RELATÓRIO TÉCNICO 1: ANALISANDO O SISTEMA DE PRODUÇÃO DO BIODIESEL

TECHNICAL REPORT 1: ANALYZING THE BIODIESEL PRODUCTION SYSTEM

DE BONI, Luis Alcides Brandini¹; GOLDANI, Eduardo²

¹Tchequímica Cons. LTDA. Center for Applied Research in Photonics. Rua Frederico Guilherme Gaelzer, 68. Bairro Jardim do Salso. CEP: 91410-140. Porto Alegre – RS. Brasil. Telefone: (0-xx-51) 9154-2489
* e-mail: deboni@tchequimica.com

²Tchequímica Cons. LTDA. Center for Applied Research in Renewable Fuels and Diesel Like Fuels. Rua Frederico Guilherme Gaelzer, 68. Bairro Jardim do Salso. CEP: 91410-140. Porto Alegre – RS. Brasil.
* e-mail: goldani@tchequimica.com

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RESUMO

O aumento gradativo na cadeia produtiva de Biodiesel no Brasil vem requerendo cada vez mais profissionais capacitados para a sua expansão e melhoramentos. Tal fato recai sobre as constantes e crescentes demandas do biocombustível para atender a percentuais de mistura ao diesel de petróleo que irão aumentar com o passar dos próximos anos. Nesse sentido, esse trabalho compila observações de pesquisadores do Grupo Tchê Química, efetuadas nos últimos anos, a respeito da produção de fluídos combustíveis sintéticos comercializados como biodiesel. Este material procurou focar-se em questões frequentemente levantadas por clientes e colegas do meio acadêmico a respeito de diferentes sistemas de produção, que usam um número maior de tanques para produzir o combustível ou um número reduzido de tanques para efetuar a mesma tarefa. Para melhor abordar tal tema, as análises foram divididas em dois tipos de usinas: as ditas especialistas e as generalistas. Cada qual traz consigo diversos fatores positivos e negativos que esperamos ser de grande valia para a tomada de decisões.

Palavras-chave: *Produção de Combustível, Usina, Biodiesel*

ABSTRACT

The gradual growth in the productive chain of Biodiesel in Brazil requires professionals enabled to its expansion and improvements. This fact is related to frequent and expanding demands of the biofuels to attend the percentages of mixture of diesel oil which will grow in the next years. In this way, this work summarize comments of the Tchê Química Group researchers, done in recent years, regarding the commercialized synthetic fuels fluid production like biodiesel. This work is focused on frequent questions asked by customers and colleagues of the academic environment regarding different systems of production that use a bigger number of tanks to produce the fuel or a reduced number of tanks to do the same task. In order to a better approach of such subject, the analysis were splitted in two types of plant: one called specialists and another called generalists. Each one brings several positive and negative aspects that we hope to be of great value for taking of decisions.

Keywords: *Fuel Production, Power Plant, Biodiesel*

Introduction

Tchê Química Group is a small company located in the south of Brazil recognized by its users for working on Chemistry Education developing schoolbooks (www.livro.tchequimica.com). On the other hand, not as recognized as on the Education basis, the company has 100% of its employees postgraduated and strongly invest in reaserching, development and strategic planning.

Because of its experience in different industries, it will be discussed in this paper Biodiesel production from different concepts. These concepts were randomly classified as specialist, when the industry uses several reactors with specific applications on its production plant, and generalist, for those which use just one reactor for all operations.

In this technical report it will not be mentioned the name of the industries as well as any reference or recomendation to industries which sell chemicals. It will only be mentioned production methods which we have had opportunity to observe at the site.

Methods

The purpose of this work is the analysis of two diffent concepts of production. We are going to name this models as specialist and generalist, because of its features.

2.1. Specialist Power Plant

One important feature of the specialist power plant is the number of containers. Beyond the fact that these power plants can provide high quality biofuels, they also are good examples for the formation of good professionals because it is possible to observe, for instance, its unit operations like mass transport, heating, stirring and decantation specifically projected for these purposes. The flowchart of Figure 1 shows the general way of production of a specialist power plant. Small details like boiler, pumps, crude glycerin storage, automation and control system, wastewater treatment system were suppressed.

