Tecnologia

Workshop Qualidade do Biodiesel e suas Misturas

Experiencias de Campo

Eng. Eduardo R. Oliveira

Brasília, 08 de Abril de 2019

PROPOSTA

Compartilhar casos reais de falhas no sistema de combustível de motores diesel e suas aplicações (contaminação relacionada a problemas com o combustível)

OBJETIVOS

Ratificar a necessidade da inclusão do requisito de **estabilidade oxidativa** nas Resoluções:

- RANP 30/2016 (Diesel Experimental)
- RANP 50/2013 (Diesel Comercial)

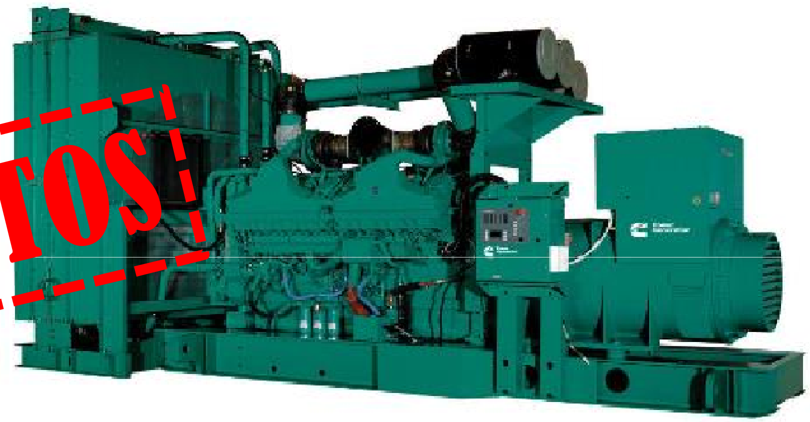
ESTRUTURA

Apresentação em PowerPoint

TEMPO

20 mins

Aonde Ocorrem os Problemas de Campo?

