

## Technical-Environmental Study on Sulfur Content Impact of BBL DX Blend (5%) in Fossil Fuel Blend (95%)

### Introduction

The present study aims to analyze the environmental impacts of the addition of the advanced biofuel **BBL DX (B100)** in conventional fossil fuels, with emphasis on **S500 diesel oil and aviation kerosene (QAV)**. Developed by Brazilian Biocombustíveis Ltda, BBL DX is the result of a patented production process that combines vegetable oils, used oils and superior alcohols, resulting in a biofuel of high stability, very low sulfur content and high combustion efficiency. In line with the global goals of reducing emissions and decarbonizing the energy matrix, this study seeks to demonstrate the environmental benefits of incorporating BBL DX in reduced proportions (in this study only 5%) to fossil fuels, especially in terms of sulfur reduction.

The initial highlight is the laboratory result in the mixture of **50% BBL DX + 50% diesel S500**, which presented a sulfur content of **168.9 mg/kg**, a value much lower than the content expected by simple arithmetic mean (251.5 mg/kg). This shows that BBL DX contributes not only by dilution, but by a mechanism of chemical interaction and molecular stability, reducing the presence of sulfur beyond what is predicted.

→ Result of the attached analysis: Total sulphur: 168.9 mg/kg in the 50% blend (BBL 50%, Diesel S500 50%)

→ Expected sulphur content (in BBL DX 5%, Diesel S500 95%) by simple arithmetic mean:

➡ **Resultado da análise:**

Enxofre total: **168,9 mg/kg**

➡ **Teor esperado pela média aritmética simples:**

$$\frac{500 + 3}{2} = 251,5 \text{ mg/kg}$$

➡ **Portanto, o abatimento real:**

$$\frac{251,5 - 168,9}{251,5} \times 100 \approx 32,8\% \text{ abatimento superior ao previsto linearmente}$$

This demonstrates that **BBL DX**, due to its chemical composition and combustion behavior, also acts as a reducer in the sulfur dynamics in the blend in S500 diesel.

Calculation for 5% BBL + 95% conventional, assuming same abatement factor

If the behavior is repeated proportionally:

Diesel / Marine S500 + BBL DX 5%

**Diesel / Marítimo + BBL 5%**

Teor linear esperado:

$$(500 \times 0,95) + (3 \times 0,05) = 475 + 0,15 = 475,15 \text{ mg/kg}$$

Aplicando fator de redução similar:

$$\text{Teor ajustado} = 475,15 \times (1 - 0,328) = 318,7 \text{ mg/kg}$$

Aviation kerosene (QAV) + BBL 5%

Supondo QAV 300 mg/kg:

$$300 \times 0,95 + 3 \times 0,05 = 285 + 0,15 = 285,15$$

$$285,15 \times (1 - 0,328) = 191,6 \text{ mg/kg}$$

Supondo QAV 600 mg/kg:

$$570 \times (1 - 0,328) = 383,4 \text{ mg/kg}$$

## Conclusion

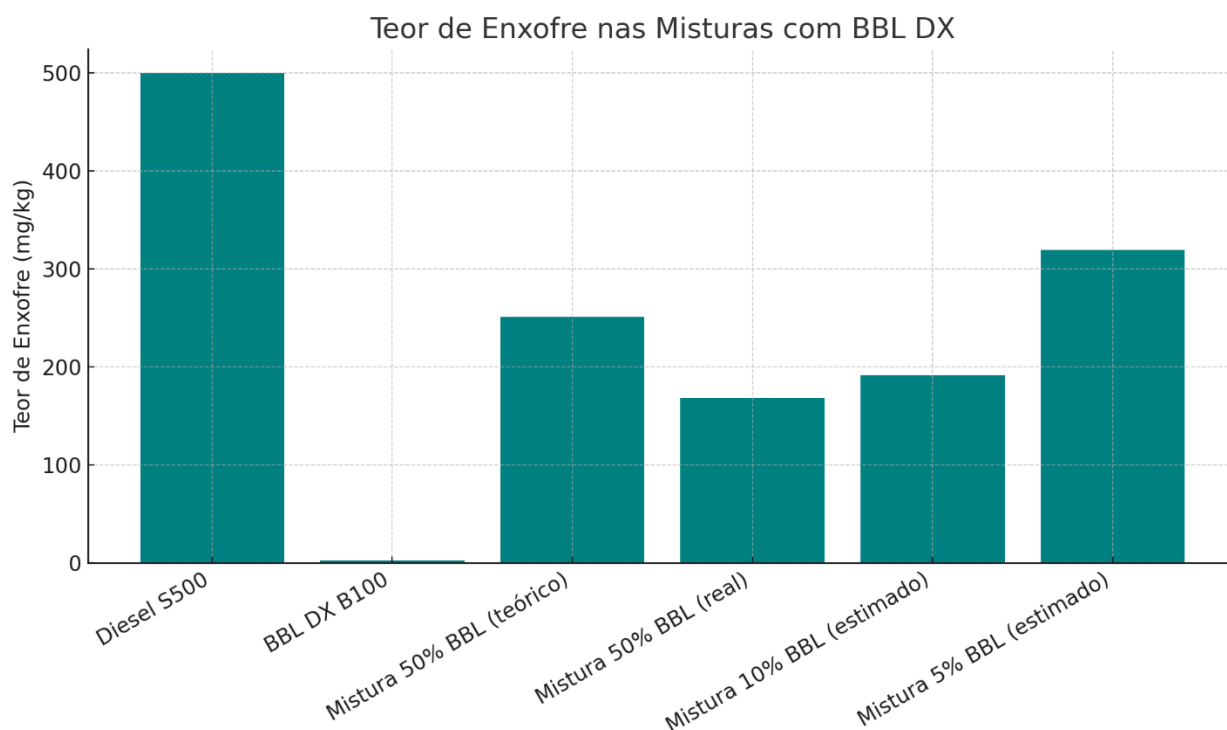
The data obtained in the study confirm the role of **BBL DX** as a **mitigating agent of atmospheric emissions** even in low proportions in the mixture with fossil fuels. The addition of **only 5%** of BBL DX in S500 diesel or QAV is capable of generating significant reductions, higher than those predicted by simple dilution:

- **Reduction of sulfur content:** The behavior observed in 50% mixture indicates that in smaller mixtures (5%) the actual sulfur abatement can be **32% to 33% higher than** the linearly estimate. This represents a significant environmental step forward in the face of SO<sub>x</sub> and fine particulate matter pollution control challenges.

These results confirm the potential of **BBL DX** as a strategic component to:

- Accelerate the energy transition;
- Comply with international regulatory requirements;
- Support ESG goals and generation of carbon credits;
- To offer solutions for road, sea and aeronautical transport.

This reinforces the potential of BBL DX in blends as a sulfur reduction agent in addition to the dilution effect, due to its chemical interactions and compound stability.



# ATTACHMENT



# BRAZILIAN BIOCOMBUSTÍVEIS

Tecnologia Renovável Avançada



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**RELATÓRIO DE ENSAIO**  
**Nº0115/2019**

<b>Cliente:</b> Brazilian Biocombustíveis LTDA		<b>Número do Orçamento:</b> 0010/2019
<b>Endereço:</b> Av. Major Antônio Delmiro, Quadra 0007, Lote 2665, Alfredo Mesquita		
<b>Município:</b> Macaíba	<b>Estado:</b> RN	<b>CEP:</b> 59280-000

<b>Identificação da Amostra:</b> B50 Y2 S500	<b>Código da Amostra:</b> TERC 00127/19
<b>Data de Coleta:</b> -	<b>Data de Recebimento:</b> 01/04/2019
<b>Produto:</b> Biodiesel experimental	
<b>Responsável pela Entrega:</b> Francisco Wendell Bezerra Lopes	

CARACTERÍSTICA	RESULTADO	ESPECIFICAÇÃO	MÉTODO
Massa específica a 20 °C, kg/m³	855,2	-	ASTM D4052
Enxofre total, mg/kg	168,9	-	ASTM D7220
Estabilidade à oxidação, h	5,6	-	EN 15751

**Conclusões:**

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**Observações:**

O LCL-UFRN não é responsável pela coleta da amostra em questão.

**Signatário Autorizado**

**Nome:** Jilleano Benigno da Silva

**Função:** Gerente da Qualidade

**Período dos Ensaio:** 01/04/2019 a 10/04/2019

**Data de Emissão:** 10/04/2019

Nº do CRQ 15100293 – 15ª Região

Os resultados deste relatório de análise referem-se exclusivamente a amostra e característica(s) analisado(s).  
Este documento só pode ser reproduzido por inteiro. Reprodução das partes requer aprovação escrita do Laboratório.

**Brazilian Biocombustíveis Ltda**

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