Practical challenges in the use of biodiesel

Siobhan Casey

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University of Birmingham

Black and Green? Carbon Footprint and Sustainability for Formulations

Biodiesel

- Innospec
- Biodiesel
- Challenges
  - Cold flow
  - Oxidative stability
- Conclusions

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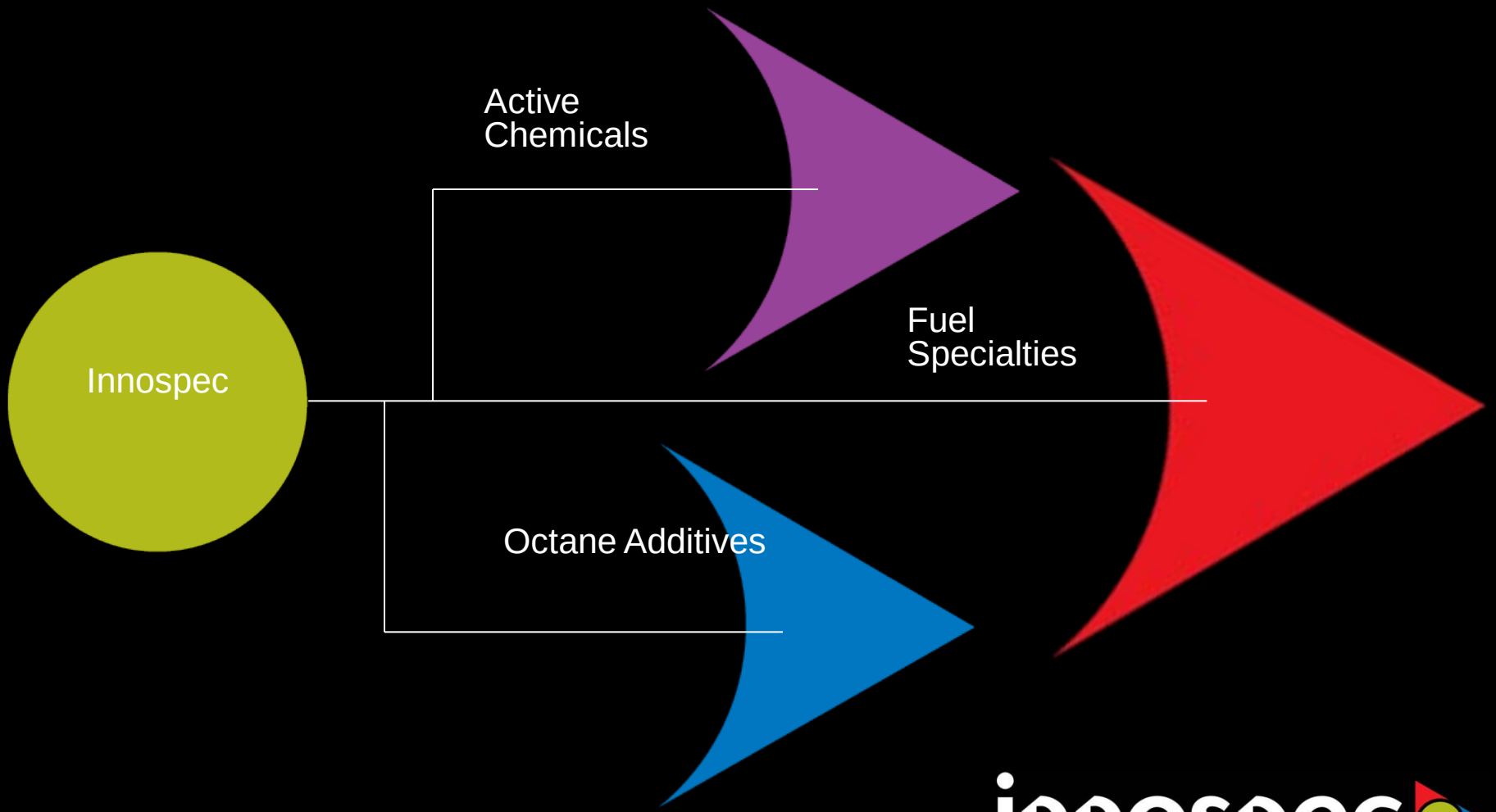
Innospec consists of three business units



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Fuel additives

- Wax anti-settling additives
- Antifoam additives
- Anti-valve seat recession additives
- Pipe line drag reducing agents
- Diesel detergency additives
- Demulsifiers
- Diesel additives
- Lubricity Improvers
- Anti-static additives
- Diesel stabilisers
- Anti-icing additives
- Corrosion inhibitors
- Combustion chamber deposit modifiers
- Metal deactivators
- Anti-oxidants
- Dyes
- Lead anti-knock additives
- Cetane improvers

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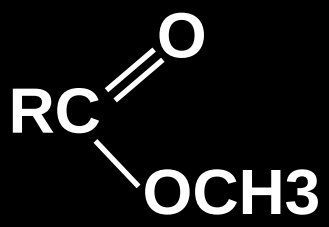
Biodiesel