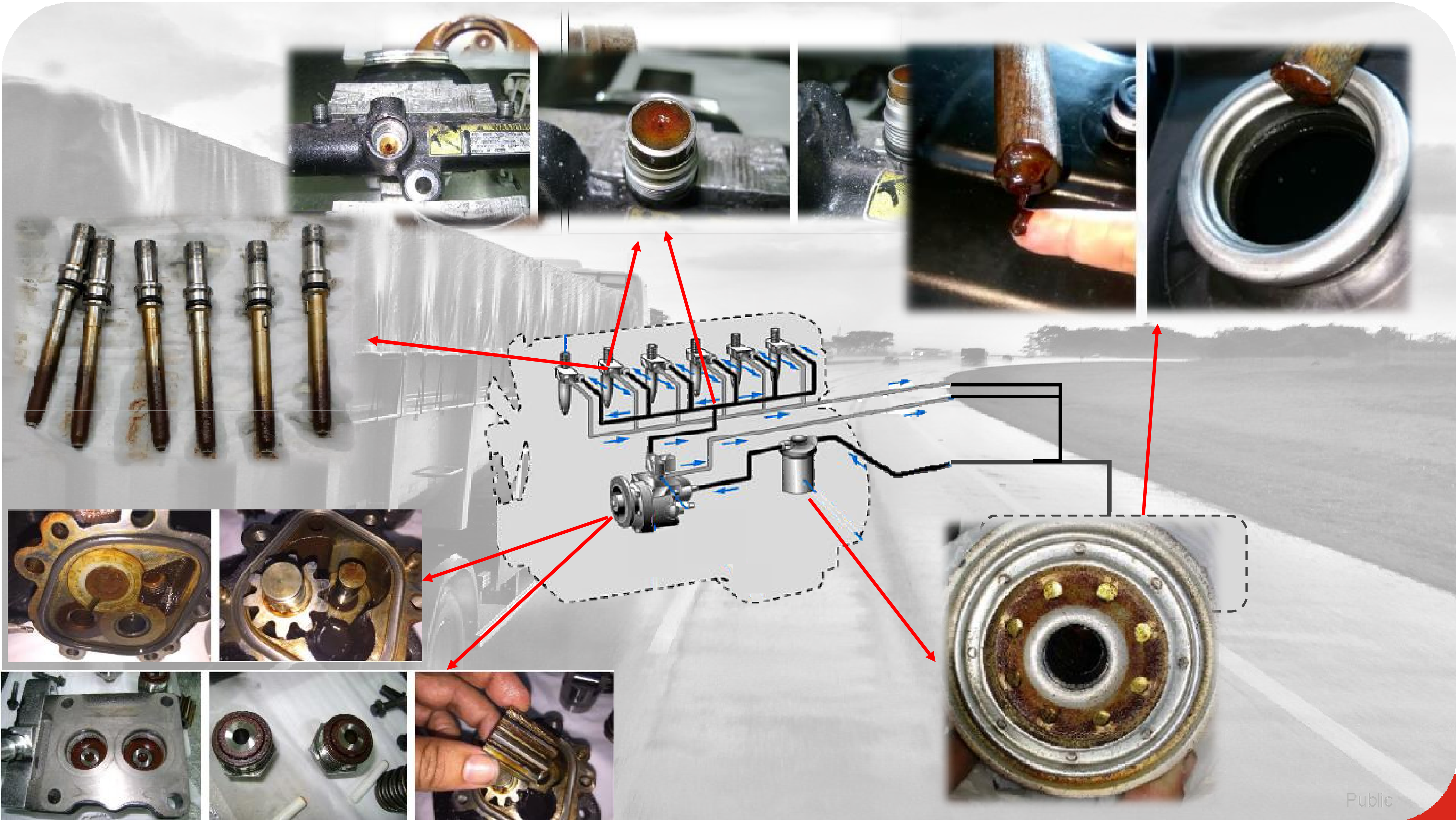


