

Novel Deodorization Technology with Focus on Processing Contaminants Mitigation

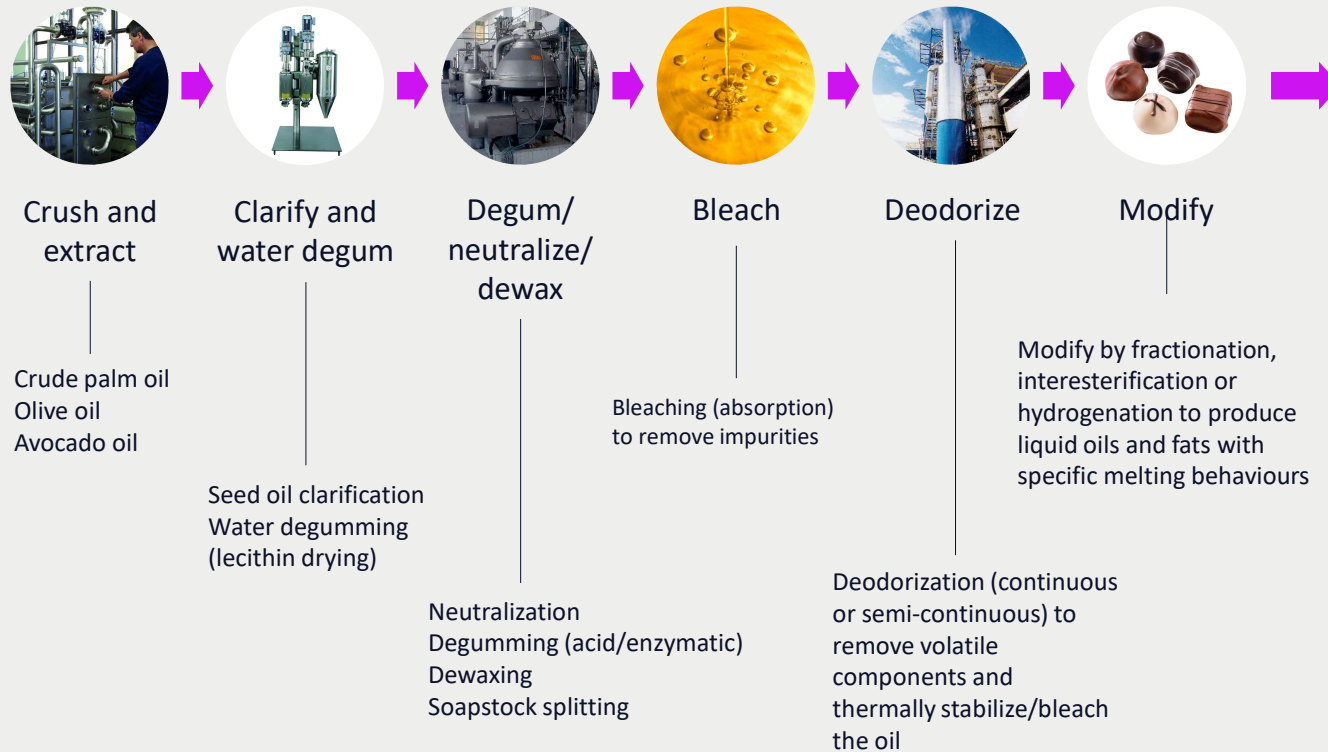
21 October 2024

Agenda

- A short introduction to Alfa Laval's oils & fats portfolio
- Alfa Laval's deodorization solutions
- Processing contaminants mitigation solutions
- Summary

