Renewable Energy and Power Quality Journal (RE&PQJ), ISSN 2172-038 X, No.9, 12th May 2011, Reference Paper: 236

Production and characterization of biogas obtained from biomass of aquatic plants

Roberto G. Pereira[1,1], Maria Cristina D. E. Pereira[2], José G. da Silva[3], Fernando Luiz B. de Abreu[3], Valdir de Jesus Lameira[4]

[1] Federal Fluminense University, TEM/PGMEC/MSG
Rua Passo da Pátria 156, CEP 24210-240, Niterói - RJ, Brazil
Phone/Fax number:+55 21 2629-5419, e-mail: temrobe@vm.uff.br

[2] UBEE
Rua Conde de Bonfim, 1067, Rio de Janeiro - RJ, Brazil
Phone/Fax number:+55 21 2176-8000, e-mail: mcrisepereira@gmail.com

[3] Federal Fluminense University, PGMEC
Rua Passo da Pátria 156, CEP 24210-240, Niterói - RJ, Brazil
Phone/Fax number:+55 21 2629-5419

[4] INESC Coimbra, Portugal
Rua Antero de Quental, 199, 3000-033, Coimbra, Portugal
Phone/Fax number: +351 239 851040/+351 239 824692, e-mail: vlameira@uol.com.br

Abstract. The present work describes an experimental investigation concerning the production and characterization of biogas, obtained from biomass of *Eichhornia crassipes* and biomass of aquatic plants mixture (*Eichhornia crassipes*; *Eichhornia azurea*; *Pistia stratiotes* and *Salvinia*). The biogas was obtained in anaerobic biodigestion process. The biogas obtained has considerable tenors of methane, in way to make possible its use.

Key words

Aquatic plants, biogas, biodigestion, renewable energy

1. Introduction

In the hydrological basin of Paraíba do Sul river in Rio de Janeiro State, Brazil, where about 2.4 million inhabitants live, the disordered evolution of urban and industrial development in the area promote a great increase of the pollutant load in the river. This increase of the wastes, mainly the one of organic origin on the rivers, it has been promoting the uncontrolled increase of several aquatic organisms.

Among the several species, the *Eichhornia crassipes* is a peculiar aquatic macrophyte, because it proliferates inordinately in polluted areas. Due to uncommon reproduction process, flotation islands of *Eichhornia crassipes* form great vegetable masses in the water impeding the river traffic, besides hindering the reception of water for treatment stations and turbines of hydroelectric power stations. For minimizing these damages, the governments and the companies are trying to control its proliferation for several means, by making use of mechanical, chemical and biological methods. The great amount of *Eichhornia crassipes* residues in the water becomes an environmental problem. Other aquatic plants, such as: *Eichhornia azurea*; *Pistia stratiotes* and *Salvinia* are also presented in the reservoirs.

The anaerobic biodigestion of these materials is an option to producing biogas and an excellent fertilizer.

1.1.Eichhornia crassipes

Cosmopolitan, widely pantropical distribution [1].

When proliferating in surplus in a hydric resource the *Eichhornia crassipes* it can propitiate the proliferation of insects, reducing the brightness, as well as reducing the tax of oxygen dissolved in the hydric resource, causing ecological unbalance and altering strongly the communities of invertebrate and vertebrates animals [2]. The growth in surplus of the *Eichhornia crassipes* can be chemically or biologically controlled.

The chemical control, in spite of impeding efficiently the growth and development of the biomass of the plant, has as negative factor of altering the quality of the water, causing intoxications or even the death of the aquatic beings. Moreover, it presents a high cost, depending on the area where is applied.

Being so, several attempts and studies have been made with biological controls with can also bring serious problems, altering the ecological balance of the area.

The mechanical control consists of removing the biomass using a manual process and using machines. In both cases, great amounts of residues are generated, many of which are deposited in the soil without any control and special cares, could cause the contamination of the soil, and, still, make the proliferation of insects possible. Therefore, an appropriate destination of this biomass is essential.

[1] Corresponding author. Tel.: +55-21-26295418; fax: +55-21-26295419
E-mail address: temrobe@vm.uff.br

European Association for the Development of Renewable Energies, Environment and Power Quality (EA4EPQ)	International Conference on Renewable Energies and Power Quality (ICREPQ'11) Las Palmas de Gran Canaria (Spain), 13th to 15th April, 2010

Biodiesel production performance estimation from simple viscosity measurements

L. Díaz, M.E. Borges* and A. Brito

Chemical Engineering Department
University of La Laguna
Avda. Astrofísico Fco. Sánchez s/n, La Laguna, Tenerife, Canary Island, 38200, Spain
* Corresponding author: eborges@ull.es

Abstract. In a biodiesel production industry a quick monitorization of the reaction extent achieved in the process it is important. The usual way to determine the reaction yield is to analyze the FAME content in the biodiesel reaction product. Analytic methods used, mainly gas chromatography, require previous sample treatment or tedious calibrations. Recently, less complicated analytic methods (nuclear magnetic resonance, infrared spectrophotometry) have been developed but they require costly equipment and analysis. The aim of this paper is to develop a cheap and fast method in order to quantify the FAME content in the reaction mixture from simple dynamic viscosity measurements and then the transesterification reaction yield. Therefore, experimentally obtained correlations from biodiesel proceeding of several oil feedstocks are presented in order to estimate the biodiesel FAME content from its dynamic viscosity, a fast determination parameter.

Key words

Biodiesel, FAME, NMR, dynamic viscosity

1. Introduction

Biodiesel, an alternative diesel fuel, is made from renewable biological production such as vegetables oils and animal fats [1]. Biodiesel production is a very modern and technological area for researchers. Its relevance comes from petroleum price increasing and from biodiesel environmental advantages [2], mainly diminishing global warming gases levels such as carbon dioxide. Moreover, its use has also showed improvements on engine exhaust emissions. For instead, combustion of biodiesel decreases carbon monoxide (CO) emissions by 46.7%, particulate matter emissions by 66.7% and unburned hydrocarbons by 45.2% [3]. Additionally, biodiesel is non-toxic, making it useful for transportation applications in highly sensitive environments, such as marine ecosystems and mining enclosures [4]. Transesterification is one of the most commercially useable methods to produce biodiesel [5]. Transesterification is a reversible reaction of a fat or oil with alcohol (methanol or ethanol) to form fatty acid alkyl esters (FAME) and glycerol in presence of a suitable catalyst.

The biodiesel production from vegetables oils is relatively simple using alkaline homogeneous transesterification, with conversion efficiency higher 98% [6]. However, the homogeneous catalyzed transesterification reaction has some disadvantages as it consumes large amount of water for wet washing to remove the salt produced from the neutralization process [7]; besides, the catalyst cannot be reutilized, they favour the formation of stable emulsions making the methyl esters (biodiesel product) separation difficult, glycerol is obtained as an aqueous solution of relatively low purity and the reaction becomes very sensitive to the presence of water and free fatty acids [8,9]. An alternative path for biodiesel production involves the use of heterogeneous catalysts. A heterogeneous catalyst can be easily removed from the produced biodiesel [10] without the use of water as washing agent and it can be reused for further reactions.

Biodiesel can be commercialized as pure biofuel or blending stock for diesel fuels, it must meet a set of requirements defined in standard specifications for a safe and satisfactory engine operation, one of these specifications is the content of fatty acid methyl esters (FAME). Besides, this parameter indicates the performance of the transesterification reaction for biofuel production from vegetable oils. There are several methods to determinate FAME content in biodiesel samples (chromatography, nuclear magnetic resonance