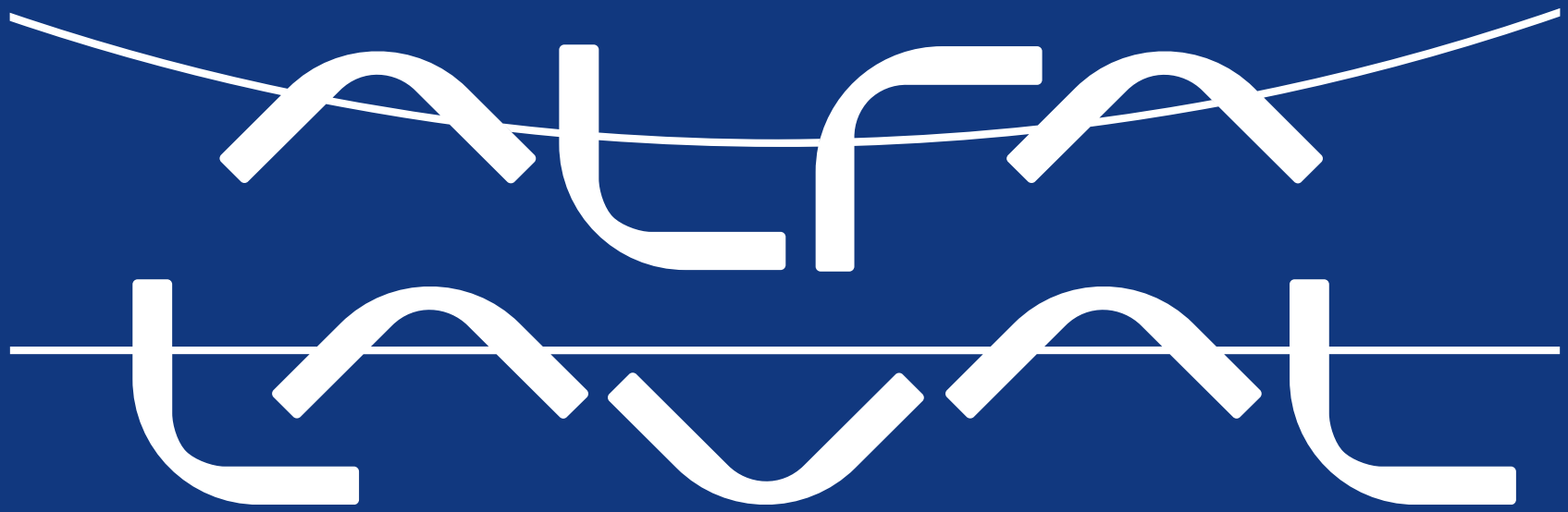

ALFA
LAVAL

3 MCPD,GE & Trans: New Challenges in Edible oil Industry

Prabhakar Nachanekar
Sr. Manager Sales & Process
Development Oils and Fats Divison

3-MCPDE and GE have been around for decades

– But have gained more attention in recent years

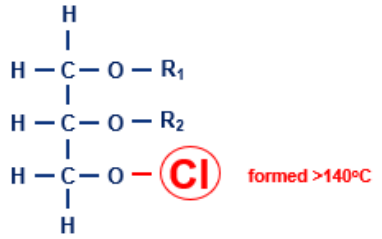
1978	Known food contaminant in hydrolyzed vegetable proteins (HVP) and found in a wide range of daily food
2008	Glycidyl esters (GE) detected in palm oil but 3-MCPDs and GEs not found in virgin oils
2013	European Food Safety Authority (EFSA) identifies margarine, preserved meats, bread and vegetable oil as major sources of 3-MCPD
Jan 2018	EFSA sets the tolerable daily intake for 3-MCPDs at 2 µg/kg body weight/day (0.002 ppm/kg body weight)
2020 and beyond	Variable, but definitely at a ***very low rate***

What is 3 MCPDE , GE & Trans ?