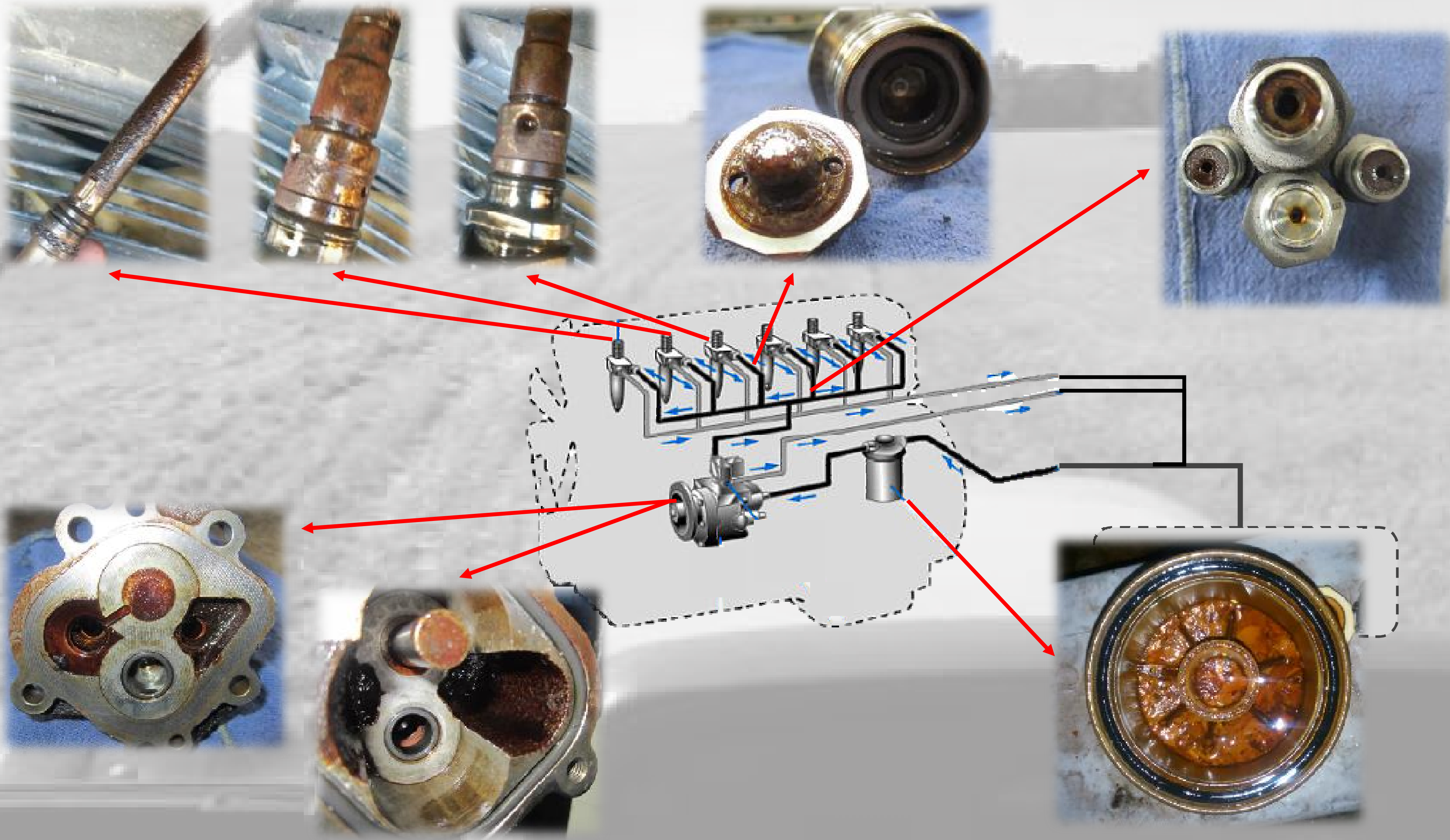
EM TODOS OS SEGMENTOS!