Our oils & fats process line portfolio

Comprehensive solutions



Biodiesel/HVO feedstock



Cooking oils



Margarine and shortening



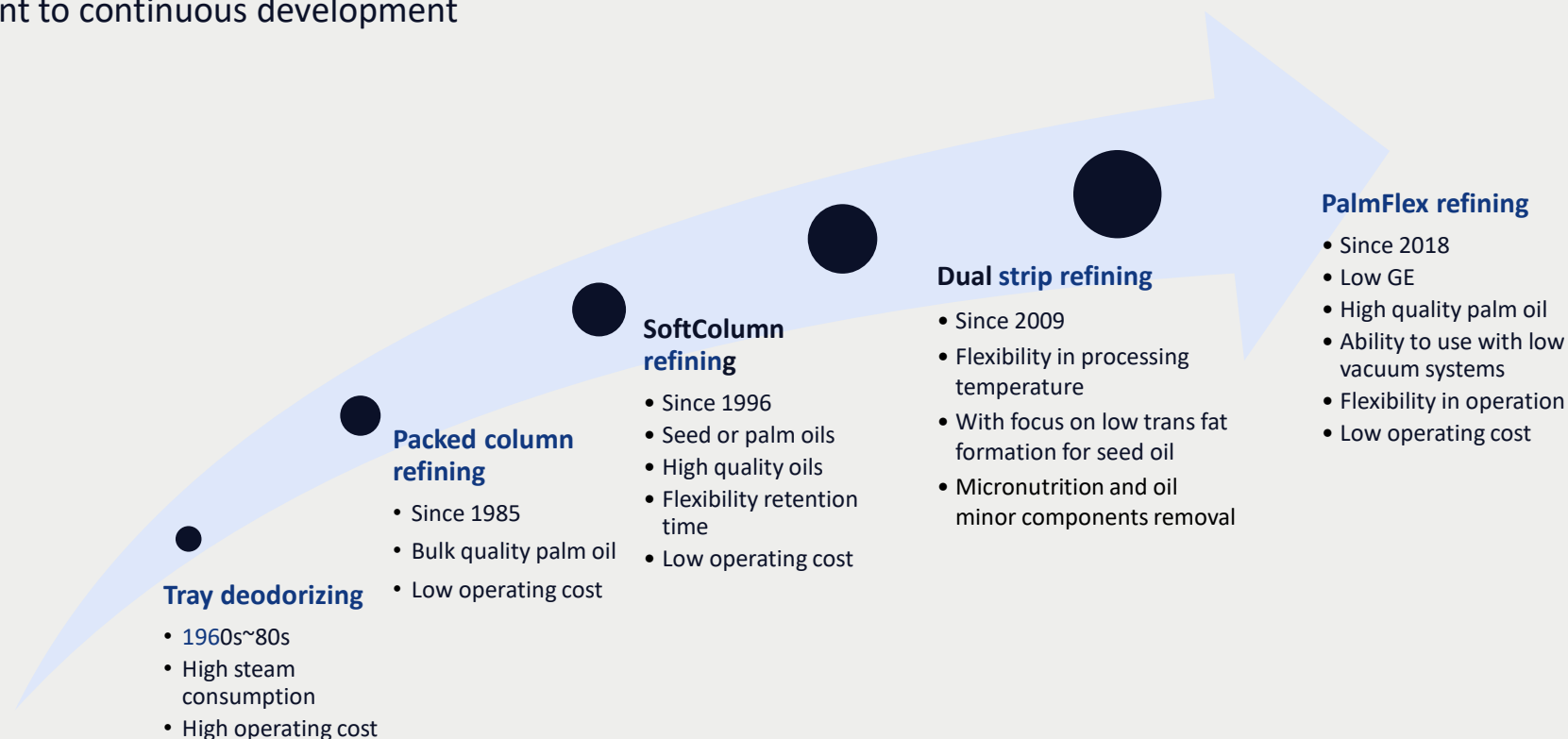
Specialty fats end product

Alfa Laval's Deodorization solutions

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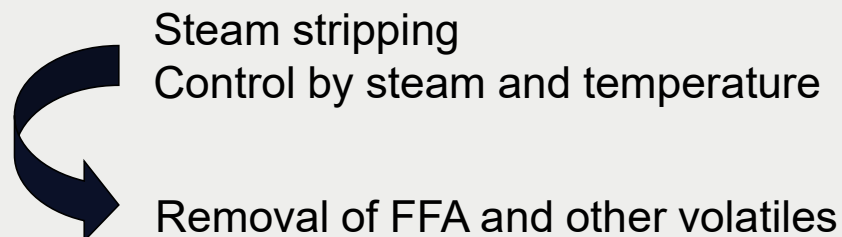
Development of Alfa Laval deodorizing technology