– Latest challenges of process contaminants

3-MCPDE (3-monochloropropanediol esters)

- Possible effect on kidney & male fertility*
- Formed >140°C in the presence of chloride ions**
- Difficult to be removed after formation

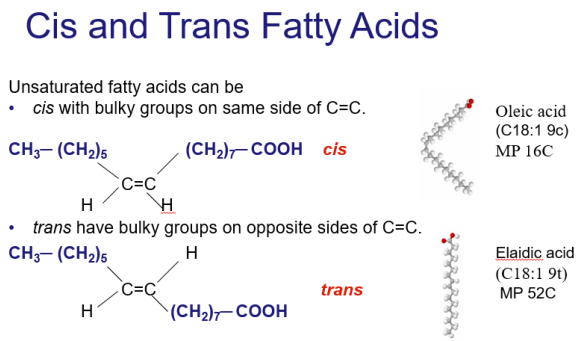


GE (Glycidyl Esters)

- Genotoxic and carcinogenic (can damage DNA & cause cancer)*
- Formed rapidly >220°C at long retention time
- Main pre-cursor Diacylglycerides (DAG)
- Can be removed by direct stripping or post-refining

Trans Fatty Acid

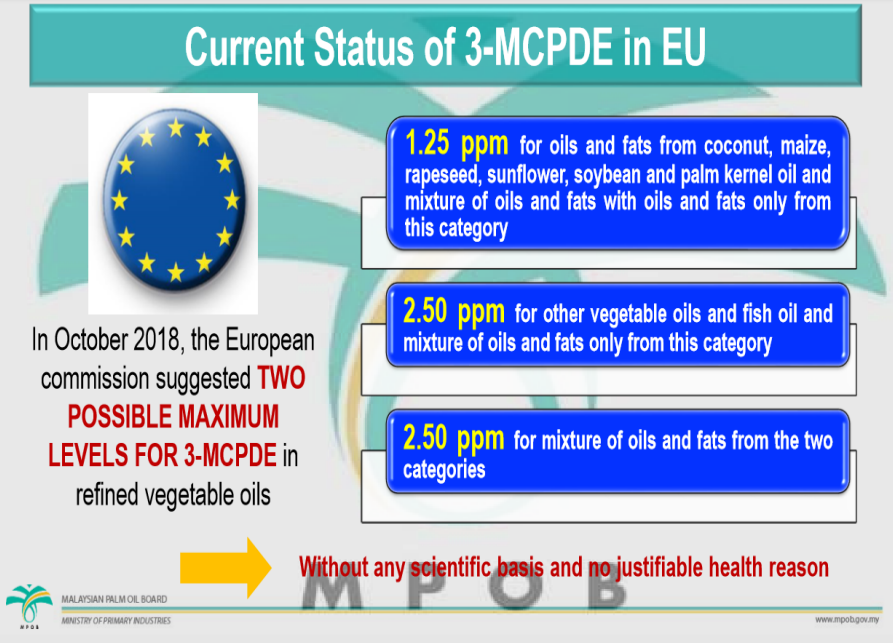
- Coronary Heart Disease (CHD)
- Trans fat and sat fat increases levels of LDL (bad cholesterol) in the body
- Formed rapidly > 240°C at long retention in Deodorizer
- Selective Hydrogenation
- Main pre-cursor unsaturated Fatty Acid
- Can be minimized by mild process condition



* European Food Safety Authority (EFSA)
** Institute of Food Science & Technology, UK (IFST)

Regulations on Trans, 3-MCPDE and GE

The Food Safety and Standards Authority of India (FSSAI) announced that all edible refined oils, vanaspati, bakery shortening, margarines, vegetable fat spreads and mixed fat spreads may only contain **3 per cent or less trans fats** by January 2021 and 2 per cent or less trans fats by January 2022. This is an important milestone since the World Health Organisation (WHO) has called for global elimination of trans fat by 2023.