- FAME – fatty acid methyl ester



Feedstock

	Lauric acid	Myristic acid	Palmitic acid	Stearic acid	Oleic acid	Linoleic acid	α-Linolenic acid
	C12:0	C14:0	C16:0	C18:0	C18:1	C18:2	C18:3
Palm oil			44	5	39	10	
Soya bean oil			10	4	23	51	7
Rape seed oil			4	2	61	21	9
Coconut oil	48	19	9	3	6	2	
Tallow oil		3	26	14	47	3	1

Typical % values of fatty acids in oils

- Blends of oils are common

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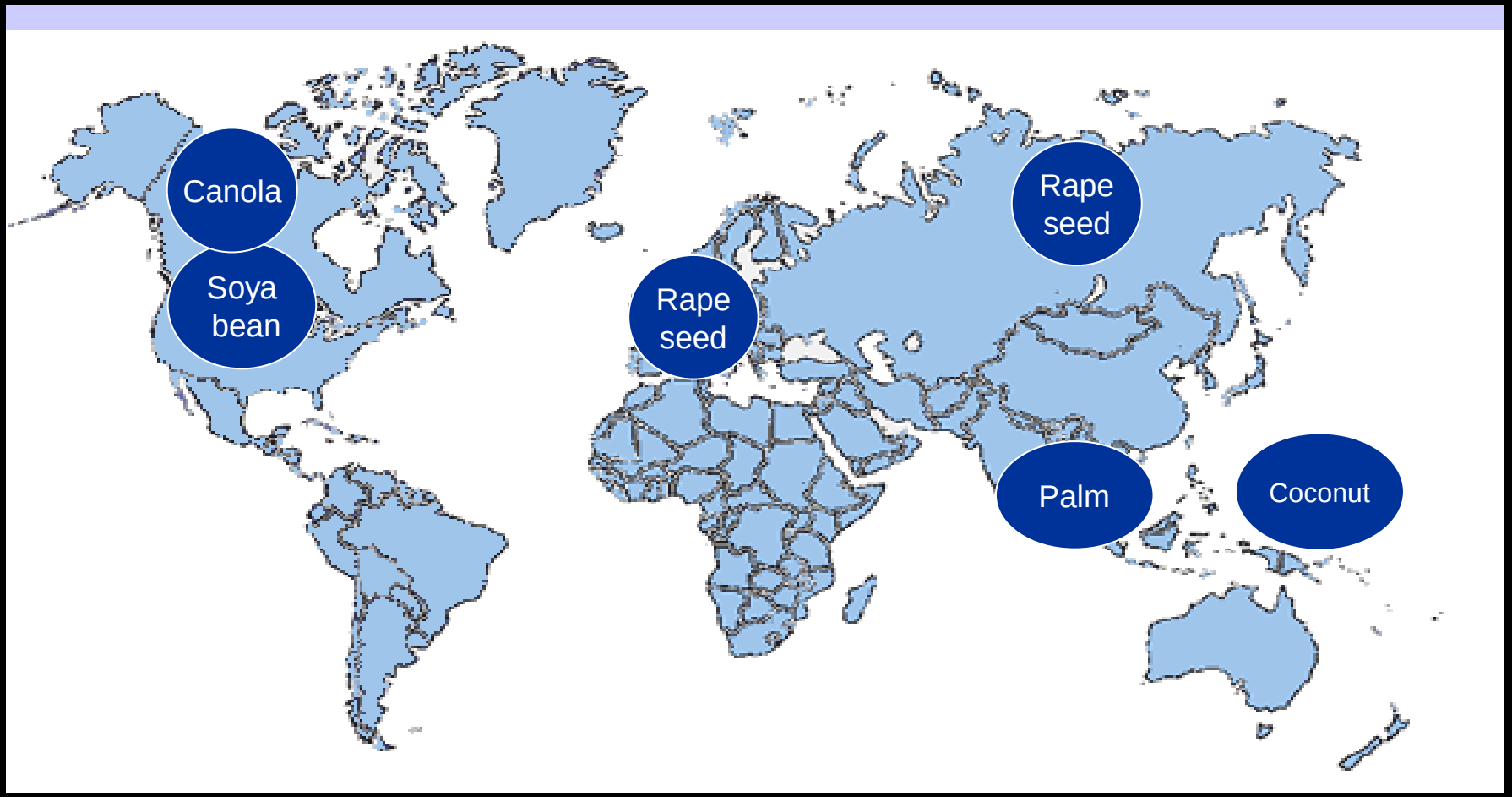
Biodiesel feedstock



