The MBT Technology

One Step Biodiesel Manufacture from Acid Oils

via MSA Catalysis

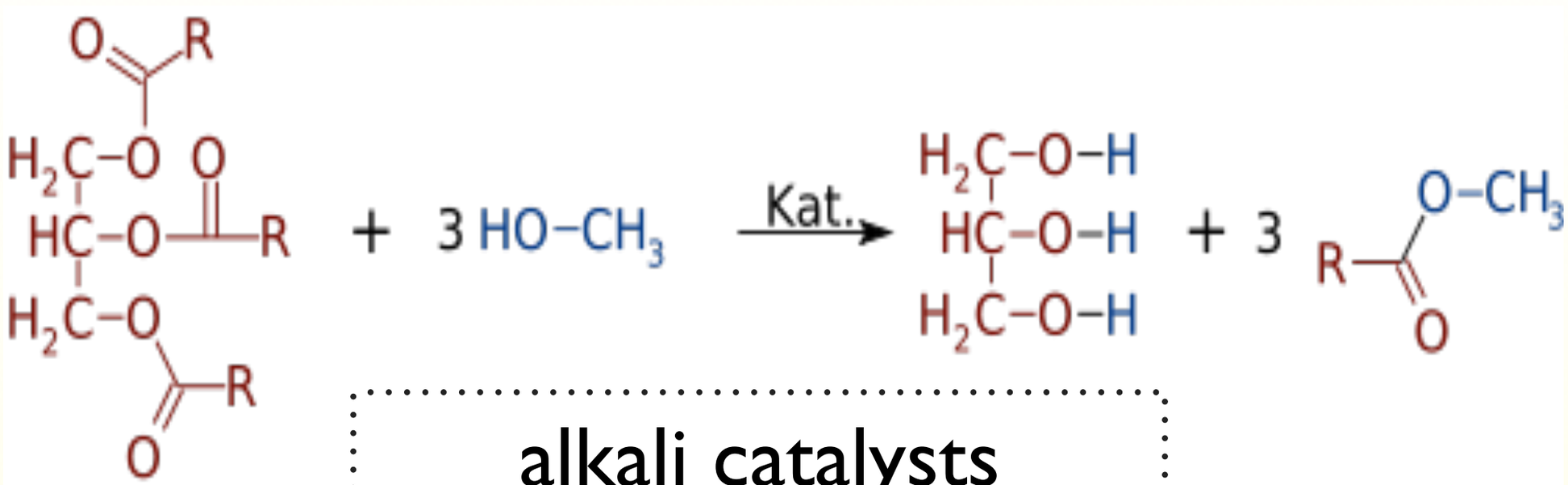
Dr. Axel Ingendoh,

inaChem GmbH, Odenthal, Germany

invent - patent - license

presented at:
8th Workshop on *Fats and Oils as Renewable Feedstocks for the Chemical Industry*
29 – 31 March 2015 in Karlsruhe, Germany

Chemistry of Biodiesel Manufacture



R = fatty acid

alkali catalysts

NaOH KOH

$NaO-CH_3$ $KO-CH_3$

driving force = phase separation

Biodiesel Market

2014 production volume EU 9,6 mt Biodiesel

254 plants
all on alkaline transesterification
many of them idle

Trend: used cooking oils UCOS
acid oils non food

inaChem GmbH
„Green" Chemicals

Benefit of UCOS

<2015 double counting => double tax reduction

>2015 90% tax reduction *rape 65% tax reduction*

Chemical Problem

Free fatty acids consume alkali catalyst

=> 2-step technology currently

Step 1 Esterification acid catalysed H_2SO_4

Step 2 Transesterification alkali catalysed

The one step alternative

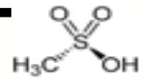
Acid catalysed esterification
and transesterification

>1.000 times slower than alkali catalysis
T > 120°C

Sulfuric acid sulfonates the fatty acids
HCl is corrosive
HNO_3 is a safety problem
What else?