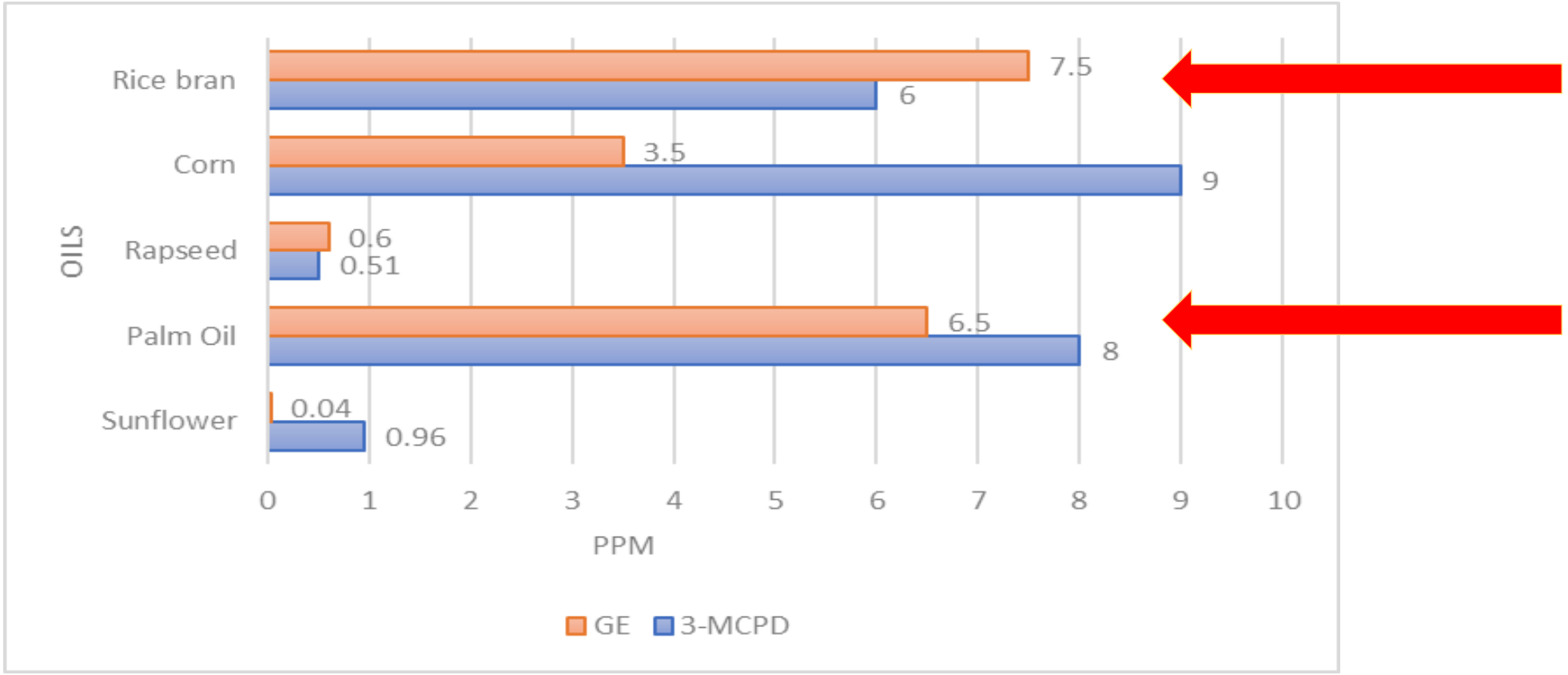


Glycidyl fatty acid esters expressed as glycidol	Maximum level µg/kg
Vegetable oils and fats placed on the market for the final consumer or for use as an ingredient in food with the exception of the foods below	1,000 1.0 ppm
Vegetable oils and fats destined for the production of baby food and processed cereal-based food for infants and young children	500 0.5 ppm

Commission Regulation (EU) 2018/290, of 26 February 2018

Prevalence of 3-MCPD and GE in Edible oils

– Not only problem in Palm Oil



Highest level of 3 MCPD and GE are found in Palm Oil , Low levels in Soft oils.

Edible Oil Quality comparison of various oils

Parameters	Rice Bran oil	Palm Oil	Soya oil	Sunflower oil	Rapeseed oil
% FFA Max	5-15	4-7	< 1.0	< 1.0	0.5- 2.0
DAG	**7-12**	**6-8**	<2.0	<2.0	<2.0
Phosphorus in ppm	300-400	25	500-800	250-450	300
Fatty Acid Composition					
Palmitic	20	42	8	6	4
Stearic	2	5	4	4	1
Oleic	40	41	28	28	60
Linoleic	33	10	53	61	20
Linolenic	1.5	<1	9	1	7