A commitment to continuous development



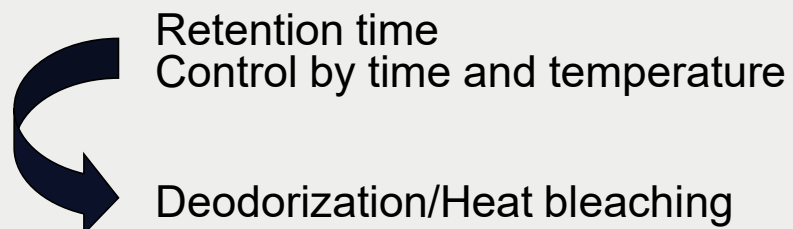
A glance back to SoftColumn™ deodorizer

Physical separation process

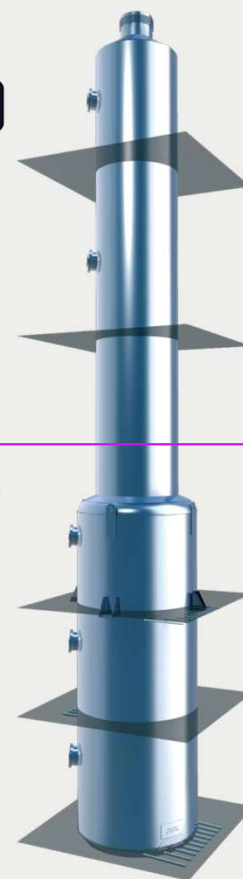


Fast

Chemical reaction process

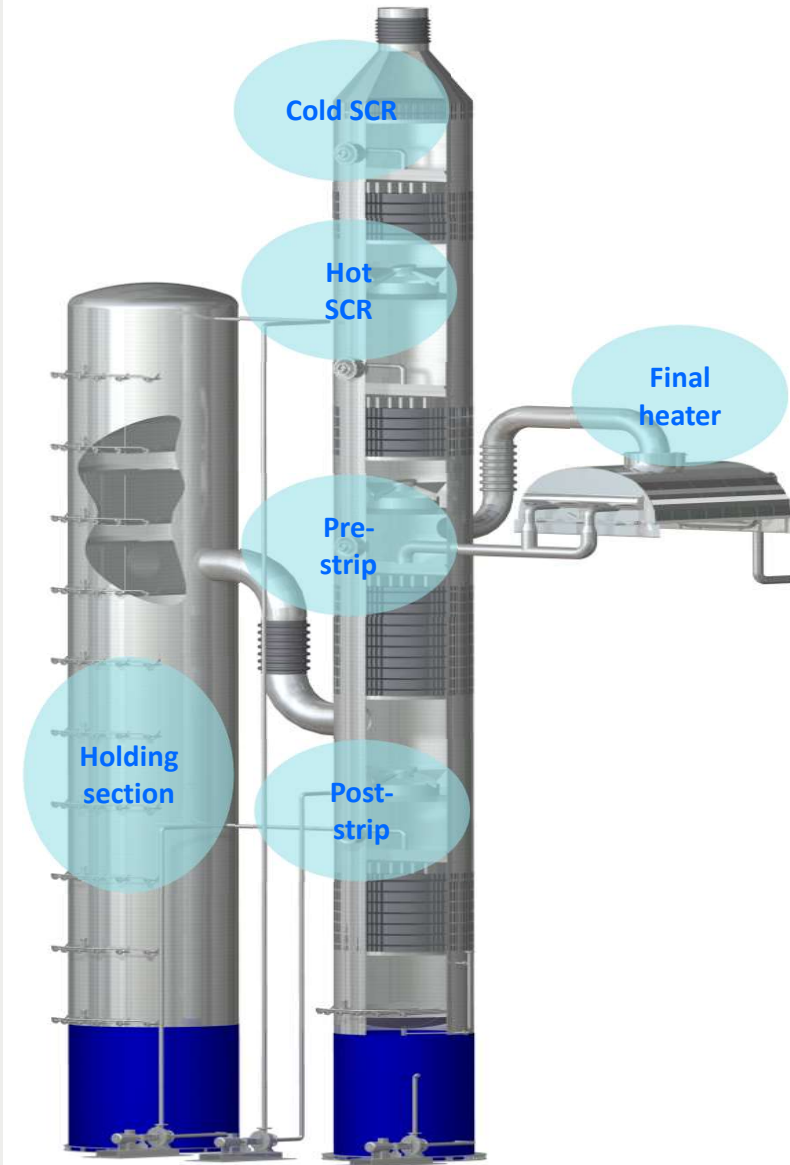