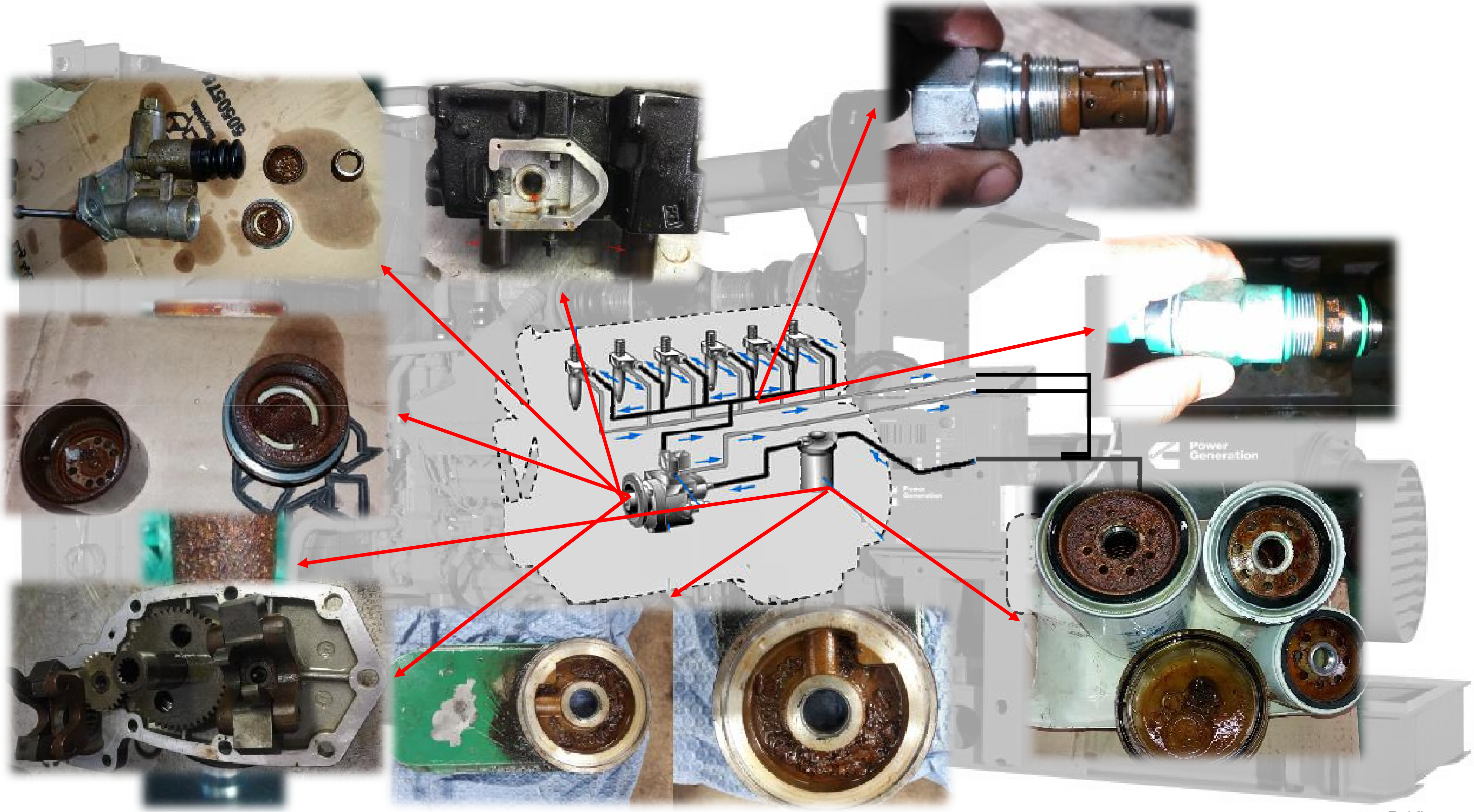
Rodoviárias: Aplicações Automotivas

Fora de Estrada: Aplicações Agrícolas, Construção e Mineração

Estacionários: Geradores






Power Generation

Veículos Europeus vs Brasileiros

Os Veículos/Equipamentos são bastante similares:

- ✓ Arquitetura dos Motores
- ✓ Componentes do Sistema de Combustível (baixa e alta pressão)
  - ✓ Bicos
  - ✓ Bombas
  - ✓ Tubulações

Destaque: Os requerimentos de emissões brasileiros para veículos pesados são baseados na norma Europeia (**Proconve P8 é baseado no Euro VI**).