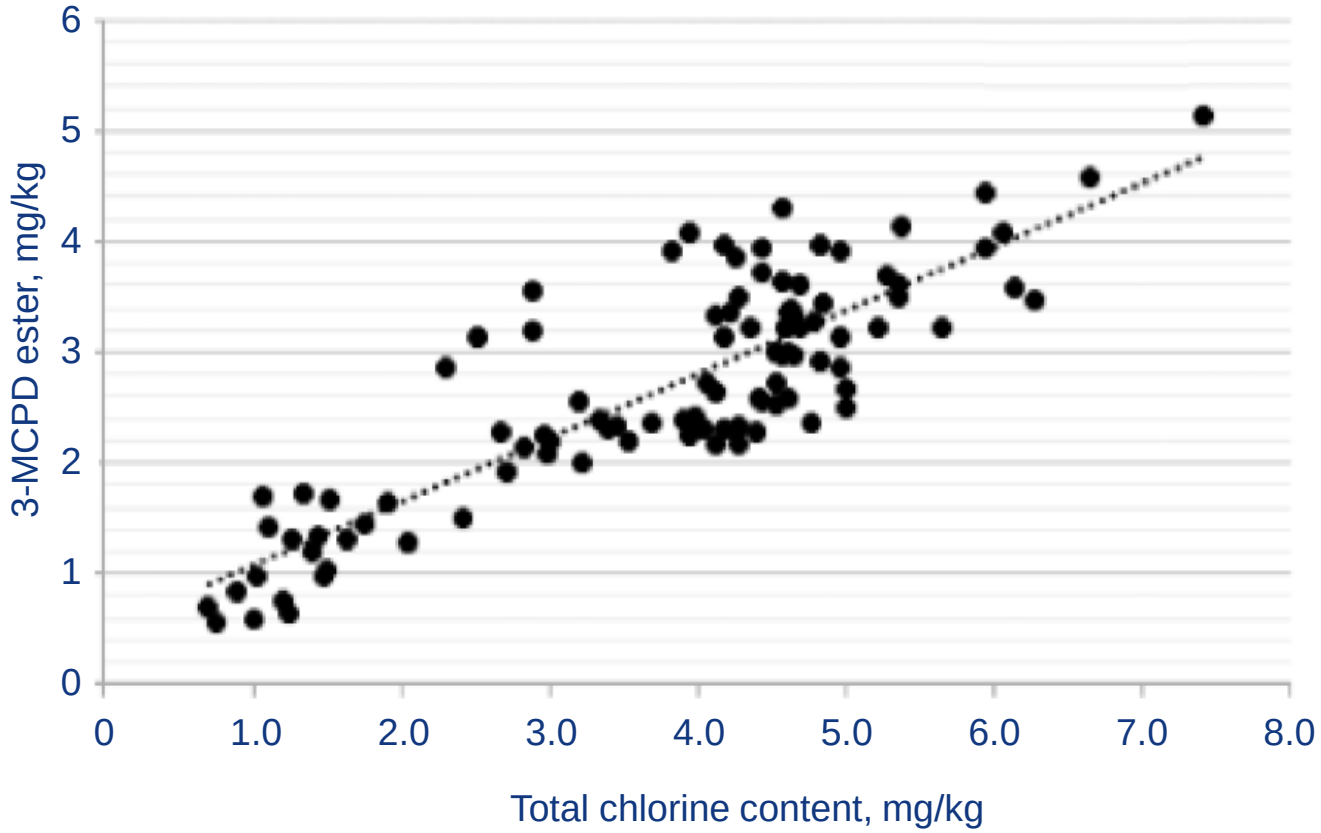
Mitigation for 3- MCPD, GE and Trans

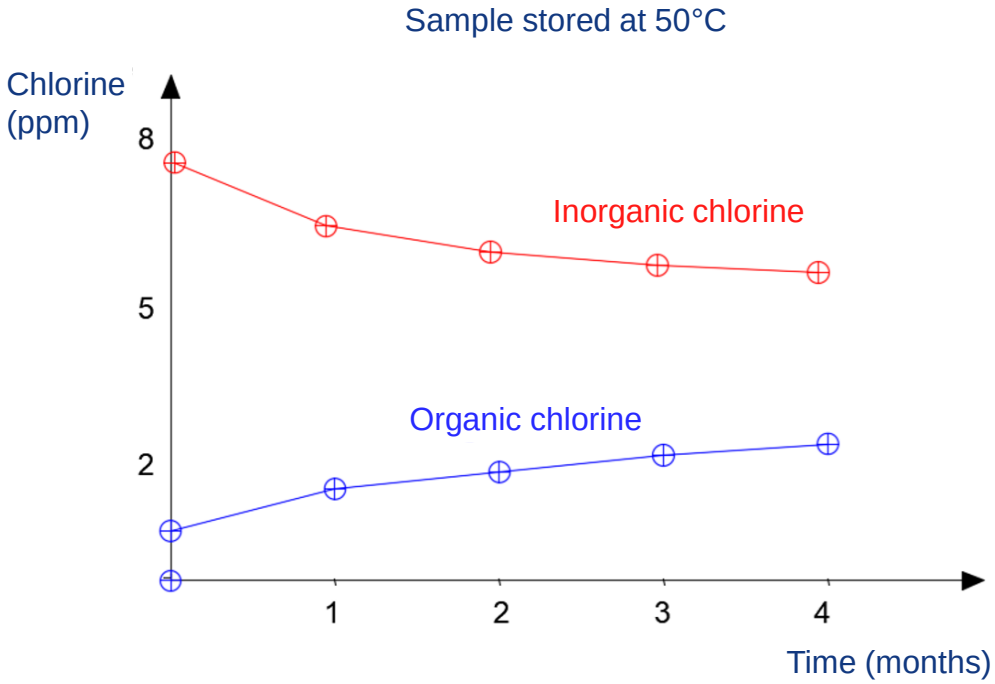
– Process Challenges

- Where and how to reduce chloride content to minimize 3-MCPD formation?
- How to fit in 3-MCPD and GE mitigation into an existing site?
- How to choose between the available GE mitigation options?
- How to prepare for stricter regulations of the maximum content of these contaminants in the future?