Flexible

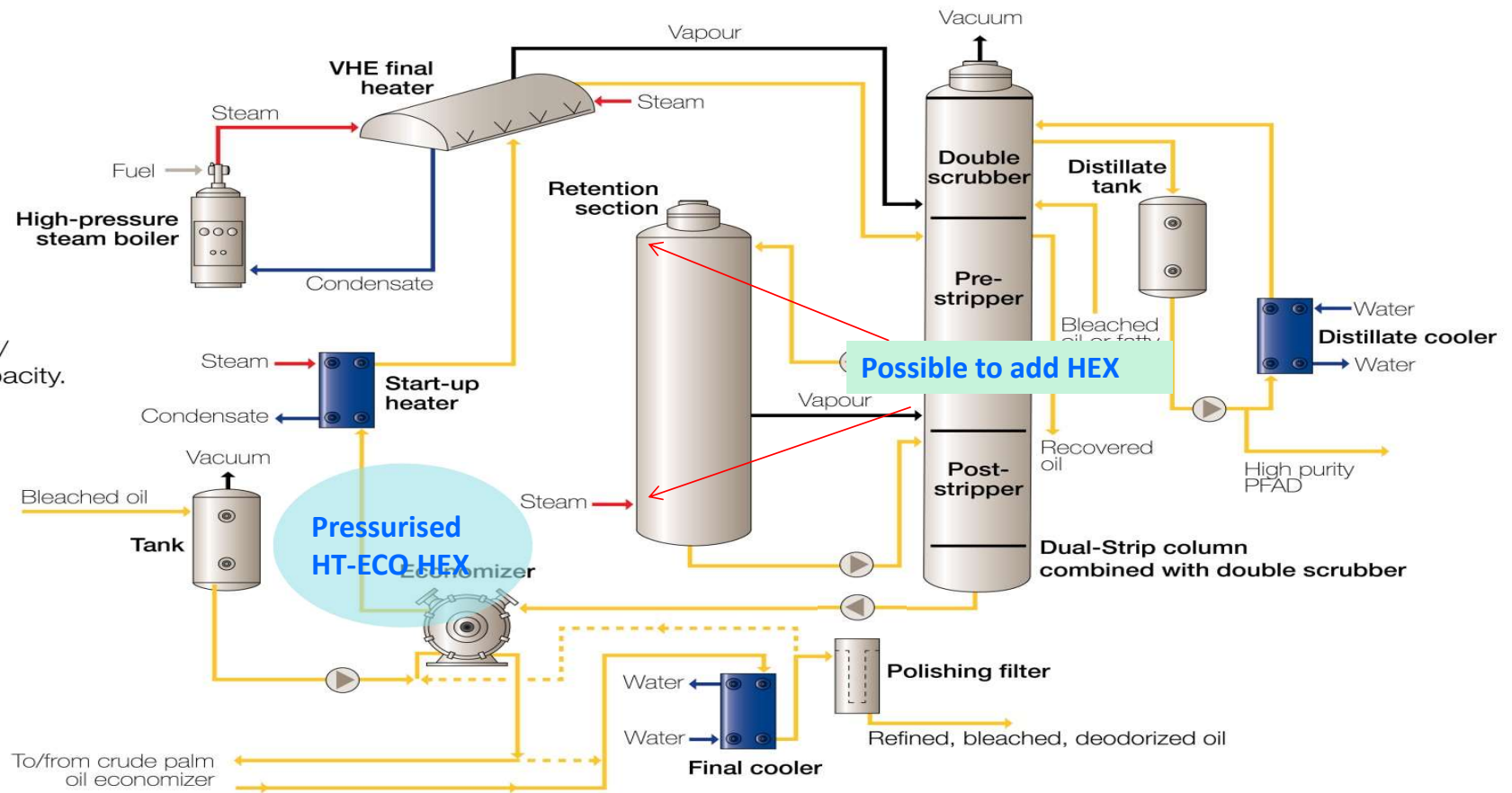


Dual Strip

- Two stage stripping: Before & after holding section
- More complete stripping
- Significantly improved heat recovery
- Possible dual temp process by installing HEX in top holding tray
- Possible retrofit solution

