# KITO® - Biodiesel Information flyer

## WHAT IS BIODIESEL?

Biodiesel refers to diesel-equivalent biofuel usually made from vegetable oil derived from soy beans, raps seeds or animal fats.

There are several different types of biodiesel. Usually biodiesel refers to an ester (or oxygenate) made from the aforementioned oils and methanol.

Biodiesels are biodegradable and non-toxic. Their combustion results in significantly fewer emissions than petroleum-based diesel (petro-diesel).

Biodiesel is currently used in diesel engines and could possibly replace fossil fuels as the world's primary transportation energy source.

# KITO® formation of explosive atmosphere

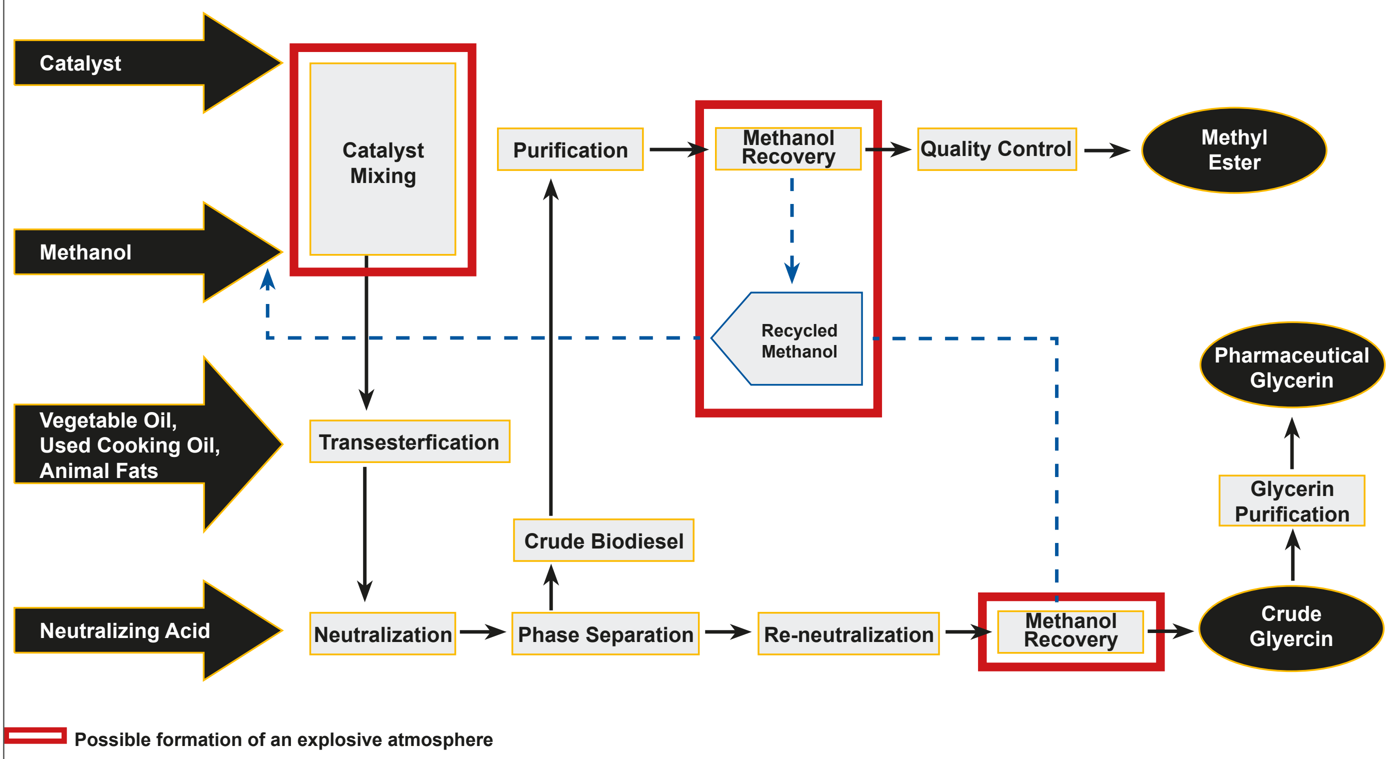
## Refining process of biodiesel

Biodiesel is made through a chemical process called transesterification, where glycerine is separated from fat or vegetable oil.

This reaction takes place in the presence of an alkaline catalyst. Important industrial catalysts used in this process are potassium hydroxide, sodium hydroxide and alkoxides.

The process releases two products -- methyl esters (the chemical name of biodiesel) and glycerine (a valuable product used in soaps and other products).