Tipos de Diesel Brasileiro usados em veículos

Diesel de Referência

- RANP 40/2008 - (P7)
- RANP 764/2018 - (P8) ← **Possui o requerimento 20h**

Diesel Comercial

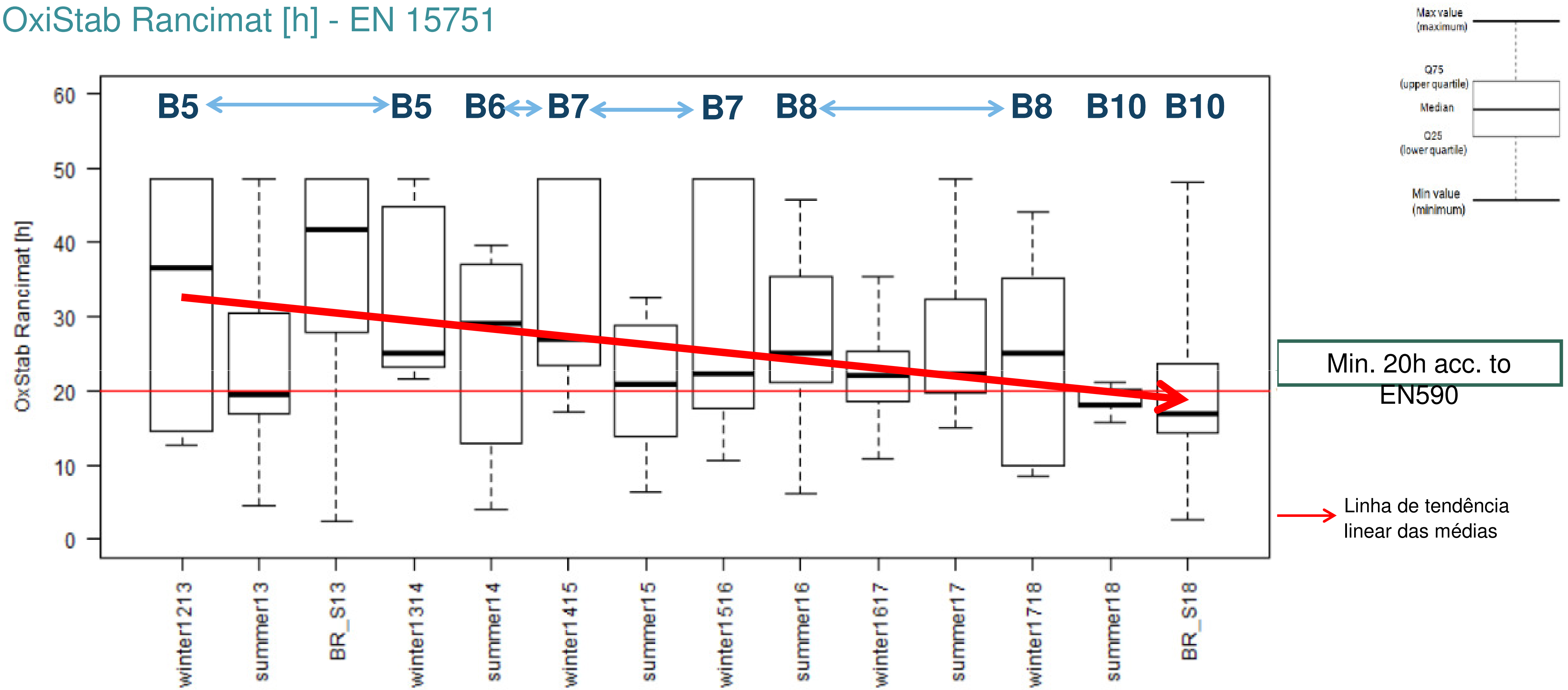
- RANP 50/2013

Diesel Experimental

- RANP 30/2016 ← **O requerimento de 20h foi retirado em 02/08/2018 pela RANP 739/2018**

SGS – Fuel Quality Survey in Brazil 2018

OxiStab Rancimat [h] - EN 15751



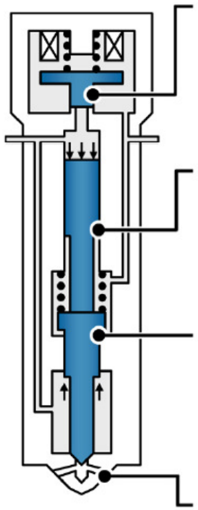
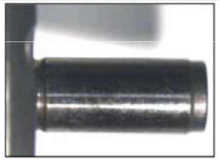
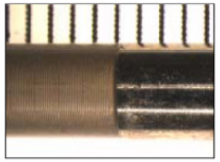
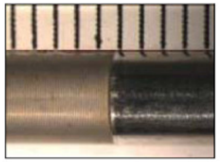
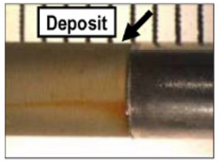
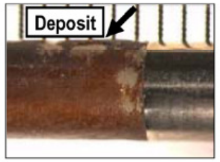
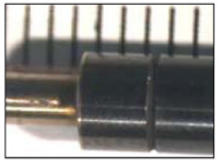
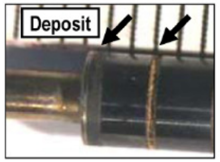
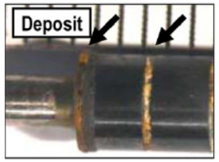
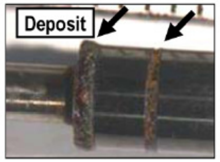
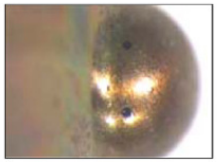
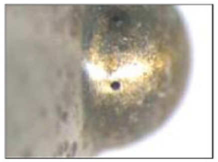
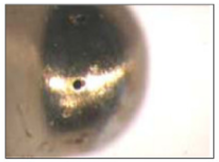
Less samples but higher sampling frequency: clear drop over last years with increasing biodiesel blend

Papers internacionais – Tema Relevante

SAE International

Biodiesel Stability and its Effects on Diesel Fuel Injection Equipment	2012-01-0860 Published 04/16/2012

Table 5. Deposit found inside injectors after injection failure at idle

Fuel (test) Injector heating Rig operation	B0-ref. (Test N°1) Tinj=130°C t=490hr	B20 (Test N°4) Tinj=90°C t=364hr	B20 (Test N°3) Tinj=130°C t=266hr	B20, Fuel renewal (Test N°2) Tinj=130°C t=448hr
Location of the part	**NO DEPOSIT**	**INCREASING DEPOSIT →**		
 Control valve				
Command piston				
Needle				
Nozzle holes				

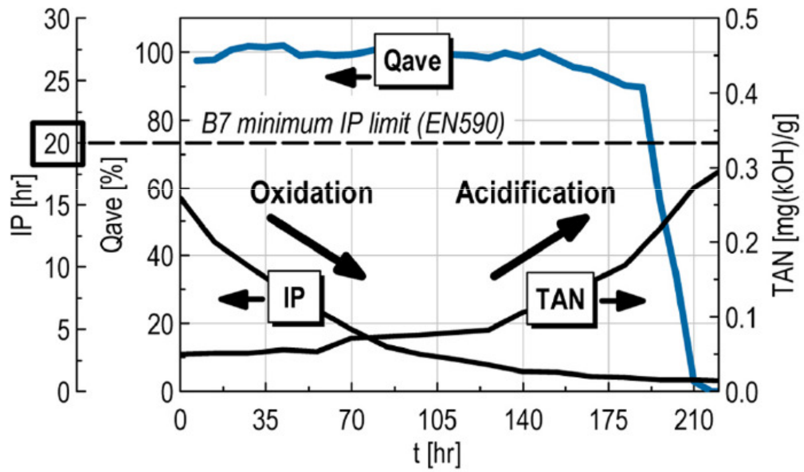


Figure 7. Fuel and injection flow rate degradation vs. time at idle (B20, Tinj=130°C)

Papers internacionais – Tema Relevante

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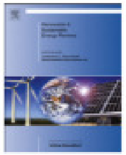

An overview of biodiesel oxidation stability

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A R T I C L E I N F O

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Autoxidation

A B S T R A C T

Oxidation Stability is one of the most important properties of fatty acid alkyl esters (biodiesel fuel) and primarily affects the stability of biodiesel during extended storage. Degradation by oxidation yields products that may compromise fuel properties, impair fuel quality and engine performance. In Europe, standardization and fuel quality assurance are crucial factors for biodiesel market acceptance, and storage stability is one of the main quality criteria. An overview of researches into biodiesel oxidation stability is presented in an attempt to convey the significance of this important property of biodiesel fuel. Aspects covered include: significance of biodiesel oxidation stability, oxidation chemistry, methods used for characterization of stability, factors known to influence stability, and consequences of biodiesel oxidation for diesel engines. The purpose of this work was to review the findings from some of the key prior research efforts available in the literature and to identify aspects of biodiesel oxidation stability in need of further study.

