BRAZILIAN BIOCOMBUSTÍVEIS LTDA

STORAGE STABILITY BENCHMARKING

BIODIESEL (FAME) vs BBL DX

BBL DX Technology – Advanced Renewable Diesel and SAF
Patent n. BR 11 2022 011447-8 A2

Brazilian Biocombustíveis Ltda – 2026
Preliminary document

- ASTM D6751 (Biodiesel)
- EN 14214
- ASTM D7467 (blends)
- ASTM D2274 / EN 15751 (oxidation)

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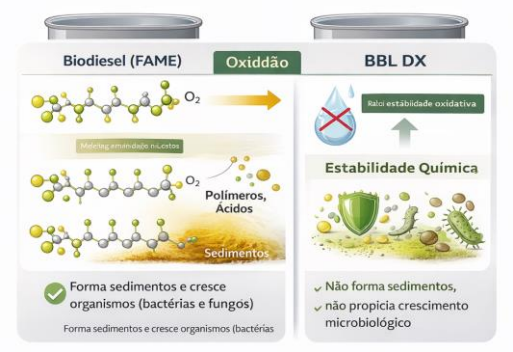
Tecnologia Renovável Avançada

1. Chemical nature and implications for storage

Conventional **biodiesel (FAME)** is made up mostly of fatty acid methyl esters, molecules that have:



- high degree of polarity,
- unsaturations susceptible to oxidation,
- hygroscopic affinity.

These characteristics make FAME **intrinsically unstable over time**, especially under real storage conditions (presence of oxygen, thermal variations, and traces of water). As widely documented in the literature and corroborated by operational experience, biodiesel suffers:

- self-initiated oxidation (formation of peroxides and polymers),
- progressive increase in acidity (TAN),
- formation of sludge, sediment and insoluble compounds,
- microbiological proliferation at fuel/water interfaces.

These phenomena lead, in a few months, to the **degradation of fuel quality**, with direct impacts on filters, pumps, injectors and tanks – an effect visually evidenced by the formation of sludge at the bottom of the container after short periods of storage.

2. Structural limitations of biodiesel in prolonged storage

Even with the use of antioxidants and good storage practices, FAME biodiesel:

- has **limited oxidative stability**,
- presents an increasing risk of microbiological contamination,
- requires rapid inventory turnover,
- Not suitable for applications that require **extended or strategic storage**.

These limitations are particularly critical in industries such as logistics, stationary generation, shipping, and reserve storage, where predictability and fuel stability are key operational requirements.

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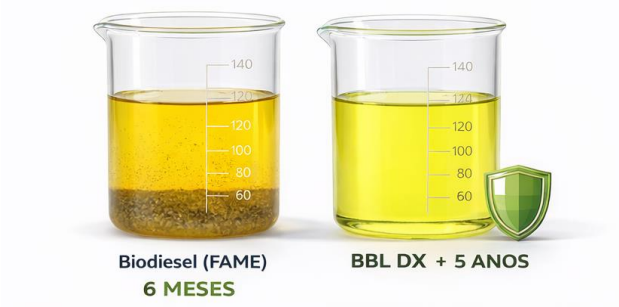
3. BBL DX's technological route and long-term stability

BBL **DX** is produced by a **technological route distinct from conventional biodiesel**, characterized by:

- absence of glycerin and soaps as by-products,
- elimination of compounds prone to polymerization,
- low polarity and low hygroscopicity,
- high oxidative stability,
- formulation that does not offer substrate for microbiological growth.



This process engineering results in a **chemically stable fuel** that **does not age at an accelerated** rate, even in prolonged storage.

Tests and field observations indicate that BBL DX **remains clear, homogeneous and free of sediments for periods of more than 5 years**, without relevant alteration of its physicochemical properties — a behavior explicitly superior to FAME biodiesel.

4. Direct comparison of storage behavior

Aspect	Biodiesel (FAME)	BBL DX
Oxidative stability	Limited	Elevated
Hygroscopicity	High	Low
Microbiological growth	Frequent	Virtually non-existent
Sludge formation	Yes, in months	Not observed
Suitability for long storage	Low	High
Operational risk	Elevated	Reduced

The comparison demonstrates that the **sludge problem is not a circumstantial effect**, but a direct consequence of the chemical nature of biodiesel. In the case of BBL DX, the **elimination of the problem occurs at the source**, through the production route and the formulation of the fuel.

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5. Technical advantages of BBL DX over biodiesel

Based on the technical memorial and physicochemical analysis, the main advantages of BBL DX are:

- **Long-term storage stability**, no need for corrective additives;
- **Elimination of the physicochemical mechanisms responsible for sludge and sediment formation**
- **Reduction of operational risks and maintenance costs**;
- Full compatibility with existing systems (drop-in);
- Greater logistical and operational predictability;
- Suitability for critical applications (maritime, industrial, strategic).

These attributes position **BBL DX** not as a simple alternative to biodiesel, but as a **technological evolution of liquid biofuels**, especially for markets that require robustness, stability and reliability.

6. Technical conclusion

The comparison between biodiesel (FAME) and BBL DX shows that:

- The instability of biodiesel in storage is structural and widely known;
- BBL **DX** eliminates the physicochemical mechanisms responsible for the formation of sludge by process engineering;
- the superior stability of **BBL DX** significantly expands the field of application of biofuels.

From a technical and operational standpoint, the choice **of BBL DX represents a paradigm shift** from a biofuel limited by its chemistry, to a renewable fuel designed for performance, longevity and industrial reliability.