**Production diagramm for Biodiesel**




## The possible formation of an explosive atmosphere

The most frequently used alkaline catalysts in biodiesel production are Sodium [Na] and Potassium [K] hydroxide.

In transesterification, alkaline catalysts are dissolved in methanol, creating a solution of 30% sodium or potassium methylate in methanol (NaOHMe or KOMe). One of the largest biodiesel process engineering companies normally uses a 30% sodium methylate solution in methanol as a catalyst for transesterification. Methanol and the used catalyst (NaOHMe or KOMe) are both classified as inflammable liquids.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**Technical requirements for Storage of Methanol and the Catalyst:**

- Storage tank with possible nitrogen blanketing to prevent humidity or explosive atmosphere
- Consider tank insulation / heat tracing for cold climates

Another option is the delivery of the NaOMe or KOMe alkoxides as a “ready to use solution” in methanol, avoiding the need to dissolve solid NaOH or KOH in methanol.

The physical properties of a 30% Sodium Methylate solution in methanol:

| Property | Value Unit |
|---|---|
| Boiling point at 1013 hPa | 92 °C |
| Flash point | 32 °C |
| Density (20 °C) | 0,97 g/cm³ |
| Viscosity | 60 – 62 mPas s |

**HAZOP Analyses for an Atmospheric Tank**

Outdoor storage tanks are normally exposed to climatic conditions like heating up through the sun and cooling down by the rain. The filling and emptying capacities as well as inert-gas supply must be considered in addition. Venting lines on tanks with flammable liquids (Flashpoint <60°C according ISO 28300) shall be protected with explosion-proof devices. They enable tanks to breathe out flammable gases and breathe in fresh air unrestricted in total safety.

The classification into hazardous zones for the storage tank in accordance to frequency and duration of explosive atmosphere according the national and international regulations is realized according Zone 0.

With a flashpoint of 32 °C, near the operating temperature, there are sufficient flammable vapors to create an explosive atmosphere. Sodium methylate and methanol are classified as explosion group IIA according ISO 16852.



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# KITO® possible formation of an explosive atmosphere