1.1.1. Deposits and corrosion

When biodiesel is oxidized, the resulting sediments can negatively influence the performance of the fuel system [8]. One potential problem is tendency to form deposits on engine parts such as injectors and critical fuel pump components [13]. In some cases, oxidation results in the chemical structure of biodiesel breaking apart to form shorter chain acids and aldehydes. In its advanced stages, oxidation causes biodiesel to become acidic, causing fuel system corrosion [14]. Corrosive acids and deposits may cause increased wear in engine fuel pumps and injectors [6]. Water present in the fuel can cause the formation of rust and corrosion exacerbated by the presence of acids and hydroperoxides formed by fuel oxidation [15].

1.1.2. Insoluble polymers

Product species of oxidation can cause polymerization-type reactions to produce high molecular weight insoluble sediments and gums. The most likely impact of sediment and gum formation will be fuel filter plugging and varnish deposition on fuel system components; and these phenomena have been observed [14]. Polymerization-type reactions lead to the formation of higher molecular weight products and an increase in viscosity. Insoluble species formation can clog fuel lines and pumps. It has been reported that polymers formed can be soluble in biodiesel, and yet become insoluble when mixing the biodiesel with petro-diesel [16]. Thus at very high levels of oxidation, biodiesel blends with petro-diesel can separate into two phases causing fuel pump and injector operational problems.

Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering
http://pid.sagepub.com/

Oxidative Stability of Biodiesel Fuel

C D Bannister, C J Chuck, M Bounds and J G Hawley

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DOI: 10.1243/09544070JAUTO1549

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Clark *et al.* [**75**] observed that higher blends of biodiesel were also more susceptible to the catalytic effects of metals when exposed. Knothe and Dunn [**41**] observed that simply having a larger mass of biodiesel sample promoted oxidation, because of the higher molar concentration of double bonds and bis-allylic positions available to react with oxygen. However, the researchers contended that lower blends, B5 or below, have little adverse oxidative properties in terms of wear, deposits, engine lubricant, fuel storage and delivery, microbiological contamination, or fuel quality [**2**].

Oxidation is a major technical issue in the use of biodiesel. Without efforts to store biodiesel properly, use in a short time frame or the addition of synthetic antioxidants to the fuel increases the viscosity and forms solid particles beyond acceptable levels.

Biodiesel oxidation can lead to blocked fuel filters owing to the increased viscosity as well as potential durability impacts on engine FIE. Oxidation after dilution with the engine lubricant can result in increased engine friction, wear, fuel consumption and NO_x emissions.

There are a number of methods able to increase the oxidative stability including feedstock selection, storage under inert gases or in temperature-controlled glass containers; however, the addition of 'radical scavenging' antioxidants is the easiest and most widely used method for extending the usable life of biodiesel fuels.

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Fuel

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Full Length Article

Chemical and microbial storage stability studies and shelf life determinations of commercial Brazilian biodiesels stored in carbon steel containers in subtropical conditions

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The most common degradative processes for biodiesel are related to humidity and exposure to air and heat. Air humidity tends to induce the incorporation of water, leading to the establishment of hydrolytic degradation processes. The biodiesel hydrolysis alters its physical and chemical characteristics. It may also affect the integrity and stability of the materials which are in contact with the biofuel, such as metallic surfaces, and polymeric materials present in parts and storage structures. In addition, when water contents raises it tends to settle in the bottom of the tanks, thus, favoring microbial development. The action of the oxygen promotes biodiesel oxidation, and the establishment of oxidative processes results in the release of free radicals, and formation of relatively unstable hydroperoxides. These decompose and promote the increase in acidity and polymerization, as well as the formation of gums and sludge, corrosion, turbidity, and varnishing of surfaces, clogging, and leaks [16,17].

Storage Stability Studies and Shelf Life Determinations of Commercial Brazilian Biodiesels Stocked in Subtropical Conditions in Carbon Steel Containers

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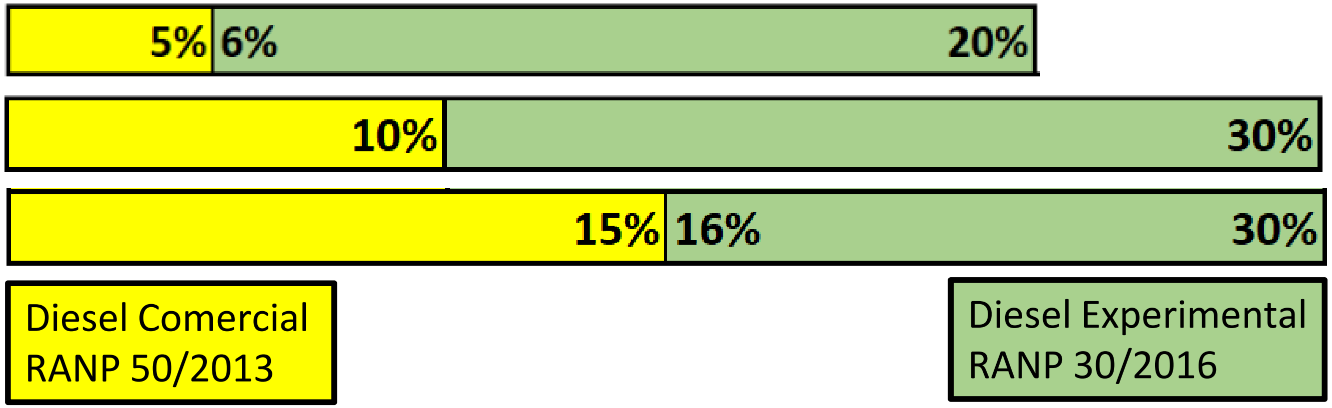
diesel engines. At present almost 85% of the Brazilian Biodiesel is made of soya oil. It is well known the high susceptibility to oxidation of soya derived biodiesel products. This sort of aging is aggravated in tropical humid countries due to the high hygroscopic nature of biodiesel. Whilst air humidity tends to induce the incorporation of dissolved water and the establishment of hydrolytic degradation processes in the mass of stored biodiesel, the action of the oxygen of the air promotes its oxidation of biodiesel, with serious consequences for the end user, such as : Incorporation of dissolved water, cloudiness, release of free radicals, acidification, formation of abiotic sludge, and in the case of the presence of water free of microbial sludge, besides attacks to polymeric and metallic materials, corrosion, turbidity and varnishing of surfaces, clogging and leaks. As a result the tendency of biodiesel to suffer significant changes over atmospheric storage time is always a matter of concern, as physical and chemical keys properties tend to go out of specification with serious risks to the end users of diesel-biodiesel fuel, particularly for pumps, parts, tanks and injection systems components of vehicle and industrial engines employed in urban, off-road and in-land applications.

Comentários Finais

Havia o requerimento de min. 20h. → **2013**

Não há o requerimento de min. 20h. → **2019**

Não há o requerimento de min. 20h. → **2023**



- Solicitamos que seja adicionado na especificação técnica do diesel **Comercial** e **Experimental** o requerimento de **20h (min) de estabilidade oxidativa** (como já é feito na Europa).
- Entendemos que é necessário realizar um estudo profundo e completo que represente a realidade brasileira quanto a este tema. Entretanto, **não concordamos com a remoção desse parâmetro antes da conclusão desses testes locais.**
- O Proconve P8 traz exigências muito acima do P7. Dessa forma, o combustível a ser comercializado na fase P8 necessita possuir uma **especificação robusta** para minimizar qualquer possibilidade do não atendimento aos requisitos legais (foco em durabilidade de emissões).