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Carbon dioxide as a solvent for pyrolysis oils

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Motivation: Usage of classical solvents and carbon dioxide for stabilizing fast pyrolysis bio oils (FPBO)
Determination of equilibrium constants and gas solubilities
Enhancing the properties of FPBO and simplify its upgrading

Hypotheses:
Dilutions with solvents lower the viscosity and prevent phase separation of FPBO.
Dilutions with alcohols lead to an increase of the pH value and prevent corrosion.
Carbon dioxide can be solved in FPBO significantly and reduce its aging.
Solved carbon dioxide improves hydrogen to solve in FPBO and improve the hydrodeoxygenation.

First Results:

solvents

carbon dioxide

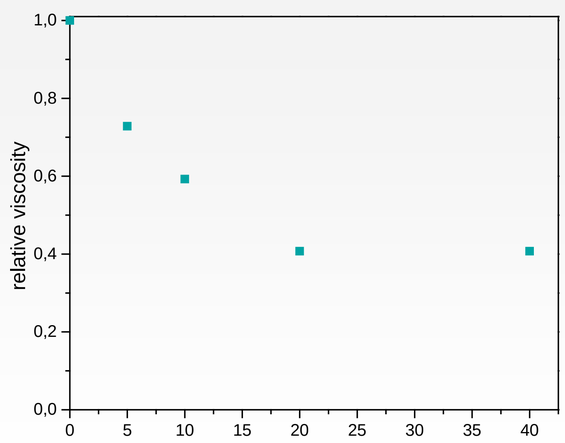


Fig. 1: Viscosity reduction by the addition of carbon dioxide at a shear rate of 100 s^{-1} and 55 °C

methanol and ethanol

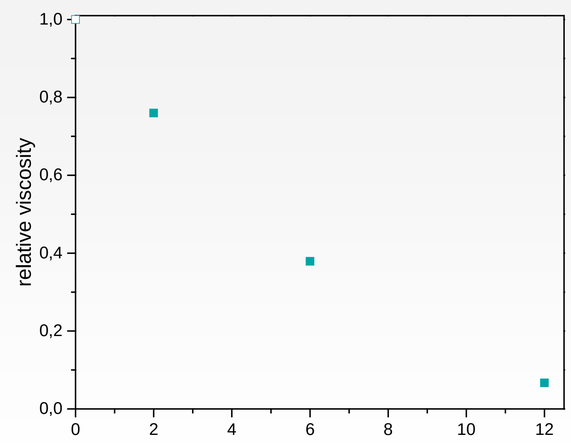
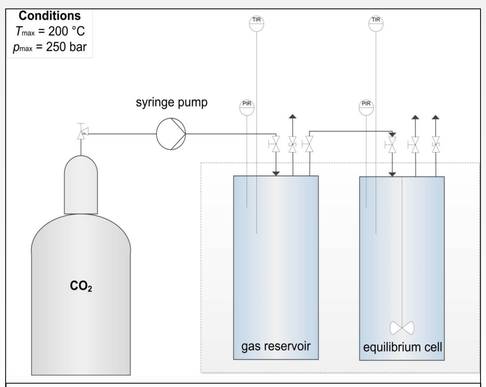


Fig. 2: Viscosity reduction by the addition of ethanol at a rotational speed of 100 min^{-1} and 55 °C

Carbon dioxide as a solvent
- Viscosity reduction
- No known consecutive reactions
- Possibility of solving hydrogen and improving the hydrodeoxygenation

Classical solvents
- Viscosity reduction
- Consecutive reactions like esterifications
- Increase of the pH value

Outlook:

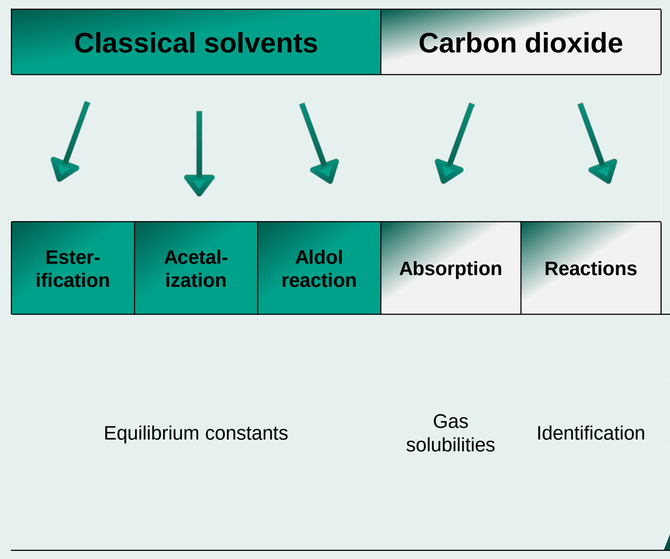


The apparatus consists of two cells. One cell is filled with carbon dioxide, the other with FPBO.

The valves between the two cells are opened and the carbon dioxide expands.

The resulting pressure decay in the gas reservoir can be related to the gas solubility.

Fig. 3: Illustration of the developed apparatus and the measurement of gas solubilities by the method of pressure decay



Literature:
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