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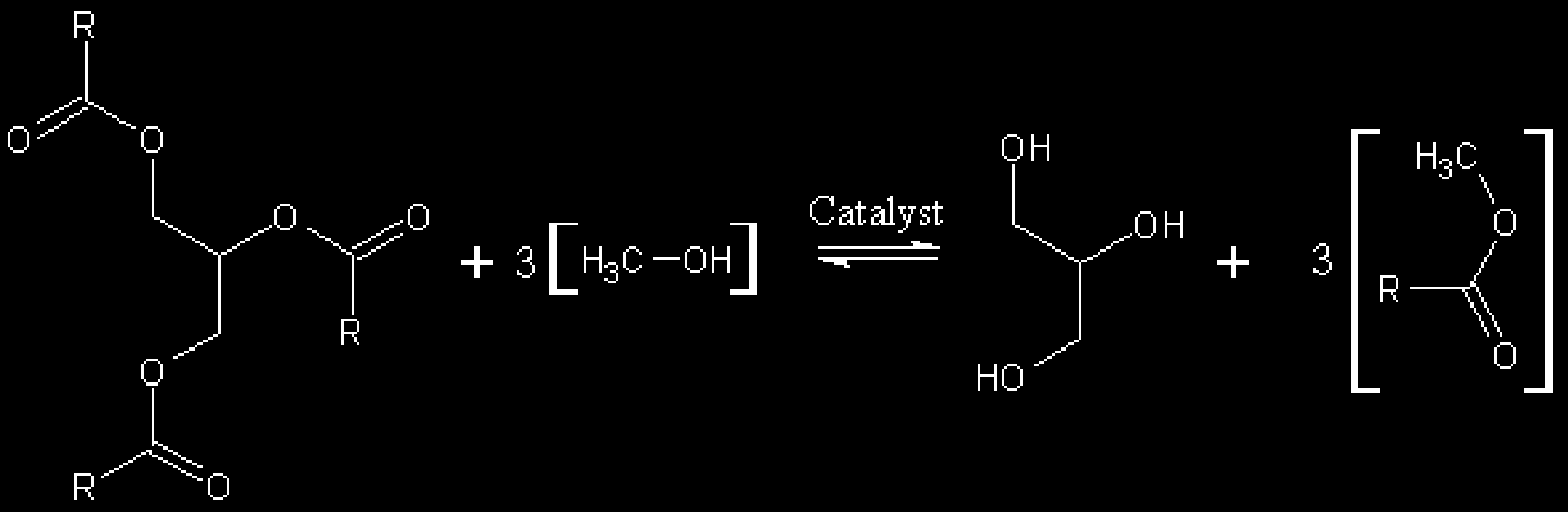
Biodiesel



Triglyceride | Methanol (3) | Glycerol | Methyl Esters (3)

Transesterifcation of fats

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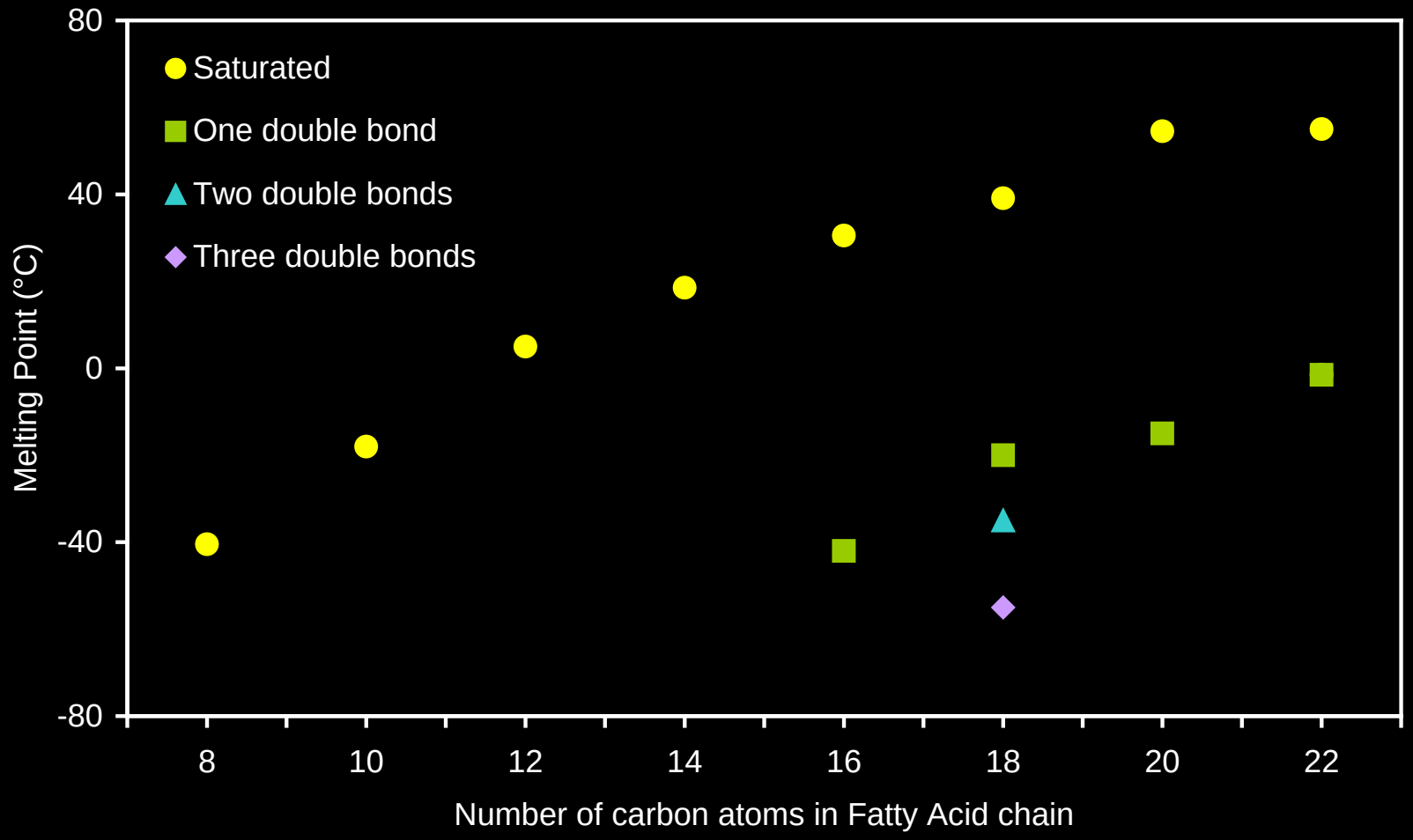
FAME melting points



