the hydrogenation process.

The use of biodiesel for electricity generation based on African palm is tied to the viability of enterprises in the region. According Kaltner (2006) cited Santos (2008), the final cost of biodiesel mainly depends on the cost of palm oil, rate conversion process and to a lesser degree, the cost of alcohol, the catalyst and the energy, required for the process of transesterification. In general, the sensitivity analyzes show that the raw material corresponds to approximately 80% of the final cost of bio-fuel, and may have great significance in the case of vegetable oils with a lower conversion rate.

Macedo et al. (2000) cited Santos (2008) mentions that one of the main benefits of palm planting in degraded areas refers to protection against soil erosion and leaching losses, phenomena quite common in areas where there is a clear alternation between dry seasons and of heavy rainfall. The large amplitude and exuberance of the palm tree in its adult stage enables the coverage of degraded soils, either by bio-mass disposed on the ground dead in the dry season or by biomass, which can reach 10 meters in diameter. This feature helps maintain or restoration of water balance and climatic area benefited, enabling further development of food crops intercropped.

4.6. Cotton (*Gossypium hisutum*)

The installation of a park of biodiesel production in Brazil has created a new market for producers of oilseeds, including the lump of cotton. This product has historically been targeted by the vegetable oil industry and farmers, who used processed as animal feed. Now, biodiesel industries also want it. Currently, there are at least 24 factories ready or under construction capable of transforming the cotton oil into biodiesel (BIONDI et al, 2008).

The scenario of low use of cottonseed for biodiesel industry is not immutable. Policy decisions on increasing the blend of biodiesel to diesel can be taken at any time by changing the calculation on which the raw material is more worthwhile to be processed. After the increase of 2% to 3% mandatory blending in July this year, the lobby of the biodiesel industry works so that the goal of reaching 5% as soon as possible. Thus, more and more farmers, including cotton farmers, may target the biodiesel industry as one of its production targets. The recent increase in core prices in the Brazilian market, albeit peripherally impact the earnings of cotton producers, and strengthens the sector becomes an impetus for the decision to plant (BIONDI et al, 2008).

For Dantas (2006), cotton (*Gossypium hisutum*) is a very complex morphological plant, having particular key used, including the identification of the species within the genus *Gossypium* and *Malvacea* family, of which it is part. The herbaceous plant has a unique organographic structure with two types of branching, with branches and fruitful seasons, two types of macrofilo (vegetative and fruiting) flowers having a full third whorl floral bracts, which is an extra protection and can have, internally and externally on the base, glands secretion, besides presenting profilos leaves sheathed with two stipules, two types of glands and at least two buds at the base of each sheet.

The cultivation of cotton has a fairly complete recovery, in addition to fiber, its main product, the cotton plant produces several by-products of agricultural and industrial interests, especially crude oil, which on average is 15% of the seed (seed) and the pie too rich in protein, which is almost half of the seed (BARROS et al., 2004).

For the next few years, the existing forecasts point to growth of the Brazilian cotton production. The Ministry of Agriculture of Brazil estimates that the average annual growth between seasons 2007/08 and 2017/18 will reach 4.41% annually, driven primarily by exports. During this period, it is projected that the production of raw cotton will increase from 2.27 million tons to 3.51 million (+54%), domestic consumption will jump from 940,000 tons to 1.09 million (+15%) advance and exports of 470 thousand to 910 thousand tons (+93%) (BIONDI et al, 2008).

For Carvalho et al. (2006), the seed cotton is byproduct of the plume and can be used both in animal feed as in the production of vegetable oil and is approximately 60% of production, depending on its variety of conditions and crop management

FINAL CONSIDERATIONS

Clearly, the search for new energy sources has been driven by the possible shortage of oil and recent results on the causes of global climate change. Therefore, biodiesel emerges as an alternative product, biodegradable and renewable shows advantages in relation to oil and its derivatives. Given the above, the man should make use of green practices in order to mitigate the negative effects caused to the environment and thus generating internal and external hard currency for the country. And one of the aforementioned practices is the use of renewable fuels at the expense of those from fossil sources, which are major emitters of CO_2 in the atmosphere and thus contributing to global warming.

REFERÊNCIAS

ABRAMOVAY, R.; MAGALHÃES, R. **O acesso dos agricultores familiares aos mercados de biodiesel: parcerias entre grandes empresas e movimentos sociais.** Project Proposal to Regoverning Markets (Component 2 – Innovative practice in connecting small-scale producers with dynamic markets). Departamento de Economia da Universidade de São Paulo, São Paulo, 2007.