The inaChem innovation

MSA catalysed **B**iodiesel
Transesterification

MBT  Technology

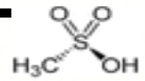
Methane sulfonic acid - MSA - catalyst for one step esterification and transesterification

Does not sulfonate, much less corrosive,
no side reactions, safe handling,
100% biodegradable, clear liquid

industrial commodity => Lutropur BASF

The inaChem innovation

MSA catalysed **B**iodiesel
Transesterification

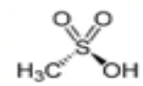
MBT  Technology

Up to 10% free fatty acids do not interfere with transesterification.

IF> 10% Esterification in a separate step but only to 90% completion

After transesterification no soaps present, no free fatty acids left. Catalyst is in the glycerol phase.

Phase separation is almost spontantanously.

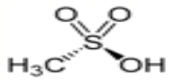
MBT  Technology

Benefits

1 no soaps	fast phase separation - no alkali metals in biodiesel	
2 steryl-glycosides	complete hydrolysis and soluble	
3 not restricted to methanol	ethanol, butanol, isopropanol equally well	
4 waxes in plant oils react	completely transesterified	sunflower oil
5 castor oil OH-function	transesterifies equally well	
6 water from feed oils	up to 5% water tolerated	
7 high acid oils	up to 10% free fatty acids tolerated	

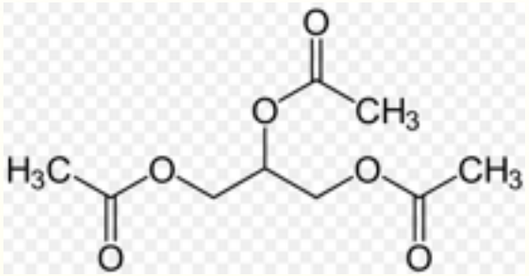
inaChem

„Green" Chemicals

MBT  Technology

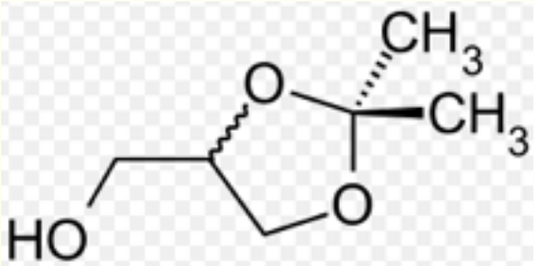
double use of catalyst

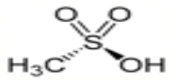
Triacetin plasticizer + acetic acid

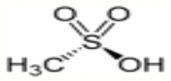


glycerol-ketal
Augeo SL 191
Solvay

„green“ solvent + aceton

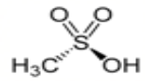


MBT  Technology

Alkaline vs MBT  Technology

plant trials running at
Tecosol GmbH Ochsenfurt, Germany

=> dramatic increase in efficiency
=> improvement of biodiesel quality

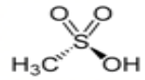
MBT  Technology

State

Lab trial finished => Product quality
is conform with DIN EN 14 214

First industrial plant under construction
at Tecosol GmbH Würzburg/
Ochensenfurt Germany

On stream expected 3rd quater 2015

MBT  Technology

European Patent EP 2 464 715

Marketing licencies through
InaChem

industrial production
Tecosol GmbH

Engineering through
REC Reliable Engineering Concepts
GmbH

One Step Biodiesel Manufacture from Acid Oils via MSA Catalysis

Axel Ingendoh, inaChem GmbH, Odenthal, Germany

R. Türck, REC Reliable Engineering Concepts GmbH, Stuttgart Germany

inaChem GmbH

„Green" Chemicals

Thank you very much for your attention!

8th Workshop on *Fats and Oils as Renewable Feedstocks for the Chemical Industry*
29 – 31 March 2015 in Karlsruhe, Germany