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Biodiesel - challenges

- Low temperature operability
- Oxidative stability

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Low temperature operability

- At low temperatures the fuel should still flow
  - Measured by the pour point
- The fuel must also pass through the fuel filter
  - Measured by the cold filter plugging point

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Cold filter plugging point

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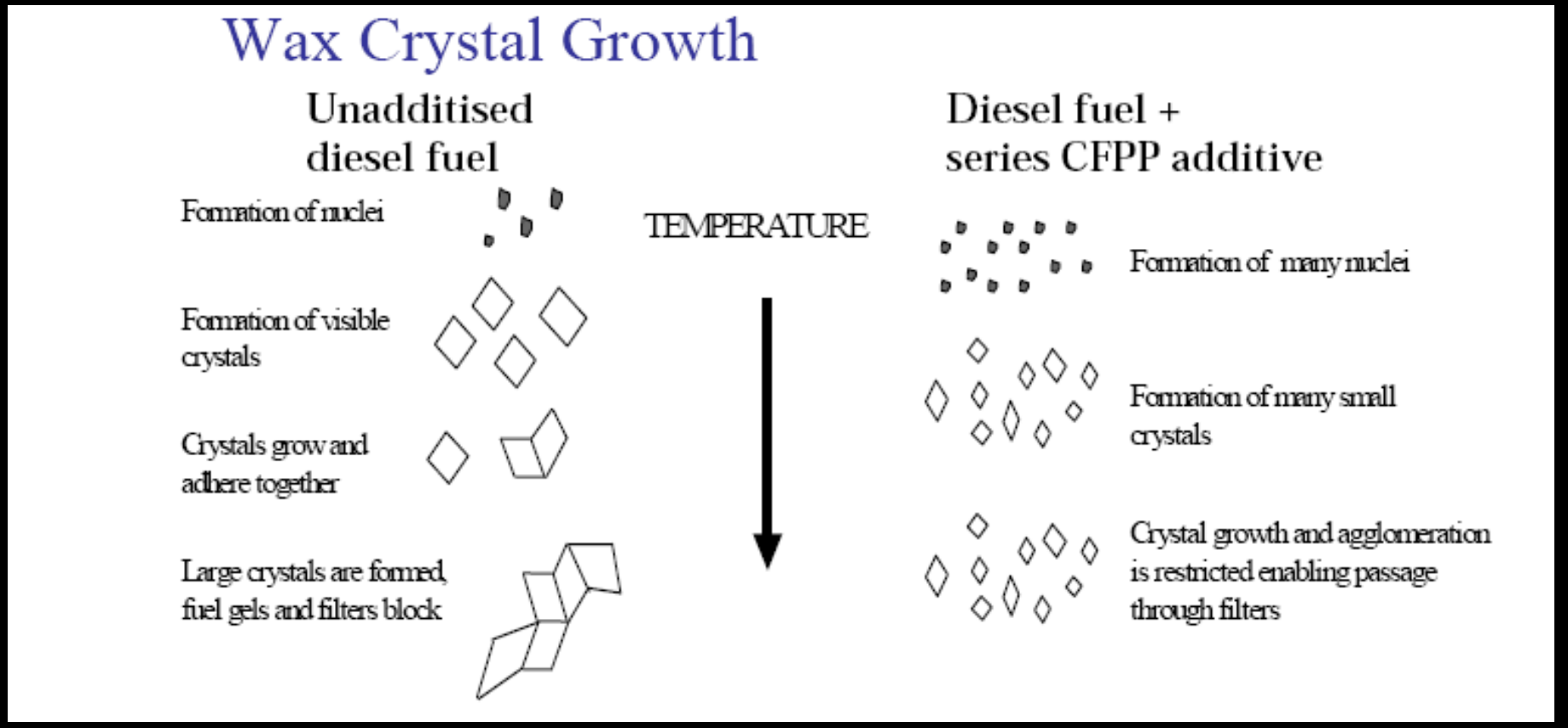
Low temperature operability



