

SYNTHETIC OIL

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BACKGROUND

- Synthetic oil is a lubricant consisting of chemical compounds which are artificially made (synthesized) from compounds other than crude oil (petroleum).
- Synthetic oil fuel or synfuel is a liquid fuel obtained from coal, natural gas, or biomass.
- South Africa meets 30 percent of transportation fuel needs by means of synthetic fuel. (SASOL)

SYNGAS

- Syngas is a mixture of hydrogen and carbon monoxide gases ($H_2 + CO$).
- Syngas may be produced from coal, petroleum coke and or anyother carbonaceous material (as well as biomass).
- Its a important fuel as well as a basic building block for many hydrocarbons and chemicals.

SYNGAS PRODUCTION

- Gasification (Thermal Treatment)
 - High temperature (>1200°C)
 - Low Temperature (<1000°C)
 - Gasification products contains a large number gases, volatiles and dust. Needs gas cleaning.
- Steam reforming (also for H₂ production)
$$\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2 + 206 \text{ kJ/mol}$$

SYNGAS AS FEEDSTOCK

- Gas cleaning
- Shift reaction



- Hydrogen production
- Diesel production using FT (Fischer-Tropsch) synthesis
- Fertilizer production through ammonia
- Methanol production for chemical Industries
- Electricity generation through combustion



Feedstock
Preparation



Products

BIO-OIL

- Bio-oil is a highly oxygenated free-flowing dark brown organic liquid produced from biomass.
- Contains water, lignin fragments, aldehydes, organic acids & alcohols.
- Heating value 18 – 20 MJ/kg
- Low viscosity, heavier than water ($\rho=1.2$)



BIO-OIL PRODUCTION



- The Fischer-Tropsch process was developed by Franz Fischer and Hans Tropsch in 1923 in Germany.

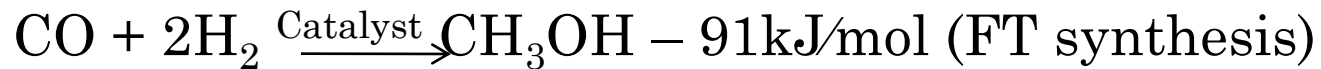


- This reactions produce a wide spectrum of oxygenated compounds including alcohols and aliphatic hydrocarbons ranging from C_1 - C_3 (gases) to C_{35+} (solid waxes)
- Germany and Japan used this technology during World War II. In 1944, Germany alone produced 6.5 million tons (124,000 barrels) a day.

SYNGAS TO ALCOHOLS/CHEMICALS

○ Alcohol (methanol)

- Methanol is in itself an important feedstock for the production of transportation fuel as well as other chemicals

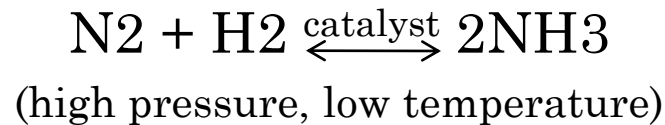


- Production of gasoline from methanol is an established commercial process.

SYNGAS TO ALCOHOLS/CHEMICALS

○ Ammonia

- Used in fertilizers, nitric acid, refrigerant etc



○ Glycerol

- By product of trans-esterification of fatty acids

BIOCHEMICAL ROUTE

○ Ethanol

- Fermentation of starch and sugars
- Milling, liquefying, hydrolysis, fermentation, Distillation, Dehydration.
- Net energy production is meagre. (pg11)

○ Diesel

- Trans-esterification of any vegetable or animal oil .

Triglyceride+ Sodium Methoxide → Biodiesel + Glycerol

KEY INFORMATION

- Production of oil from non-food source is recommended.
- Made comparison of fuel to wheel energy ratio of the oil to electric vehicle.
- Energy loss in methanol production
 - Biomass to methanol 30 – 47 %
 - Coal to methanol 41 – 75 %

RECOMMENDATION

- This chapter has given overall introduction of bio-fuel production from all possible sources.
- I would like to suggest a detail introduction to any of the technology that is in accordance with the objective of the book.
- Flow arrangement of the information.

CONCLUSION

- Synfuel is the wonderful technology that converts low quality of fuel into high quality.
- Products and bi-products can be used to produce plastic, resin, fertilizer etc.
- However it must be bear in mind that, source of synfuel must be renewable i.e. biomass.