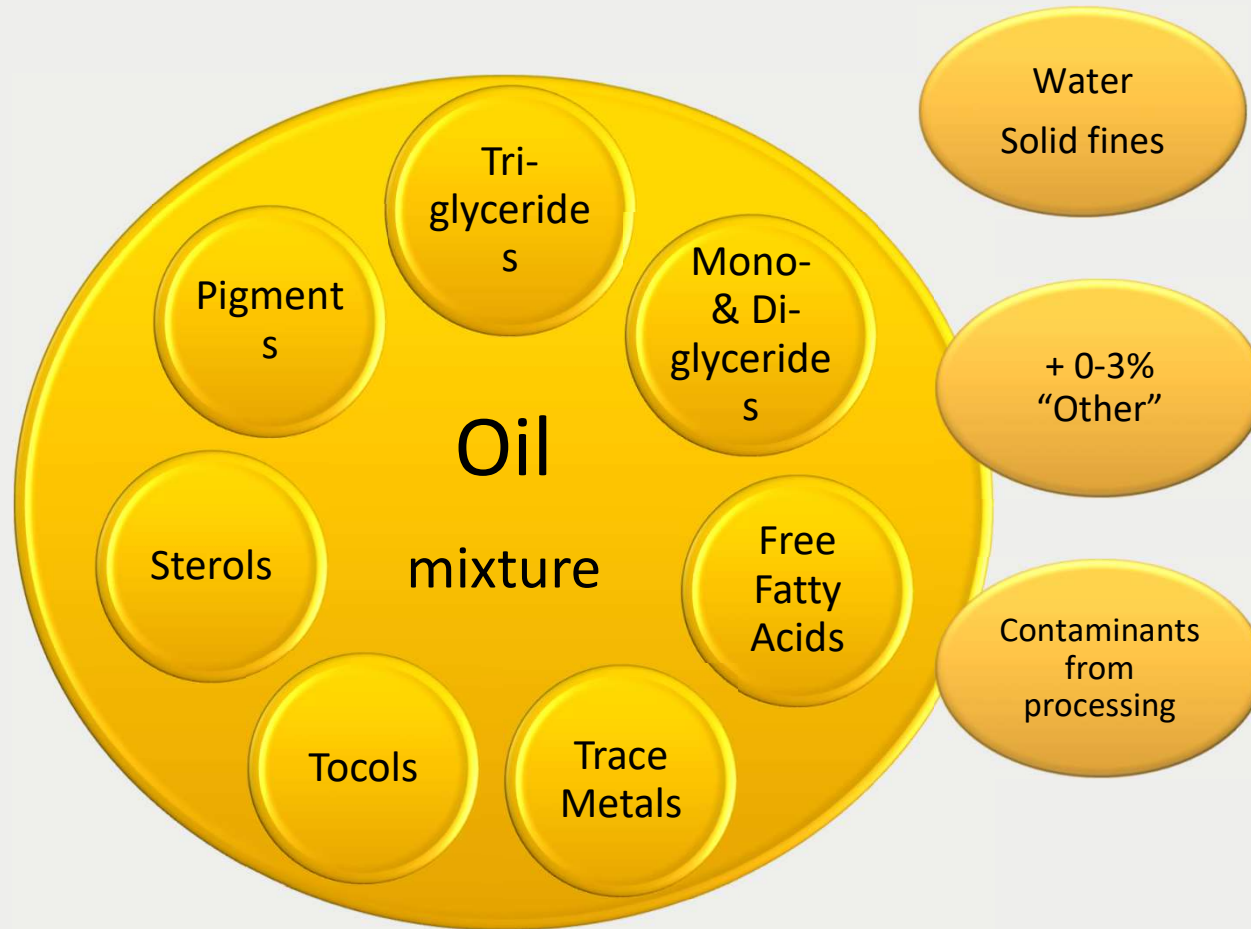


Dual Strip process overview

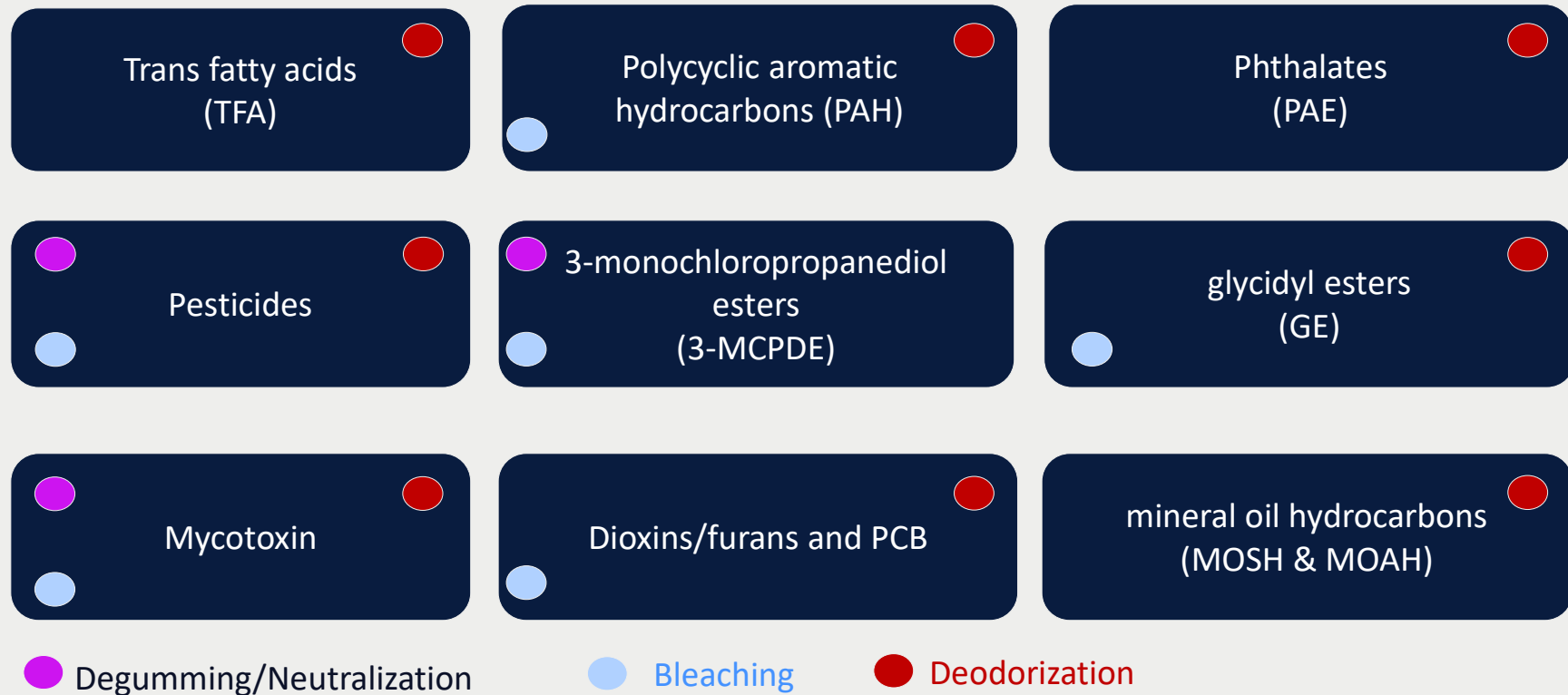


SoftColumn Dual-Strip continuous deacidification/deodorization for high capacity.

Composition of crude oil



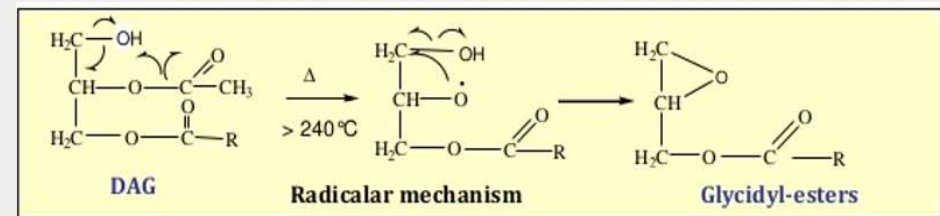
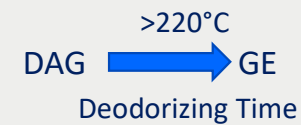
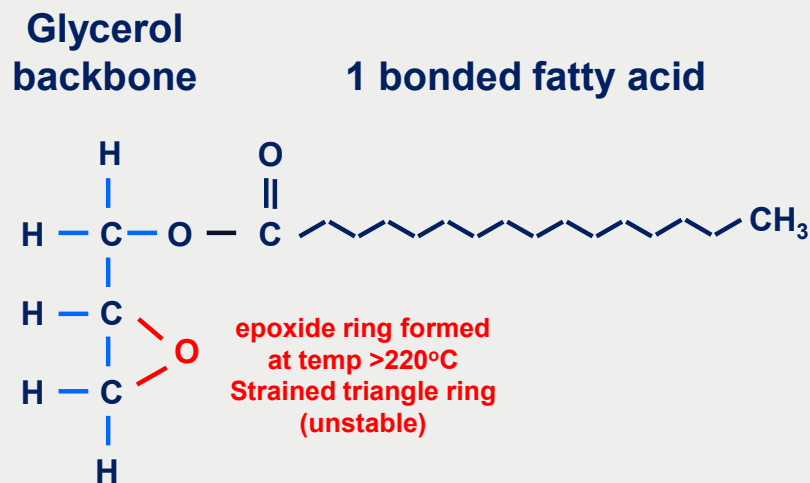
Processing Contaminants



Glycidyl Esters (GE)

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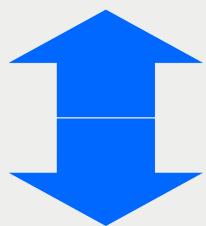
GE formation & The contributing factors



Contributing factors :

- High Diacylglycerides (DAG)
- High deodorizing temperature ($>220^{\circ}\text{C}$)
- Long retention time in deodorizer
- Hydrolysis at high temperature with steam effect

High temperature
High DAG in feed
Long retention time

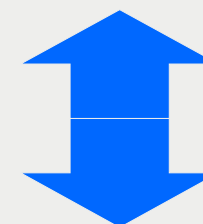


Low temperature
Low DAG in feed
Short retention time

GE “Formation / Stripping Balance”