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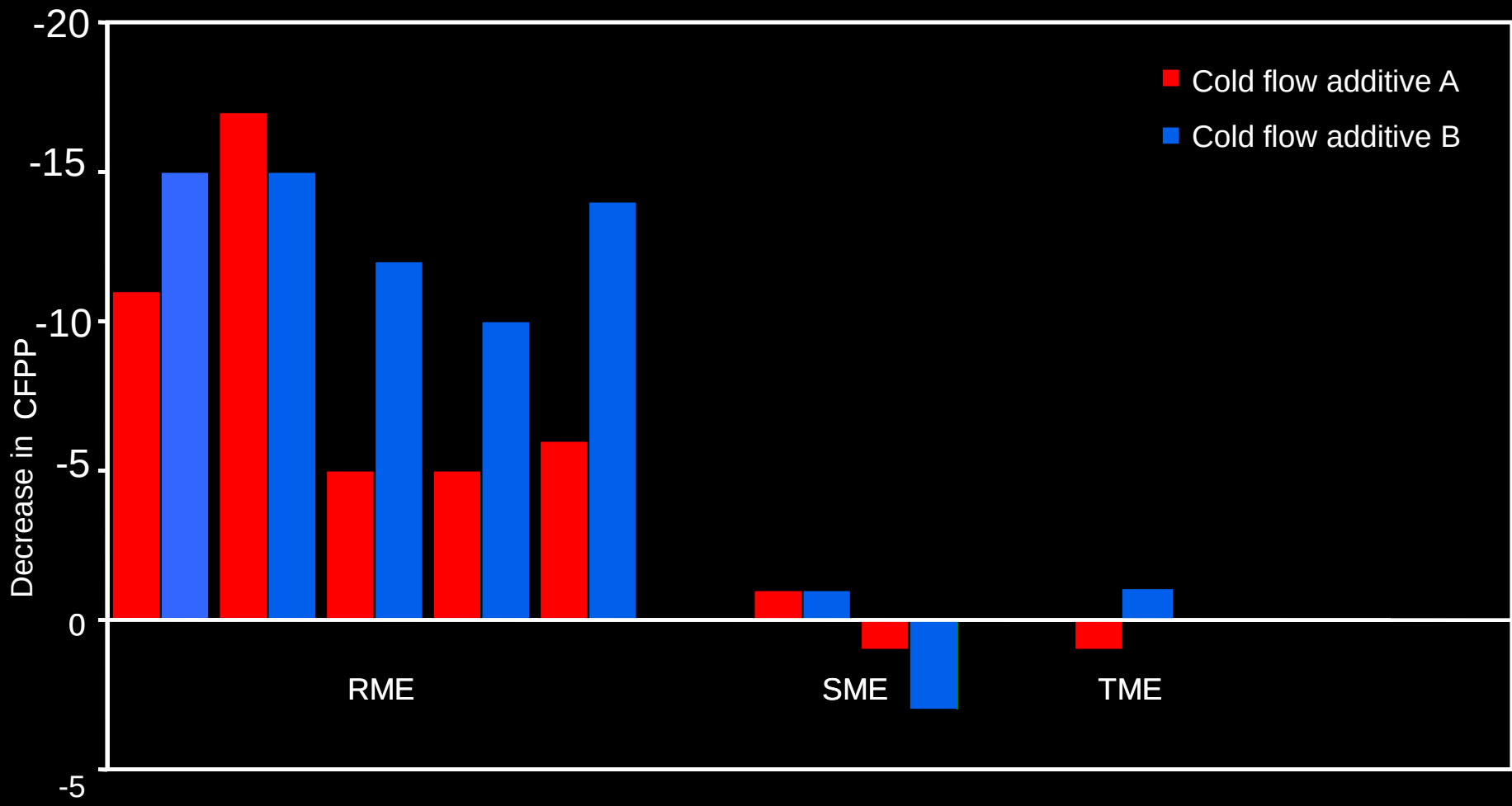
Low temperature operability



