CIMAC TECH TALKS: THE FUELS OF TODAY LEADING INTO TOMORROW

USE OF BIOFUELS IN MARINE APPLICATIONS

23.06.2021

Kai Juoperi
Chief Expert, Engine Fluids
Wärtsilä Finland Oy

- Spectrum of biofuels is very wide.
  - There exists biofuels performing well in diesel and DF engines exist,

  but also
  - serious operating problems have been experienced with some biofuel qualities.

- Biofuel qualities from which experience exists:
  - Cold pressed rapeseed oil
  - Animal fats
  - Paraffinic diesel fuel from synthesis / hydrotreatment and their blends with fossil diesel
  - Biodiesel (FAME) and its blend with fossil diesel
  - Palm oil (kernel oil, stearine, RBD)
  - Fish oil
  - Refined waste cooking oil

- Based on both internal / external discussions the use of biofuels has increased.
- Most customers are interesed in about drop-in-fuels like HVO and biodiesel.
- Both the blends with fossil diesel and the use as pure biofuel are under interest.
- Customer questions are concerning:
  - In which engine types the use is allowed.
  - Possible needed modifications.
  - Are the fuels miscible with each other and what are the allowed blending ratios.
  - Influence on engine overhaul intervals.
  - Influence on engine component lifetime.
  - Influence on engine performance.
  - Influence on emissions.

BIODIESEL – PROS AND CONS

Advantages

+ Sulphur oxide emissions closed to zero
+ Reduction in CO_2 emissions
+ Lower particulate emissions
+ Bio diesel mixes well with petroleum diesel
+ Good lubrication properties
+ Can be used in the existing engines w/o modifications
+ The EN 14214:2012 standard available

Disadvantages

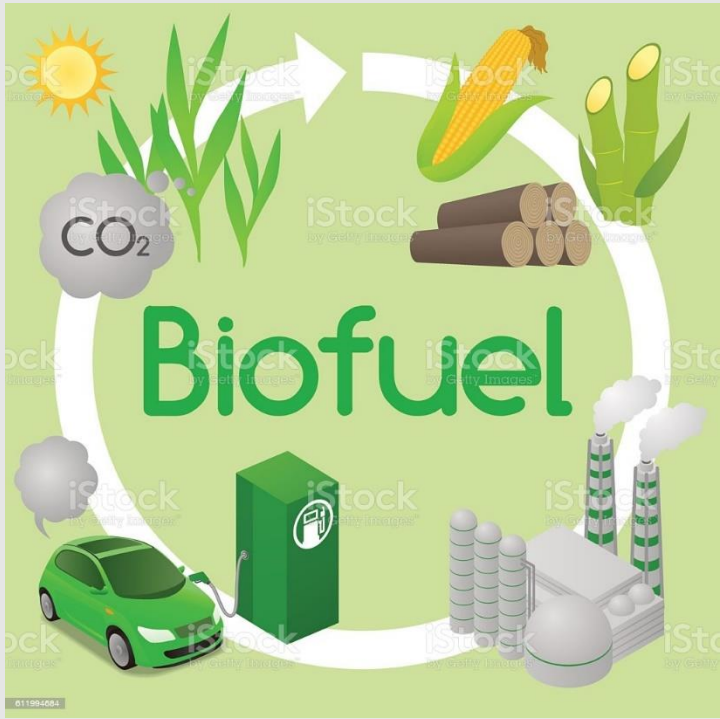
- Increased NO_X emissions, estimation +10-20%
- Contains ~10% less energy than petroleum diesel
- Water separation from bio diesel more challenging
- Solvent characteristics may degrade rubber and attack certain metals
- Can foster heightened microbial activity
- Not suitable for long term storage (Acid number increases, oxidation takes place)
- Cold flow properties may be a problem
- Price about double compared to fossil diesel
- Production volumes low and competition with other segments

- Vessel: M/V Autosky.
- Owner: United European Car Carriers, Norway.
- Main engines: 2 * Wärtsilä 8L46.
- Biofuel quality: GoodFuels MR1-100.
- Service hours on biofuel: 3650 / 3050 h.
- Lubricating oil quality: A commercial SAE 40 BN 30 oil.
- Engine condition:

  + Regular scheduled maintenance done, injectors inspected in more detail, nothing abnormal observed.

  - Some wax formation in leak pipes -> trace heating to be installed.
- Customer satisfaction: The customer is happy with the gathered experience and is planning to continue biofuel operation.

- Marine fuel palette will be wide in the future including various carbon neutral / carbon free fuels and biofuels will be a part of this palette.
- Depending on feedstock and production processes the use of biofuels is decreasing GHG emissions by 40-80% compared to fossil MGO & HFO.
- Blends of FAME and VLSFO have also started to enter the market.
- The use of 3rd generation biofuels utilizing specially engineered crops such as algae will become more common in the future.
- It's highly appreciated that IMO will solve the NO_x issue related to the use of biodiesel / FAME and possible other biofuels producing higher NO_x emissions than measured with fossil MGO in the EIAPP*) test. At the moment MARPOL Annex VI (Reg. 18) says that: Any fuel being not derived from petroleum refining is not allowed to cause increase of NO_x.



*) Engine International Air Pollution Prevention certificate

THANK YOU! THE NEW WÄRTSILÄ SMART TECHNOLOGY HUB IN VAASA, FINLAND

Kai Juoperi
e-mail: kai.juoperi@wartsila.com
Tel. +358-10-709 2480

DISCLAIMER & CONFIDENTIALITY

Disclaimer:

*The information and conclusions in this presentation are based upon calculations (including software built-in assumptions), observations, assumptions, publicly available competitor information, and other information obtained by Wärtsilä or provided to Wärtsilä by its customers, prospective customers or other third parties (the "**information**") and is not intended to substitute independent evaluation. No representation or warranty of any kind is made in respect of any such information. Wärtsilä expressly disclaims any responsibility for, and does not guarantee, the correctness or the completeness of the information. The calculations and assumptions included in the information do not necessarily take into account all the factors that could be relevant.*

Nothing in this presentation shall be construed as a guarantee or warranty of the performance of any Wärtsilä equipment or installation or the savings or other benefits that could be achieved by using Wärtsilä technology, equipment or installations instead of any or other technology.

Confidentiality: