Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.
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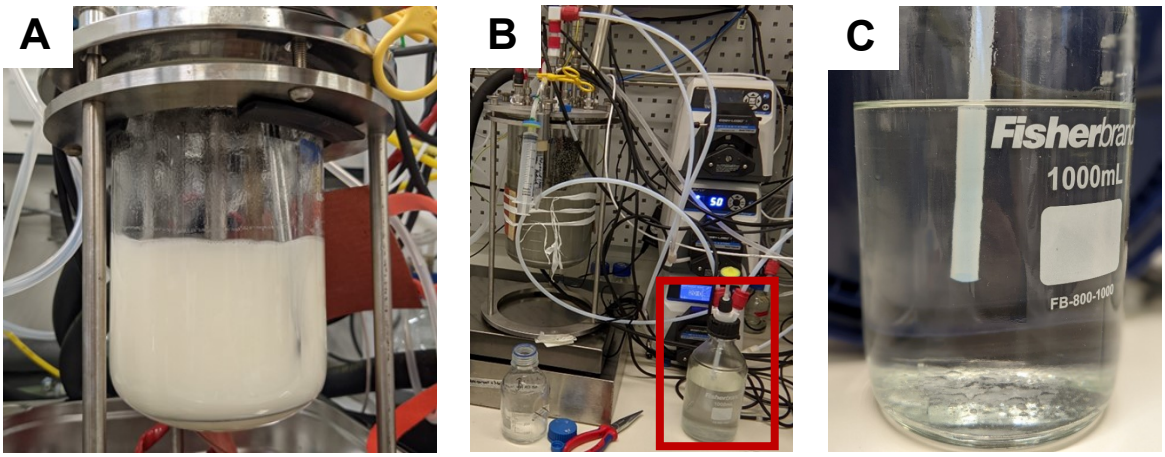

Fig. A.1 Pictures of the cultivation broth of bioreactors with *P. taiwanensis* VLB120 Δ6 pProd as a production host for methyl ketones with 2-undecanone as the organic solvent for *in situ* product extraction. A shows a cultivation in a stirred tank bioreactor (STR) with emulsion formation. B shows the cultivation in the novel multiphase loop reactor with countercurrent liquid liquid extraction in the outer compartment. From the solvent reservoir (red box picture B, picture C), the organic phase is pumped in a cycle. Notably, there is no emulsification in B and C.

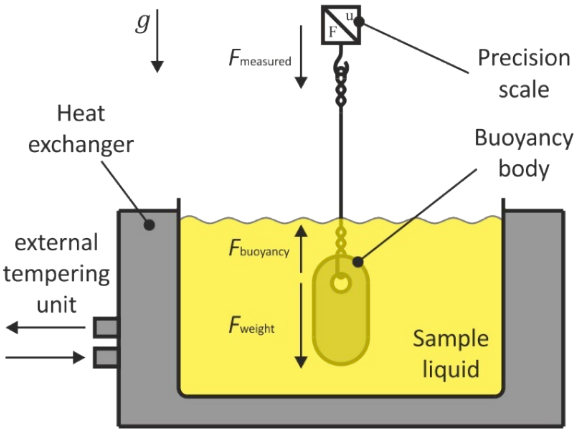

Fig. A.2 Measurement setup for the determination of liquid density.[1]

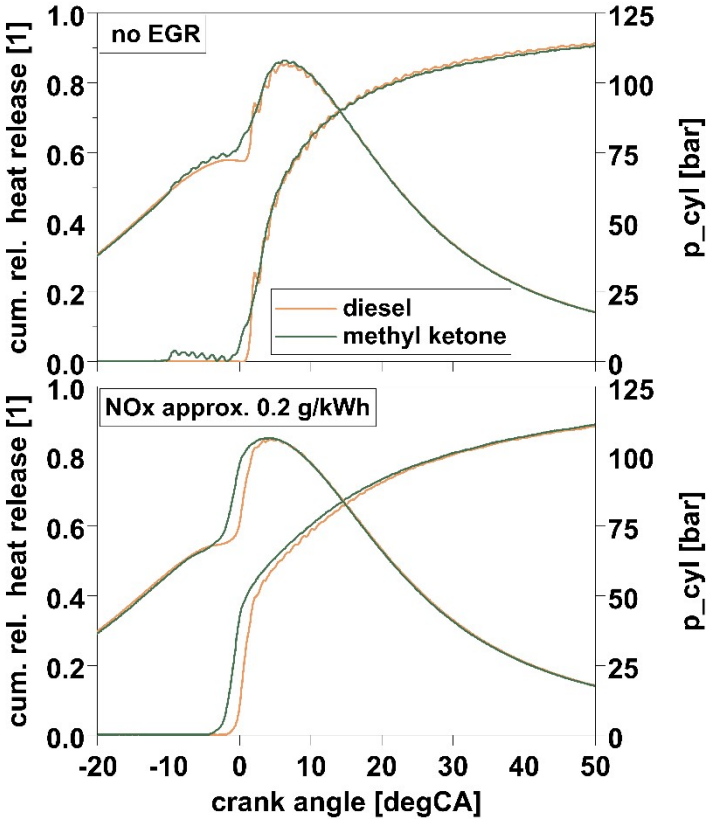

Fig. A.3 Cylinder pressure and cumulative relative heat release over crank angle for the respective measurements in the displayed variation where exhaust gas recirculation (EGR) is off (top, refers to rightmost point in previous plot) and under very high EGR condition (closest to 0.2 g·kWh^{-1}) for the methyl ketone blend and diesel. N = 1500 min^{-1}; IMEP = 6.8 bar; p_{rail} = 900 bar; CA50 = 5.8 °C AaTDC; p_{in} = 1.5 bar; p_{exh} = 1.6 bar. η = indicated efficiency; FSN = filter smoke number; SOI = start of injection; DOI = duration of injection; PRR = pressure rise rate; HC = unburned hydrocarbon; λ = relative air fuel ratio; EGR = exhaust gas recirculation; IMEP = indicated mean effective pressure; CA50 = center of combustion.