Rape methyl ester CFPP ~ -14C

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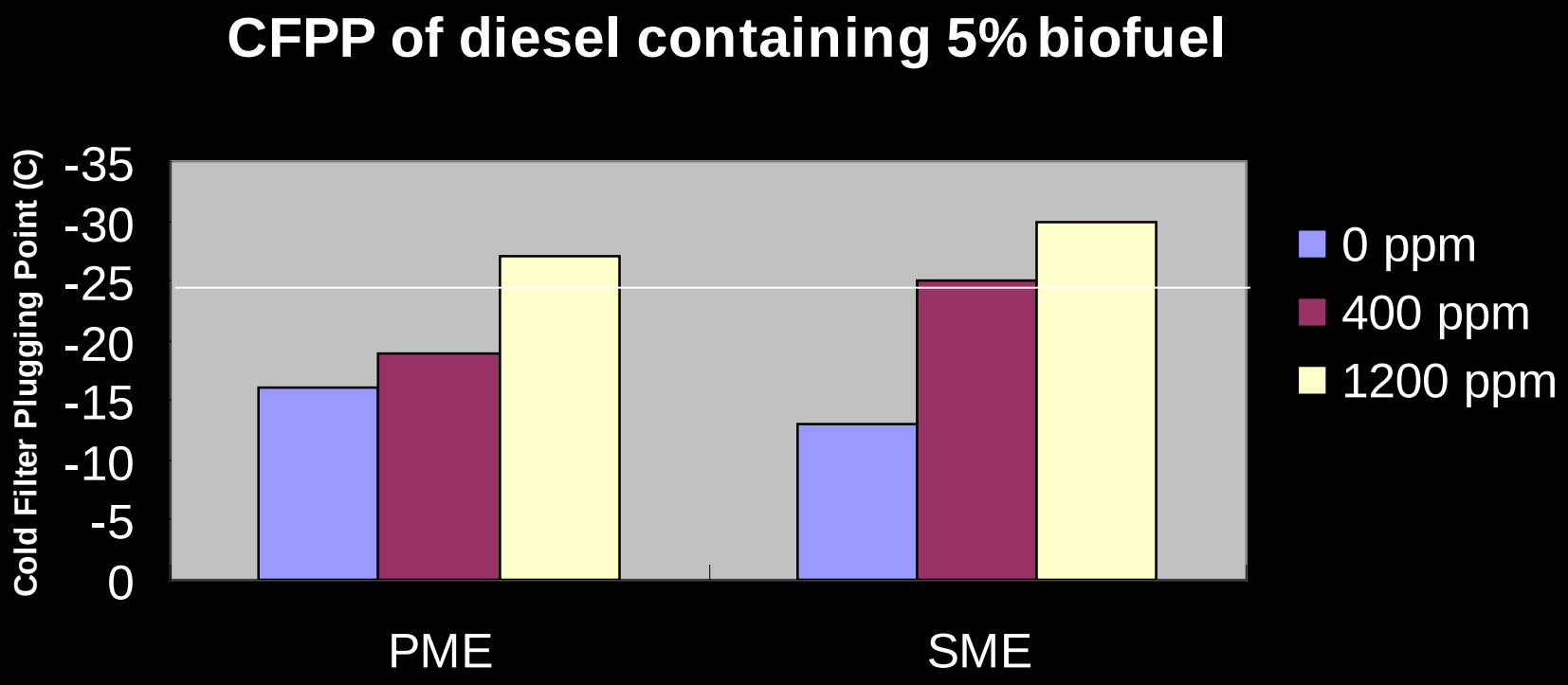
Low temperature operability