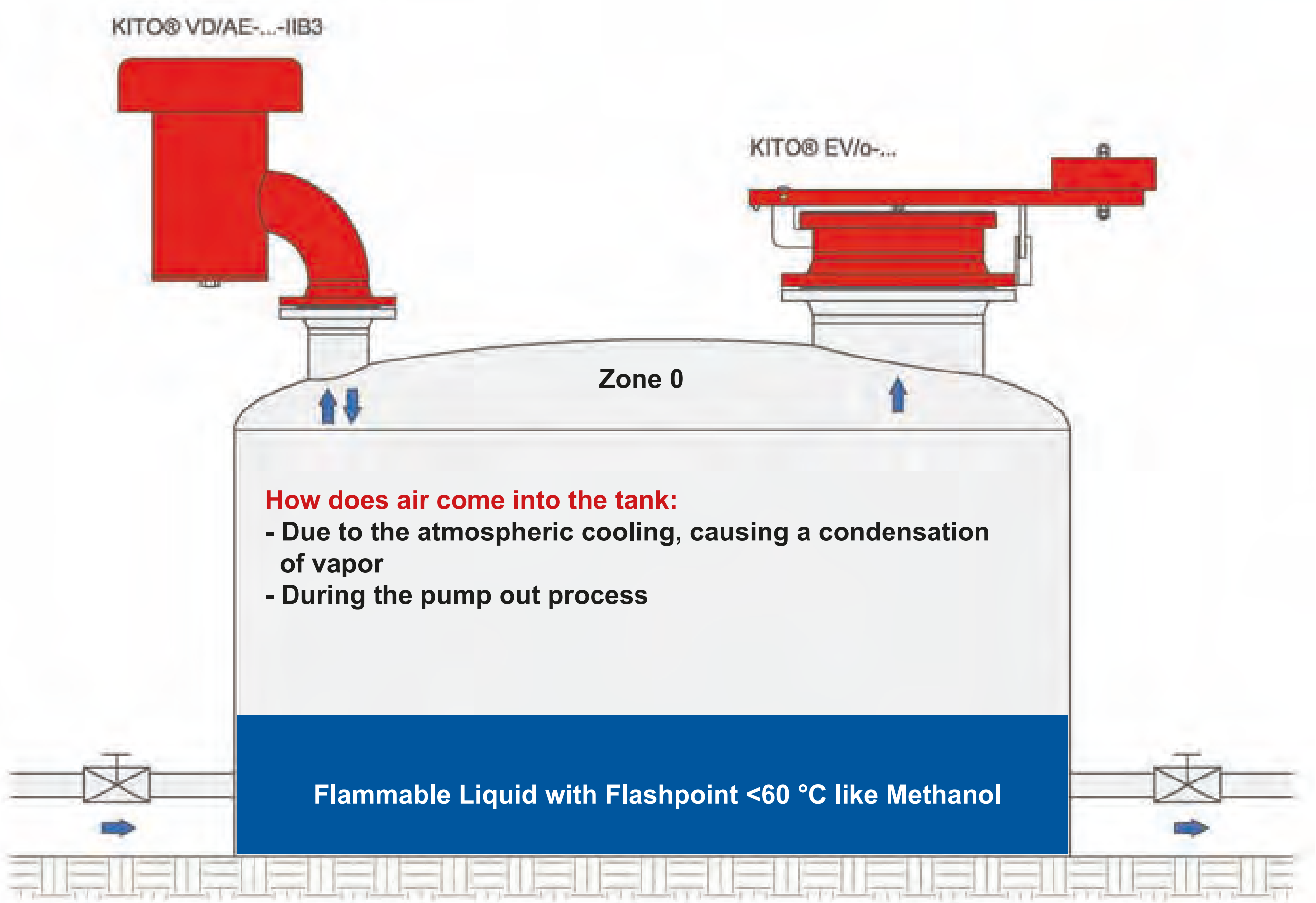


*Fig. 1: Example of a protection a storage tank with flammable liquids*

**Storage of a 30% Sodium Methylate solution in methanol or pure methanol:**

A) For the normal atmospheric in-and outbreathing KITO® recommend the following devices:

**KITO® VD/KL-IIA** (Pressure- and vacuum relief valve deflagration- and endurance burning proof) - catalogue - chapter E (Fig. 2)

**KITO® VD/KS-IIA** (Pressure- and vacuum relief valve deflagration- and endurance burning proof) - catalogue - chapter E (Fig. 3)

Alternative suitable equipment not in line with German safety rules:

**KITO® VD/AE-IIB3** (Pressure-and vacuum relief tested for atmospheric deflagration) - catalogue - chapter E (Fig. 4)

B) For the emergency venting KITIO® recommend the following device (not necessary for the German market):

**KITO® EV/O** (Emergency relief valve) - catalogue - chapter E (Fig. 10)

C) In case of inert gas blanketing according API 2000 7th / ISO 28300 Annex F - level 3 (Guidance for inert-gas Blanketing of tanks for flashback protection) no additional protection against flame propagation is required.

Recommended KITO® devices:

Nitrogen blanketing valve: **ZM/R** made by Instrum (Fig. 5)

**KITO® VD/OG** (pressure and vacuum relief valve) – catalogue - chapter E (Fig. 6)

D) For a vapor recovery line the following devices are recommended:

KITO® flame arresters prevent the propagation of flames and explosions (deflagration and detonation) in all kind of tank farms where gases are collected by vapor recovery lines. Typical KITO® Detonation Arresters for this kind of applications are:

**KITO® FDN** (In line detonation flame arrester for stable detonations) - catalogue - chapter G (Fig. 7)

**KITO® EFA-DET4-IIA** (in-line detonation arrester-bi-directional) - catalogue - chapter G (Fig. (8) in combination with a **KITO® VD/TA** (in-line pressure relief valve) - catalogue - chapter F (Fig. 9)

For Sodium methylate and Methanol applications, the commonly used material of construction is stainless steel.

**Storage of the final product Biodiesel (methyl ester):**

The flashpoint of Biodiesel is >130°C.

Humidity influences the quality of Biodiesel. Some manufacturers use additional nitrogen blanketing for the storage tank.

A) For the normal atmospheric in-and outbreathing KITO® recommend the following devices:

**KITO® VD/OG** (pressure and vacuum relief valve)- catalogue - chapter G (Fig. 6)

B) Recommended KITO® device for the emergency venting (not necessary for the German market):

**KITO® EV/O** (Emergency relief valve) - catalogue - chapter E (Fig. 10)

C) Recommended KITO® device for blanketing

Nitrogen blanketing valve: ZM/R mady by Instrum (only in stainless steel housing material available)

For Biodiesel applications, the commonly used material of construction is carbon steel.


Fig. 2: VD/KL-IIA


Fig. 3: VD/KS-IIA


Fig. 4: VD/AE-IIB3


Fig. 5: Nitrogen Blanketing Valve: ZM/R by Instrum


Fig. 6: VD/OG


Fig. 7: FDN


Fig. 8: EFA-DET-IIA


Fig. 9: VD/TA


Fig. 10: EV/O