Table A.1 Strains used in this study and for the defined inoculum of the fuel tank simulation. The method was adapted according to Ackermann *et al.* for methyl ketones.[2] DSMZ = Deutsche Sammlung von Mikroorganismen und Zellkulturen, German Collection of Microorganisms and Cell Cultures.

Strain	Database number	Source
Acinetobacter beijernikii	DSM 22901	DSMZ
Acinetobacter venetianus	DSM 23050	DSMZ
Burkholderia cepacia	DSM 7288	DSMZ
Micrococcus luteus	-	Leuchtle *et al.* (2018)[3]
Micrococcus yunnanensis	DSM 21948	DSMZ
Pseudomonas fluorescens	-	Leuchtle *et al.* (2018)[3]
Pseudomonas poae	-	Leuchtle *et al.* (2018)[3]
Candida cylindracea	DSM 2031	DSMZ
Debaryomyces hansenii	DSM 70244	DSMZ
Debaryomyces polymorphus	DSM 70816	DSMZ
Pichia membranifaciens	DSM 21959	DSMZ
Raffaelea sp.	-	Leuchtle *et al.* (2018)[3]
Rhodotorula mucilaginosa	DSM 18184	DSMZ
Ustilago maydis	-	Leuchtle *et al.* (2018)[3]
Yarrowia deformans	CBS 2071	DSMZ
Yarrowia lipolytica	-	Leuchtle *et al.* (2018)[3]
Paecilomyces lilacinus	DSM 846	DSMZ
Penicillium chrysogenum	DSM 21171	DSMZ
Penicillium citrinum	-	Leuchtle *et al.* (2018)[3]
Micrococcus luteus	-	Leuchtle *et al.* (2018)[3]

Ohnesorge Diagramm

Based on the fluid mechanical properties viscosity, density and surface tension, Ohnesorge, Reynolds, and Weber number were calculated for different nozzle diameters and injection pressures. The corresponding results are plotted on the Ohnesorge diagram as shown in Figure A.4. The Ohnesorge diagram indicates which form of spray can be expected for different Reynolds and Ohnesorge numbers. The range of atomization, which is desirable for spray processes in internal combustion engines, refers to Weber numbers higher than 40.3. A comparable atomization process can be assumed for the same Weber numbers [9, 10]. As can be seen, the Ohnesorge numbers of the methyl ketone mixture are slightly larger than those of the diesel fuel investigated. The Weber numbers of both fuels, on the other hand, are very identical, which also indicates a similar spray behavior. Especially when examining the other bio-hybrid fuels, it is noticeable that their Weber and Ohnesorge numbers differ significantly more from each other.

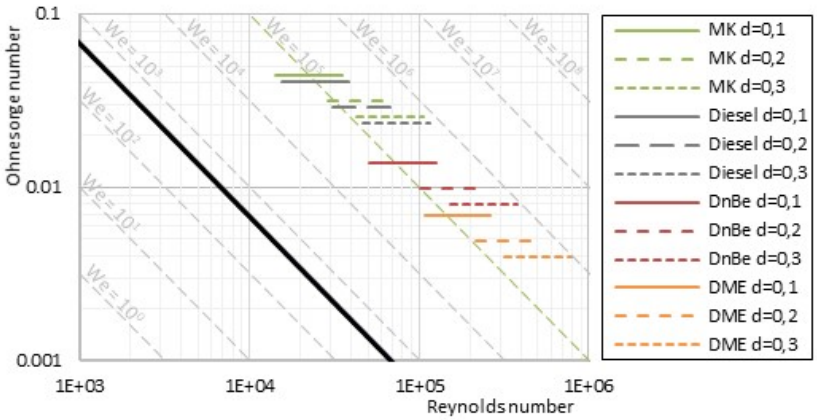

Fig. A.4 Ohnesorge diagram for the methyl ketone blend, diesel, and different bio-hybrid fuels. MK = methyl ketones; DnBe = di-n-butylether; DME = dimethyl ether.

References

1. M. Hofmeister, A. Frische, M. Grunewald, M. A. Reddemann, C. Grütering, L. M. Blank, R. Kneer and K. Schmitz, presented in part at the 21. International Sealing Conference, Stuttgart, Germany, October 12-13, 2022.
2. P. Ackermann, K. E. Braun, P. Burkardt, S. Heger, A. Konig, P. Morsch, B. Lehrheuer, M. Surger, S. Volker, L. M. Blank, M. Du, K. A. Heufer, M. Ross-Nickoll, J. Viell, N. von der Assen, A. Mitsos, S. Pischinger and M. Dahmen, *ChemSusChem*, 2021, **14**, 5254-5264.
3. B. Leuchtle, L. Epping, W. Xie, S. J. Eiden, W. Koch, D. Diarra, K. Lucka, M. Zimmermann and L. M. Blank, *International Biodeterioration & Biodegradation*, 2018, **132**, 84-93.