ANP. **Agência Nacional do Petróleo, Gás Natural e Biocombustíveis**. Resolução ANP n° 21, 10/07/2008. Disponível em: <http://www.anp.gov.br/biocombustiveis/biodiesel.asp>. Acesso em: 26 set. 2008.

ARAÚJO, L. G. de; SOUSA, K. C. I. Pinhão Manso para Produção de Biodiesel. **Revista Anhangüera,** v.9 n.1 jan./dez 2008. p.95-119.

ARRUDA, F. P. de; BELTRÃO, N. E. de M.; ANDRADE, A. P. de; PEREIRA, W. E.;

ARRUDA, F. P. de; BELTRÃO, N. E. de M.; ANDRADE, A. P. de; PEREIRA, W. E.; SEVERINO, L. S. Cultivo de Pinhão Manso (*Jatropha Curca* L.) como Alternativa Para o Semi-Árido Nordestino. Rev. bras. ol. fibros., Campina Grande, v.8, n.1, p.789-799, jan-abr. 2004

AZEVEDO, D. M. P.; BELTRÃO, N. E. de M. **O agronegócio da mamona no Brasil.** Brasília, DF. Embrapa. 2° ed., 2007. 506 p.

BARNWAL, B.K.; SHARMA, M.P. "Prospects of biodiesel production from vegetable oils in Índia". **In:** Energy Policy. Indian Institute of Technology, Uttaranchal, India: 2004.

BARROS, M. A. L; SANTOS R. F. DOS, FERREIRA, P. F. Análise dos Sistemas de Produção Identificados para os Algodões de Sequeiro e Irrigado no Estado da Paraíba. **In:** Congresso Brasileiro de Algodão. EMBRAPA Algodão. Campina Grande, PB. 2004. Disponível em: <www.cnpa.embrapa.br/produtos/algodao/publicacoes/trabalhos_cba4/011.pdf>. Acesso em: 31 mai. 2012.

BICUDO, T. C. et al. **Estabilidade e Tempo de Indução Oxidativa do Óleo de Pinhão Manso para Produção de Biodiesel.** Paraíba, 2007. Disponível em: <http://www.biodiesel.gov.br/docs/congresso2007/caracterizacao/26.pdf>. Acesso em: 09 set. 2008.

BIONDI, A., MONTEIRO, M., GLASS, V. **O Brasil dos Agrocombustíveis:** Impactos das Lavouras sobre a Terra, o Meio e a Sociedade - Palmáceas, Algodão, Milho e Pinhão-manso. Repórter Brasil, 2008. Disponível em: <http://www.reporterbrasil.org.br/documentos/o_brasil_dos_agrocombustiveis_v2.pdf>. Acesso em: 31 mai. 2012.

BRASIL. Ministério da Ciência, Tecnologia e Inovação. **Programa brasileiro de biocombustíveis: rede brasileira de biodiesel - PROBIODIESEL**. Brasília, 2012.

CARNIELLI, F. **O combustível do futuro.** 2003. Disponível em: <www.ufmg.br/bo-letim>. Acesso em: 22 mai. 2012.

CARNIELLI, F. **O combustível do futuro**. Boletim Técnico, Universidade Federal de Minas Gerais, UFMG. 2003.

CARRÃO-PANIZZI, M. C.; MANDARINO, J. M. G. Produtos Proteicos do girassol **In**: __ Girassol no Brasil. Editores, Regina Maria Villas Bôas de Campo Leite, Alexandre Magno Brighenti, César de Castro. Londrina: Embrapa Soja, 2005. cap. 4 p. 51-68.

CARVALHO, B. C. L. de; PEIXOTO, S. E.; OLIVEIRA, E. A. S. **Potencialidades das Oleaginosas Cultivadas no Estado da Bahia para a Produção de**

Biodiesel. 2006. Disponível em: <www.ebda.ba.gov.br>. Acesso em: 31 mai. 2012.

CARVALHO, E. M. **Torta De Dendê (*Elaeis guineensis, Jacq)* Em Substituição Ao Feno De Capim-Tifton 85 (*Cynodon spp)* Na Alimentação De Ovinos,** Itapetinga-Ba: UESB, 2006, 40p, (Dissertação – Mestrado em Zootecnia, Área de concentração em Produção de Ruminantes)**.**

CARVALHO, J. E. U.; NASCIMENTO, W. M. O. do; MÜLLER, C. H. **Características físicas e de germinação de sementes de espécies frutíferas nativas da Amazônia.** Belém, PA: Embapa **-** CPATU, 1998. 18p. (Embrapa-CPATU. Boletim de Pesquisa, 2003).

DANTAS, H. J. **Estudo termoanalítico cinético e reológico de biodiesel derivado do óleo de algodão *(Gossypium hisutum).*** Dissertação (mestrado) UFPB/CCEN. João Pessoa, 2006. 86p.

