

Sustainable Biodiesel Production from Non-Consumables Oils in Peru

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Submitted: 31 Oct 2019; Accepted: 05 Nov 2019; Published: 13 Nov 2019

Abstract

In the country and the world, it has become aware about the characteristics of non-renewable fossil fuels, and the high use of transport vehicles that use these fuels, in addition to industries and other sectors; these have boosted global research on alternative fuels, especially those derived from biomass.

Peru in the change of its energy matrix has taken actions that allow it to increase the use of renewable energies such as biodiesel and bioethanol. Currently there are other proposals such as biorefineries that allow the greatest use of their natural resources.

The investigations that have been carried out since 2010 have allowed us to have a technological contribution for the sustainable production of biodiesel in Peru.

Keywords: Biodiesel, Jatropha Oil, Biorefinery, Transesterification

Introduction

In the global context (see figure 1), it is Europe that has led the market in 2009, with a production of 49.8%, followed by the American continent with a share close to 33%. In the Asia-Pacific region, Australia is the largest producer, followed by China and India. However, the countries with the highest production worldwide in 2009 were Germany, USA, France, Argentina and Brazil, which in together they produced 64.8% of the total biodiesel in the world.

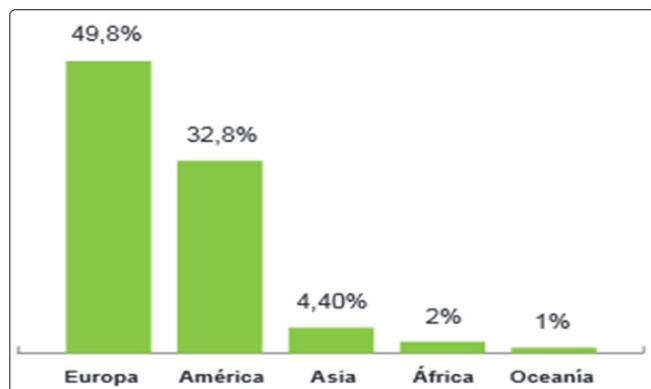


Figure 1: World Biodiesel production by continents

Instituto Interamericano de Cooperación para la Agricultura, ARPEL. Manual de Biocombustibles. 2008.

The debate about considering biofuels as competitors persists, with reference to the areas of cultivation and natural resources, from the food sources of the world population. However, this is true if it is that the problem is seen as competition of the cultivation surfaces.

An alternative is biodiesel, which has the potential to partially replace the diesel obtained from the Petroleum. The most important aspect in the production of biodiesel is the economy, which focuses on the used raw materials, Peru has housed the Higuierilla and Jatropha curcas successfully on their land, being able to get to produce a good amount of this raw material. One proposal is the production cleaner biodiesel with a competitive wreck, and of adequate quality.

Biofuels in Peru

Peru, due to its climatic diversity and resources, has a diversity of alternatives for the production of biodiesel. The raw materials that have potential (tested or under study) to produce biodiesel in Peru are oil palm, rapeseed, cotton, pine nut, castor; In addition to numerous Amazonian oilseed species. Likewise, waste oils and fats, fish oil, animal tallow and certain types of oil producing algae are alternative sources of raw material that must be inventoried and studied.

Change in the energy matrix

As published by the Ministry of Energy and Mines in 2007, where the energy matrix is evaluated in 2005 and a change is established in the primary sources of energy in the future. Figure 2 shows the increase in natural gas consumption and the use of renewable energy. Although there are currently photovoltaic and wind power plants in the south of the country, their participation in the energy matrix is not yet appreciable.

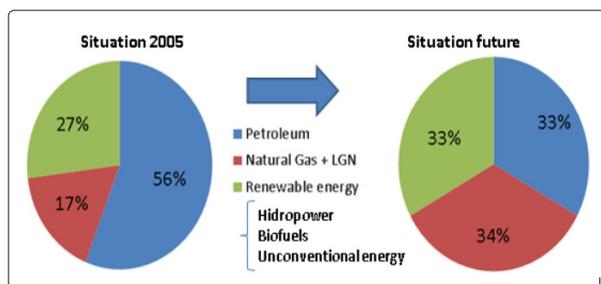


Figure 2: Change in the energy matrix

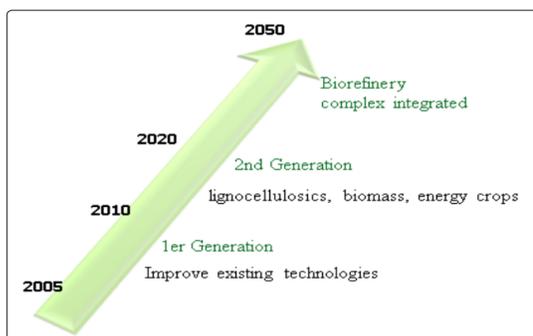


Figure 4: Future vision of Biofuels

Legal Framework of Biofuels in Perú

Law 28054 enacted in 2003 proposes the promotion of the Biofuels market. In the supreme decree N° 021-2007-EM, the regulation for the biofuel market is promulgated.

What arises with the legislation is:

- diversify the energy matrix
- promote agroindustrial development
- reduce environmental pollution
- offer an alternative market in the fight against drugs

Dates are also established for the adaptation of fuels with mixtures with bioethanol and biodiesel. As seen in the figure 3, as of 2011 there is 5% of Biodiesel in mixtures with gasoline and 7.8% of Bioethanol in mixtures with gasoline.