Figure 1 – Simplified Flowchart of a specialist power plant. Legend: 0 – alcohol storage; 1 – catalyst storage; 2 – alcohol and catalyst mixer; 3 – oil/grease storage; 4 – transesterification reactor; 5 – decantation tank; 6 – refine system; 7 – dehydration/filtering system; 8 – final product storage; 9 – crude glycerin storage; 10 – refine's byproducts storage.

In some cases we can observe an evolution in the productions systems of the specialist power plants where more transesterification reactors and decantation tanks (or both plus a centrifuge) were added. It allows the transesterification reaction to be conducted in two or more steps in order to get high yield conversion from triglycerides into FAME (fatty acid methyl ester), as shown in the flowchart of Figure 2.

Figure 2 – Alternative flowchart of a specialist power plant. Legend: 0 - alcohol storage; 1 - catalyst storage; 2 - alcohol and catalyst mixer; 3 - oil/grease storage; 4 - transesterification reactor; 5 - decantation tank; 6 - refine system; 7- dehydration/filtering system; 8- final product storage.

In the flowchart of Figure 2, the reactors (4) are reduced in terms of volumetric capacity in each transesterification reaction because there is a reduction in the volume of alcoholic solution of the catalyst added as a consequence of triglycerides proportion inside the reactor be lower in each step.

2.2. Generalist Power Plant

The generalist power plants have one reactor that is expected to do all operations that a specialist power plants do in more than one reactor. The flowchart of Figure 3 summarize this type.

Figure 3 - Alternative flowchart of a specialist power plant. Legend: 0- alcohol storage; 1- catalyst storage; 2- alcohol and catalyst mixer; 3- oil/grease storage; 4- transesterification reactor; 5- final product storage.

Discussions

The targets of the different types of synthetic fuels production are a good quality product along with low cost and profit generation for the industries.

Until now, we have had the opportunity to analyze only one generalist power plant which, in our point of view, shows some advantages and disadvantages as follow:

Advantages (↑)

- Small number of containers;
- Lower implementaion cost;
- Lower number of unit operations;
- Lower consumption energy in comparison with specialist power plants (depending on the management production type);

Disadvantages (↓ , depending on the point of view of the owner of the power plant)

- It can only be possible to start a new batch when the previous one has finished;
- It is necessary an experient operator or a reliable automated system in order to do not lose the right unit operations order resulting in production loss;
- The power plant we have had analyzed did not show fuel refine systems letting catalyst traces, alcohol and saponifications through;

- The only reactor did not show thermal isolation;

We have had the opportunity to know different specialist power plants. All of them showed advantages and disadvantages but we are going to discuss the positive and negative aspects in a general way.

Positive Aspects (↑)

- Each container or reactor has a specific function which reduces the probability of a mistake of the operator;
- All power plants had fuel refine system (it does not matter if it is aqueous or anhydrous);
- Due to the fact that there are several containers and reactors at the power plant, it is possible to do different unit operations at the same time;

Negative Aspects (↓, depending on the point of view of the owner of the power plant)

- High number of containers and reactors;
- Higher maintenance and implementation cost;
- Tendency to present a higher number of unit operations, instrumentation and control;
- Higher energy consumption
- Tendency to present badly projected tubulation allowing head loss.
- It may show lower refine capacity than transesterification capacity causing a reduction of the potential production capacity;
- Higher necessary time to finish a batch because of the higher number of steps consisting of fluids transport;

Conclusions

In our point of view, specialists power plants have nowadays better capacity to sell good quality fuel due to refine steps (which actually dominate the national market these days). However, these kind of power plants have a high

energy consumption.

The generalist production system is expected to improve the quality when solving the problem of lack of refine steps without increasing the number of containers to do not become a specialist power plant. In the near future, the generalist power plants can be as competitive as the specialist power plants showing a tendency to a better energetic management. It means that it can be possible to produce the same quantity of fuel with lower energy consumption (which is mainly used for heating and to keep the fuel temperature constant).

Suggested Reading

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