DELATORRE, A. B.; RODRIGUES, P. M.; AGUIAR, C. DE J.; ANDRADE, V. V. V.; ARÊDES, A.; PEREZ, V. H. Produção de biodiesel: considerações sobre as diferentes matérias-primas e rotas tecnológicas de processos. **Pespectiva On Line**. Vol. 1, N. 1. 2011.

EMBRAPA. Centro Nacional de Pesquisa de Algodão - CNPA. **Pesquisa com mamona pode viabilizar biodiesel brasileiro.** 2008. Disponível em: <www.cnpa.embrapa.brjornal/mamonaPDU.htm>. Acesso em: 17 ago. 2011.

FERRARI, A. R., OLIVEIRA, V. S., SEABIO, A., **Química Nova**, 28 (1): 19, 2005.

FREITAS, S. M. DE; FREDO, C. E. Biodiesel à Base de Mamona. **Informações Econômicas**, SP, v. 35 n. 1, jan. 2005. p. 37-42.

GAUSS Consultores Associados LTDA. O Conceito de Sustentabilidade. **Revista Banas Qualidade**. 2008 Out; 1-5.

GAZZONI, D. L. **História e Biodiesel.** Disponível em: <http://www.biodieselbr.com/biodiesel/historia/biodiesel-historia.htm>. Acesso em: 26 mai. 2012.

GHASSAN, T. A.; MOHAMAD I. AL-WIDYAN, B.; ALI O, A. Combustion performance and emissions of ethyl ester of a waste vegetable oil in a water-cooled furnace. **Appl. Thermal Eng.**, v.23, p.285-293, 2003.

HINRICHS, R. A.; KLEINBACH, M.; trad. VICHI, F. M.; MELLO, L. F. de. **Energia e meio ambiente.** São Paulo: Thomson, 2003. 543 p.

IMCOPA. **Soja.** Disponível em: <http://www.imcopa.com.br/empresa >. Acesso em 25 mai. 2012.

JORDÃO FILHO, W. **Implementação de negócios de biodiesel no Brasil:** Estudo de viabilidade técnica e financeira preliminar, 2004.

KNOTHE, G. et al. **Manual de Biodiesel.** 1ª Ed. São Paulo: Editora Blucher, 2006.

LIMA, P. C. R. **O biodiesel e a inclusão social.** Consultoria Legislativa. Brasília, 2004. Disponível em: <http://apache.camara.gov.br/portal/arquivos/Camara/internet/publicacoes/estnot-tec/pdf/2004_676_Estudo.pdf>. Acesso em 25 mai. 2012.

LOFRANO, R. "Alimento e Combustível com a Floresta Preservada". **In:** Anuário da Agricultura Brasileira. São Paulo: Consultoria e Agroinformativos, 2008.

MACHADO, P. R. M. **Avaliação de desempenho do óleo de soja como combustível para motores diesel**. Dissertação de Mestrado. Universidade Federal de Santa Maria - UFSM. 2003. Disponível em: <http://w3.ufsm.br/ppgea/admin/dissertacoes/0905081454_MACHADO_Paulo_Romeu_Moreira.pdf>. Acesso em: 26 mai. 2012.

MARQUES, D. de A. **Pinhão manso para produção de biodiesel: um promissor negócio ou um grande desastre**. APTA, São Paulo, ago. 2007. Disponível em: <http://www.apta.sp.gov.br/noticias.php?id=2709>. Acesso em: 24 mai. 2012.

MAZIERO, J. V. G.; CORRÊA, I. M.; TRIELLI, M. A.; BERNARDI, J. A.; D'AGOSTINI, M. F. Avaliação de emissões poluentes de um motor diesel utilizando biodiesel de girassol como combustível. **Engenharia na Agricultura**, Viçosa, MG, v.14, n.4, 287-292, Out./Dez, 2006.

NOGUEIRA, L. A. H.; PIKMAN, B. Biodiesel; novas perspectivas de sustentabilidade. **Conjuntura & Informação - Agência Nacional do Petróleo,** n.19, 2002. Disponível em: <http://www.anp.gov.br/NXT/gateway.dll/doc/informe_ci.htm> Acesso em: 26 mai. 2007.

NUNES, C.F. **Caracterização de Frutos, Sementes e Plântulas e Cultivo de Embriões de Pinhão Manso (*Jatropha curca* L.).** Dissertação (Mestrado). Universidade Federal de Lavras. 2007. 78p.