Rape > Soy >Palm

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Biodiesel - challenges

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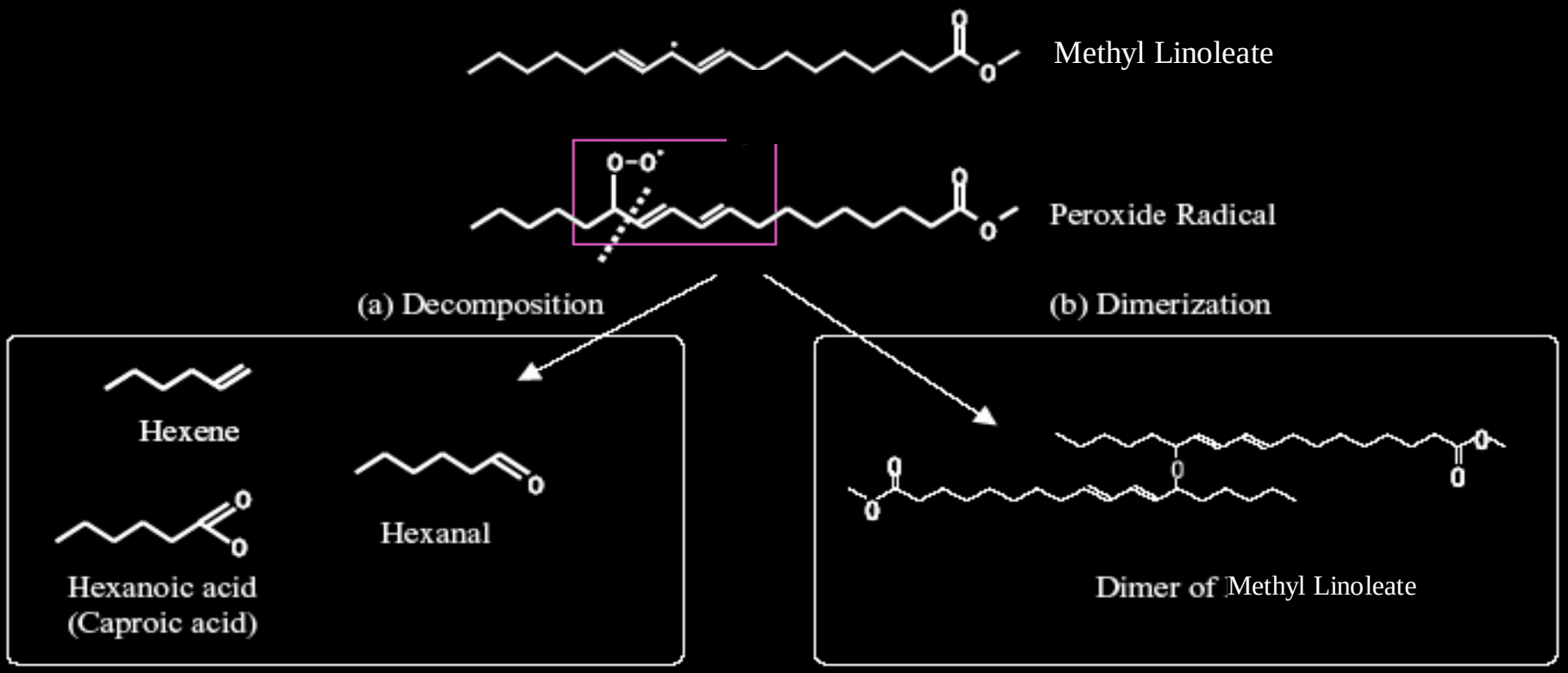
Oxidative stability



Taken from “Analysis of Oxidative Deterioration of Biodiesel Fuel” Ogawa T., Kajiya S., Kosaka S., Tajima I. and Yamamoto M.
SAE 2008-01-2502

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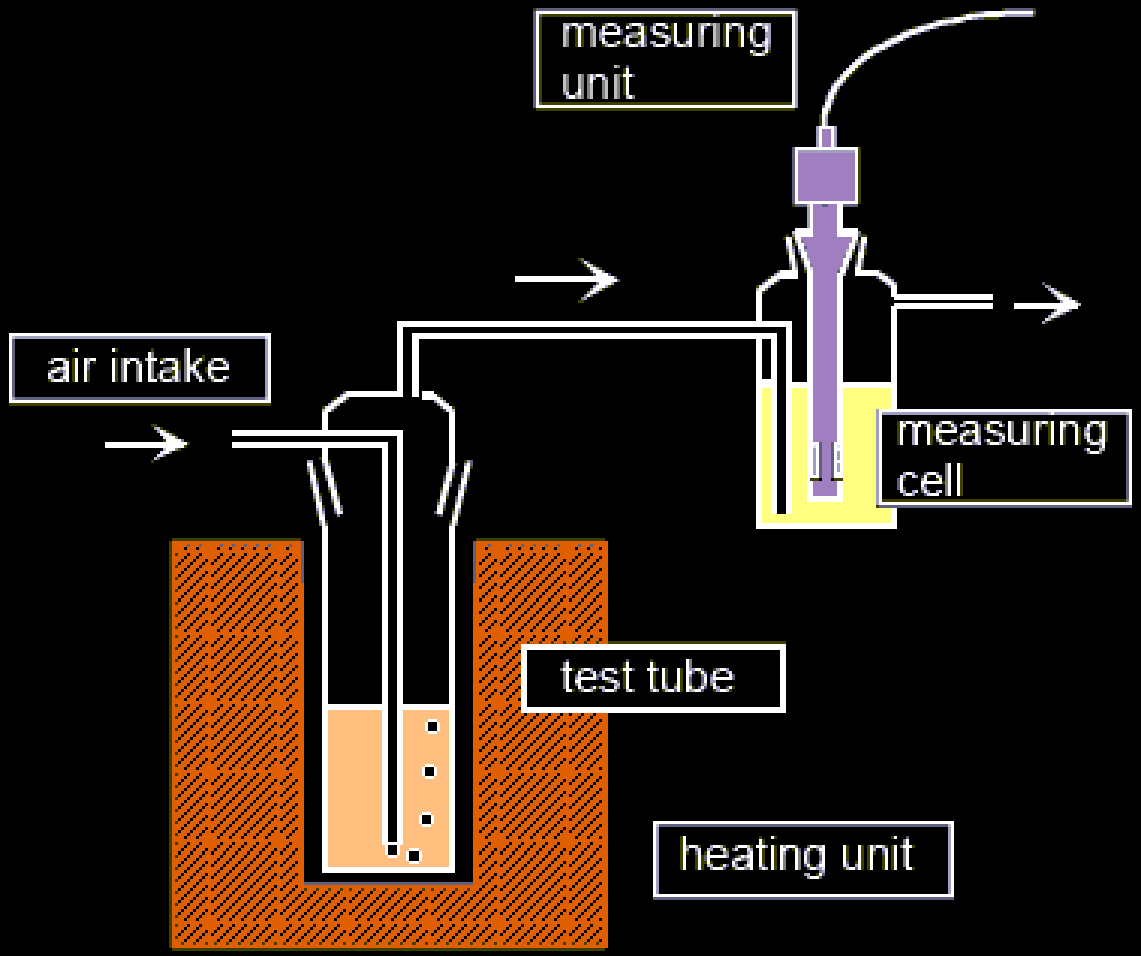
Rancimat