High temperature
High steam sparging
Stronger vacuum



Low temperature
Low steam sparging
Weaker vacuum

GE stripping pilot test result

Test conducted for RBD palm oil



No.	Sample	GE result (mg/kg)	3-MCPD result (mg/kg)
1	GE of RBDPO feed	9.4	0.91
2	GE test at 200°C	1.1	0.86
3	GE test at 210°C	0.3	0.84
4	GE test at 220°C	0.1	0.86
5	GE test at 230°C	0.1	0.83
6	GE test at 240°C	0.2	0.80



Analysis method: AOCS Cd 29c-13

Proces parameters: Suction pressure 0.7 mbara / sparge-steam amount 1.7%

Mineral Oil Hydrocarbons

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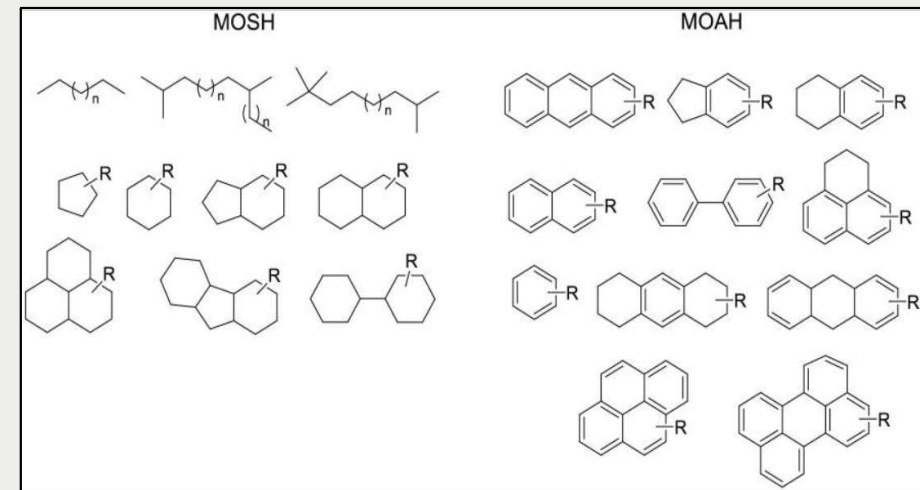
MOSH & MOAH

Latest challenges of hazardous compounds

Mineral Oil Hydrocarbons (MOSH, MOAH)

- complex mixture of hydrocarbons C10 up to C50

- Pose potential health hazards in animal studies
- For MOSH & MOAH C10-C24, high temperature deodorization with steam stripping and vacuum could reduce them
- For C24-C30, partial removal is possible depending on steam stripping, strong vacuum and temperature
- Good manufacturing practices is still the best to address these contaminants
- Usage of food-grade lubricants



MOSH = Mineral Oil Saturated Hydrocarbons

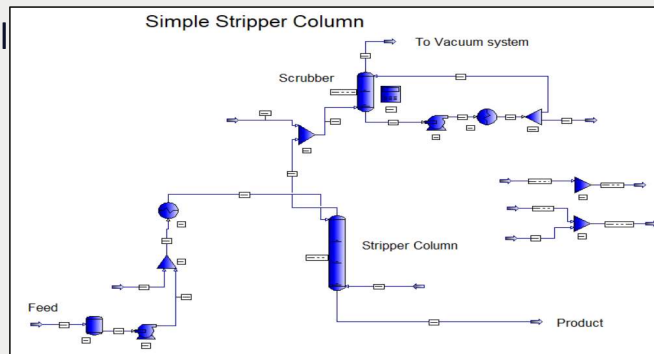
MOAH = Mineral Oil Aromatic Hydrocarbons

Palm oil MOSH & MOAH reduction – pilot test

with Alfa Laval PRO II simulation tool and pilot plant

Palm Oil stripping test for MOSH/MOAH removal at :

- Three different temperatures 210°C, 225°C and 240°C
- Analytical results compared with results from simulation tool PROII at same process parameters



based on Alfa Laval's proprietary lipid property library coupled with the process simulator PRO II from SimSci with data provided by customer