OLIVEIRA, F. C. C.; SUAREZ, P. A. Z.; SANTOS, W. L. P. dos. Biodiesel: Possibilidades e Desafios. **Química Nova na Escola**. N° 28, MAIO, 2008. Disponível em: <http://qnesc.sbq.org.br/online/qnesc28/02-QS-1707.pdf>. Acesso em: 24 mai. 2012.

OLIVEIRA, L. B.; MUYLAERT, M. S.; ROSA, L. P.; BARATA, M.; ROVERE, E. Renew. **Sust. Energ.Rev**. DOI:10.1016/j.rser. 2006.

PENHA, M. da N. C. et al. **Caracterização físico-química da semente e óleo de pinhão manso (*Jatropha curcas*) cultivado no Maranhão**. Maranhão, 2007. Disponível em: <http://www.biodiesel.gov.br/docs/congresso2007/caracterizacao/13.pdf>. Acesso em: 19 mai. 2012.

PLÁ, J. A. **Histórico do Biodiesel e suas perspectivas.** 2003. Disponível em: <www.ufrgs.br/decon/publionline/textosprofessores/pla/hist_rico.doc>. Acesso em: 23 mai. 2012.

PLÁ, J. A. Perspectivas do Biodiesel no Brasil. **Indic Econ**, FEE, Porto Alegre, v. 30, n. 2, p, 179-190, set, 2002.

RAMOS, L. P. **A Qualidade da Matéria-Prima para a Produção de Biodiesel - Parte 1**. 2006. Disponível em: <http://www.biodieselbr.com/colunistas/ramos/qualidade-materia-prima-producao-biodiesel-1.htm>. Acesso em: 27 mai. 2012.

RAMOS, L. P.; KUCEK, K. T.; DOMINGOS, A. K.; WILHELM, H. M. **Biodiesel**: Um projeto de sustentabilidade econômica e sócio-ambiental para o Brasil. 2008. Disponível em: <www.resol.com.br/textos/Biodiesel.pdf>. Acesso em: 25 mai. 2012.

ROCHA, M. T. **Aquecimento global e o mercado de carbono:** uma aplicação do modelo CERT / Marcelo Theoto Rocha. Piracicaba, 2003. 196 p.

SAIZ, P. **Cultura do girassol:** produção de biodiesel e outras utilidades. Embrapa Soja. 2009. Disponível em: <http://hotsites.sct.embrapa.br/prosarural/programacao/2009/cultura-do-girassol-2013-producao-de-biodiesel-e-outras-utilidades>. Acesso em: 28 mai. 2012.

SANTOS, A. M. **Análise do potencial do biodiesel de Dendê para a geração elétrica em sistemas isolados da Amazônia.** Dissertação. COPPE/UFRJ, M.Sc., Planejamento Energético, Rio de Janeiro, 2008. Disponível em: <http://www.ppe.ufrj.br/ppe/production/tesis/anameliam.pdf>. Acesso em 30 mai. 2012.

SATURNINO, H. M.; PACHECO, D. D.; KAKIDA, J.; TOMINAGA, N.; GONÇALVES, N. P. Cultura do pinhão-manso (*Jatrofa curca* L.). **Informe Agropecuário**, v. 26, n. 229, p. 44 – 78, 2005.

SEVERINO, L. S. Cultivo de pinhão-manso (*Jatropha curca* L.) como alternativa para o semiárido nordestino. **Revista Brasileira de Oleaginosas e Fibrosas**, Campina Grande, v. 8, n. 1, p. 789-799, jan./abr. 2004.

SILVA, P. R. C. Agricultura e pecuária: biodiesel de *Jatropha curcas L.* **Serviço brasileiro de respostas técnicas**. Bahia, Fev. 2006. Disponível em: <http://sbrt.ibict.br> Acesso em: 26 mai. 2012.

SLUSZZ, T.; MACHADO, J. A. D. Características das potenciais culturas matérias-primas do biodiesel e sua adoção pela agricultura familiar. In: ENCONTRO DE ENERGIA NO MEIO RURAL, 6., 2006, Campinas. **Proceedings online.** Disponível em: <http://www.proceedings.scielo.br/pdf/agrener/n6v1/032.pdf>. Acesso em: 26 mai. 2012.

SUAREZ, P.A.Z.; MENEGHETTI, S.M.P. 70º aniversário do biodiesel em 2007: evolução histórica e situação atual no Brasil. **Química Nova**, v. 30, p. 2068-2071, 2007.

VENTURA, D. A. M. F.; ALVES, K. B.; SANTOS, M. K. V. A. dos. Análise comparativa entre o biodiesel de girassol e o biodiesel de mamona. João Pessoa. Inclusão Social e Energia: **Anais...** Campina grande: Embrapa Algodão, 2010. p. 7-12.

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