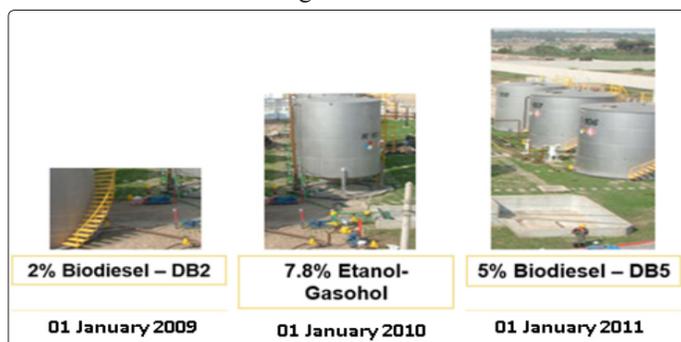


Figure 3: Schedule for application of biofuels in Peru

Sustainable Biodiesel Production

There are many benefits obtained from the production of biofuels for energy purposes, the following are considered:

- Almost zero emission of CO₂, one of the main responsible for global warming.
- High bio-degradability, comparable to that of dextrose.
- Does not contain sulfur which allows the use of catalysts to improve combustion and minimize exhaust gases

However, there are not only benefits of energy purposes, biodiesel production also implies socio-economic advantages:

- Self-supply of fuel to the agricultural producer.
- It will cover a large part of the country's dependence on the supply of fossil fuels by oil producing countries.

To consider a clean and sustainable production of biodiesel, the sources available, as well as the technology, must be analyzed. In a future vision (see figure 4), 2nd generation biodiesel is established by 2020 and by 2050 implement Biorefineries. These proposals must be considered by investors.

Within this vision of the future there is a proposal of the law of added value that gives greater impulse to technology parks, technology-based companies and start-ups. These will arise from the linkage of the academy, company, state and society. An ecosystem that allows the Peruvian economy greater economic growth.



Figure 5: Ecosystem of Biofuels

Until 2008, in Peru a small industry of biodiesel production from palm has been developed, taking into account the following companies, as well as their production and location. See table 1.

Table 1: Companies dedicated to the production of Biodiesel from palm oil

Companies	Tons per year	Gallons per year	Location
Biodiesel Peru International S.A.C	12 000	3 637 368	Huarochiri - Lima
Interpacif Oil S.A.C	4 750	1 439 791	Chorrillos - Lima
Inter Latinoamericana	1 780	539 543	Villa EI Salvador - Lima
Univ. Nac. Agraria-La Molina	360	109 121	La Molina Lima
Industria del Espino S.S. Divison Agro energia Group Romero	50 000	3 637 368	Uchiza - San Martin
Heaven Petroleum Operation S.A.C	100 000	30 311 400	Lurin - Lima
Pure BioFuels Corp.	55 000	16 671 270	Callao - Lima

Despite all these companies and the growing demand for biodiesel; the biodiesel production chain, the following is observed:

1. There are different investors for each link in the chain.
2. The weakest link in the chain is agriculture, whose weakness is due to land scarcity, high transport costs and uncertainty of agricultural productivity.

Therefore, it is observed that it is necessary to strengthen agricultural activity and improve the chain of the biodiesel production chain, to ensure the supply of raw material in sufficient quantity and quality for the industry.

At present, research in Peru has been few regarding the production of biofuels, it is in this sense that UNI, through its Faculty of Chemical and Textile Engineering (FIQT), has investigated since 2009 the various routes that lead us to dominate these processes with the final objective of obtaining biofuels from renewable sources that do not compete with food sources.

The project “Use of lignocellulosic materials to obtain bioethanol” was executed from 2011 to 2013, with flattering results. In the tests, sawdust was used as a primary source of cellulose, a fungus native to the Peruvian jungle for enzymatic hydrolysis of cellulose in fermentable reducing sugars, broken yeast for fermentation and national kaolin as a source of molecular sieves for the last stage of Preparation of bioethanol, which is dehydration. Thus, this project sought not only to give added value to waste generated in the forestry and / or agricultural industry (using sawdust, in our case, mainly).



Figure 6: Plant pilot of Bioethanol

In addition, research was conducted on Biofuels: about the production of biodiesel from *Jatropha Curcas* and *Ricinus Communis* (see figure 7). Both have a high oil content in their seeds, so these two crops are placed in an advantageous position with respect to others. However, it is necessary to generate the necessary knowledge to establish the specific conditions for optimization throughout the biodiesel production chain.

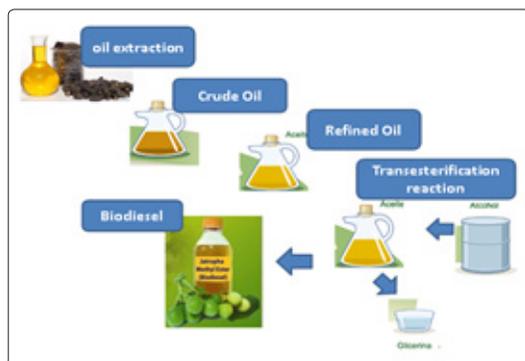


Figure 7: Transesterification Basic for Biodiesel

Conclusions

The production of biodiesel admits a wide variety of vegetable oil, so that the ideal crop for our country can be found, in which the possibilities are many. The liters of biodiesel that can be obtained per hectare, from each of the oil crops vary.

Peru needs to reconstitute its industry, which must be done with transnational perspectives, in which all the comparative advantages of our country are taken full advantage, as well as its present and future opportunities. Peru has the opportunity to change its energy matrix with sustainable crops [1-14].

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