Deionised water

European Standard 14214: Six hours

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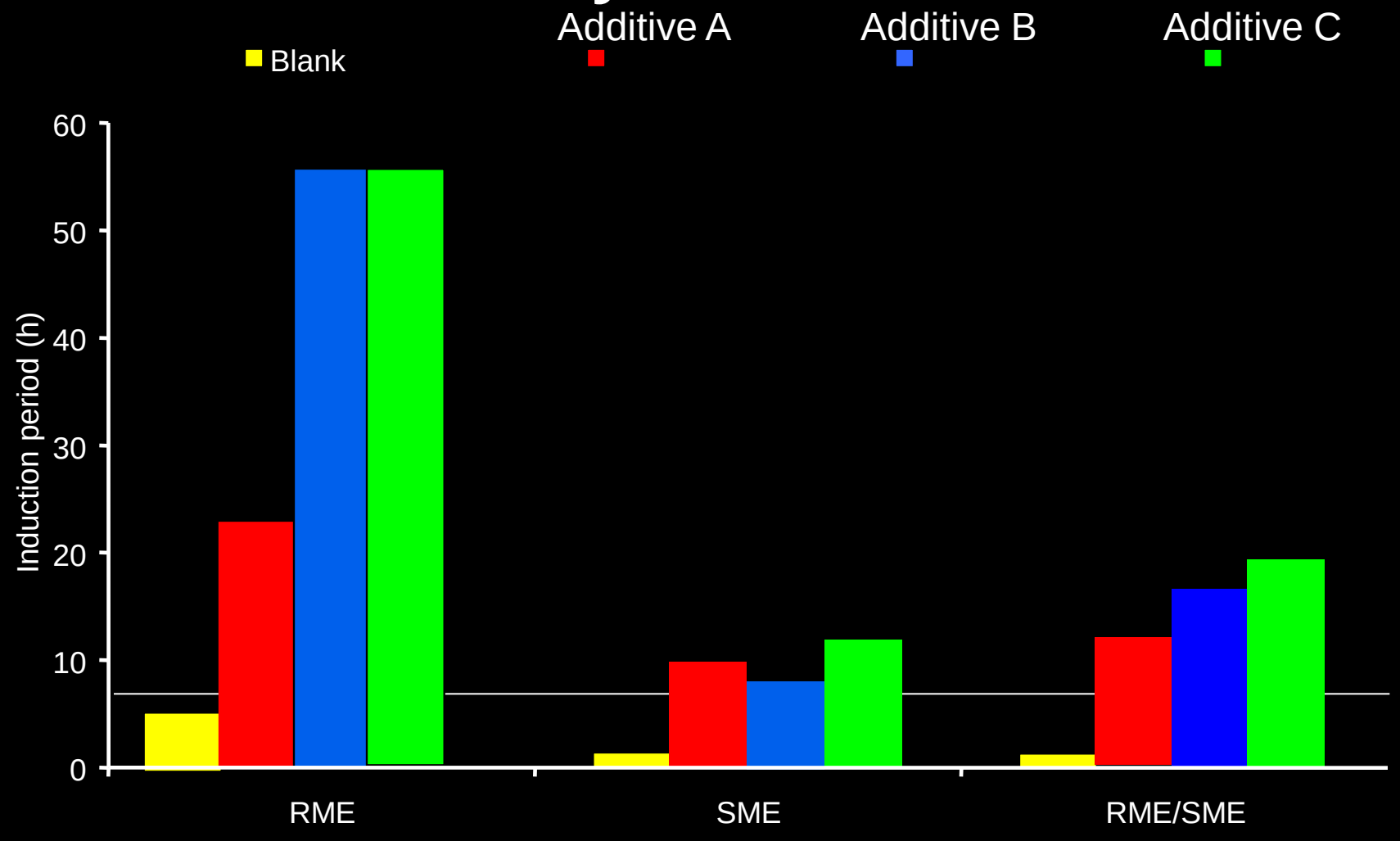
Oxidative stability



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Conclusions

- Two of the major technical obstacles to widespread acceptance of higher FAME use are;
  - stability of the FAME and FAME blends
  - the low temperature operability issues

- Palm methyl ester shows good stability but poor cold flow properties
- Rape and soy methyl ester show good cold flow and stability properties when treated with additives

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