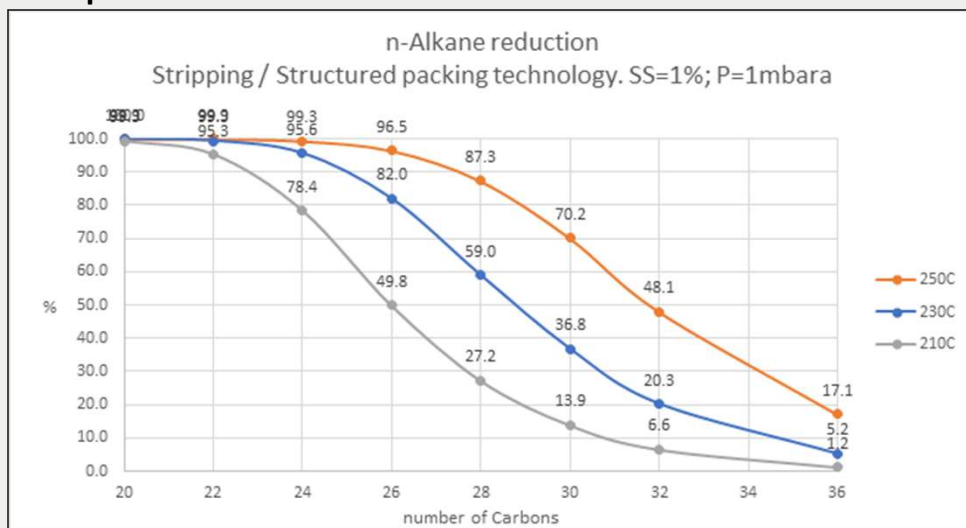
Alfa Laval pilot stripping plant in Denmark

Palm Oil			210°C		225°C		240°C	
MOSH		Feed	Pilot Plant	PROII	Pilot Plant	PROII	Pilot Plant	PROII
C10 - C25	ppm	13.9	2.1	0.3	0	0	0	0
C26 - C35	ppm	41	12	16.5	4.7	6	0	3
C36 - C50	ppm	26	33	29.1	26	26.3	17.8	23.3
Sum C10 - C50 (excl. LOQ)	ppm	80.9	47.1	45.9	30.7	32.3	17.8	26.3
Reduction in total MOSH	%		41	43	62	60	77	67
MOAH		Feed	Pilot Plant		Pilot Plant		Pilot Plant	
C10 - C25	ppm	2.5	0		0		0	
C26 - C35	ppm	7.6	2.3		0		0	
C36 - C50	ppm	7	6.8		4.9		3.7	
Sum C10 - C50 (excl. LOQ)	ppm	17.1	9.1		4.9		3.7	
Reduction in total MOAH	%		46		71		78	

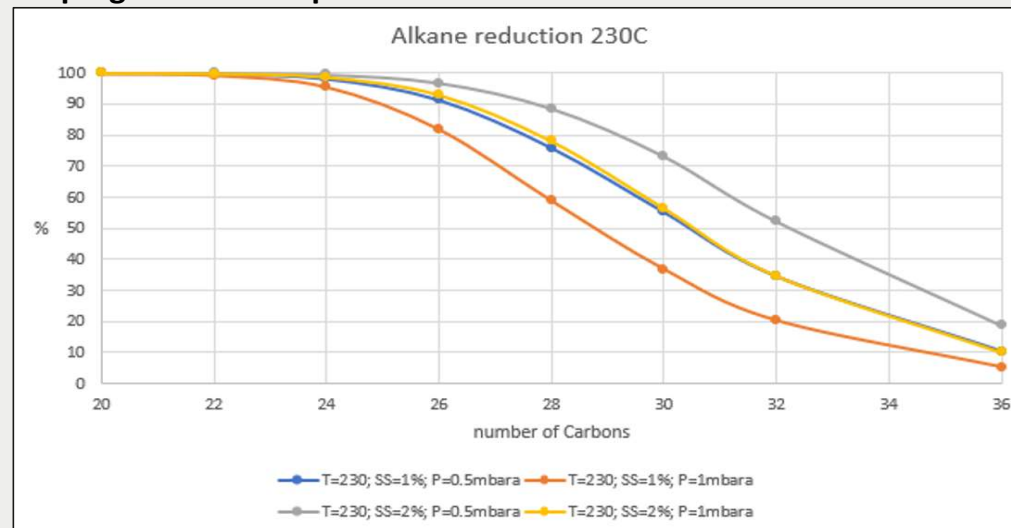
Influence of process parameters on MOSH & MOAH removal

with Alfa Laval PRO II simulation tool

Temperature influence *



Sparge steam and pressure influence *



* Data provided by a Malaysian refiner. Result shall vary with other samples. Contact Alfa Laval for personalized simulation

* Performance based on Alfa Laval's proprietary lipid property library coupled with the process simulator PRO II from SimSci



Achieve the highest quality

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Alfa Laval deodorizing technology

- Consistent high-quality oil
- Flexibility in operating choices
- Low operating cost with high heat recovery
- Flexibility in plant layout
- Safe and easy operation and maintenance
- Modularized setup and easy upgrade

The background of the slide is a photograph of a field of tall, green plants, possibly sugarcane, with a bright sun flare breaking through the leaves on the right side. The image is darkened to allow the white text to stand out.

Thank you for
your attention!

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