Mitigation of 3 MCPDE

– Precursor is Chloride

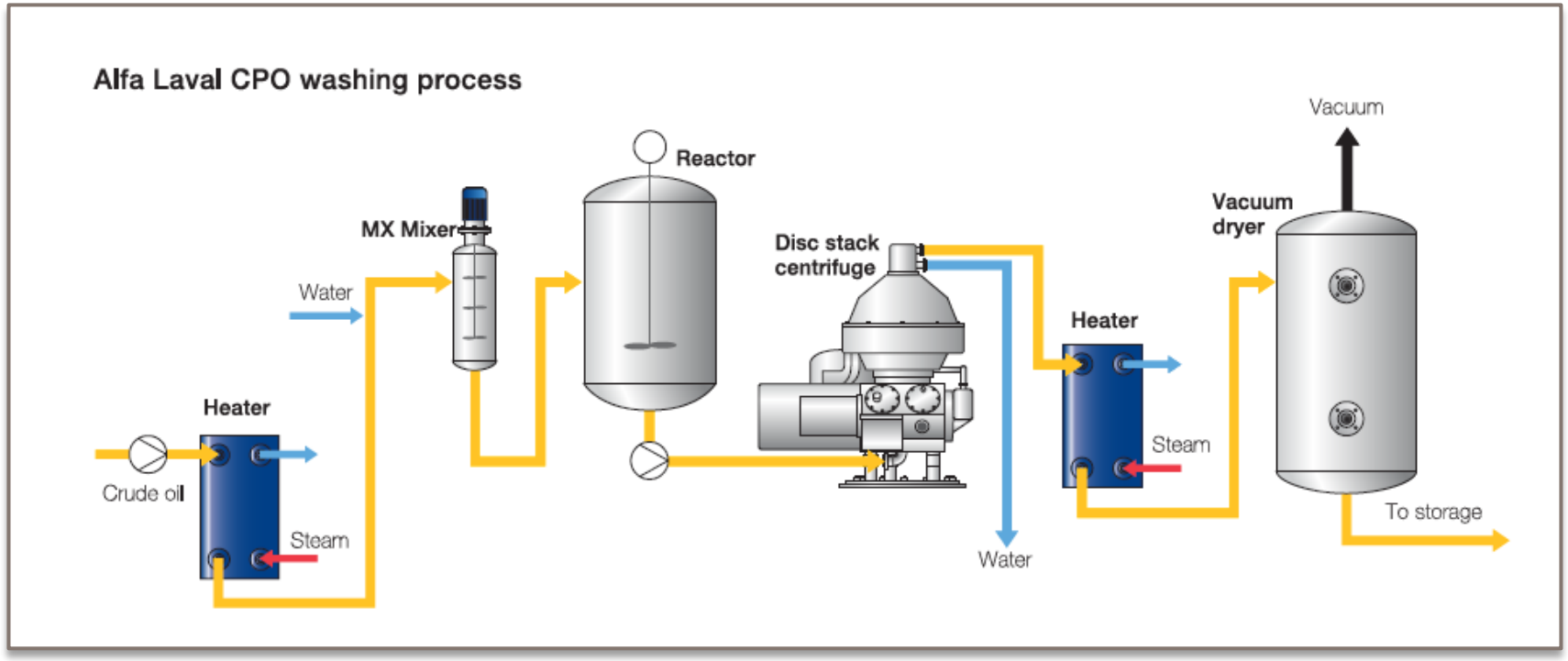




* Study done by a refinery in Italy

CPO washing

– Mitigation of 3-MCPDE with chlorides washing



Guarantee :

- (Mills) Total chlorine removal >80% of total chlorine
- (Refinery) Total chlorine removal >60% of total chlorine or >80% removal of inorganic chlorides

Mitigation of Glycidyl Ester

– Precursor is DAG

First

- Minimize formation by limiting time and temperature

Second

- Re-refine it with activated bleaching earth followed by mild Deodorization

Third

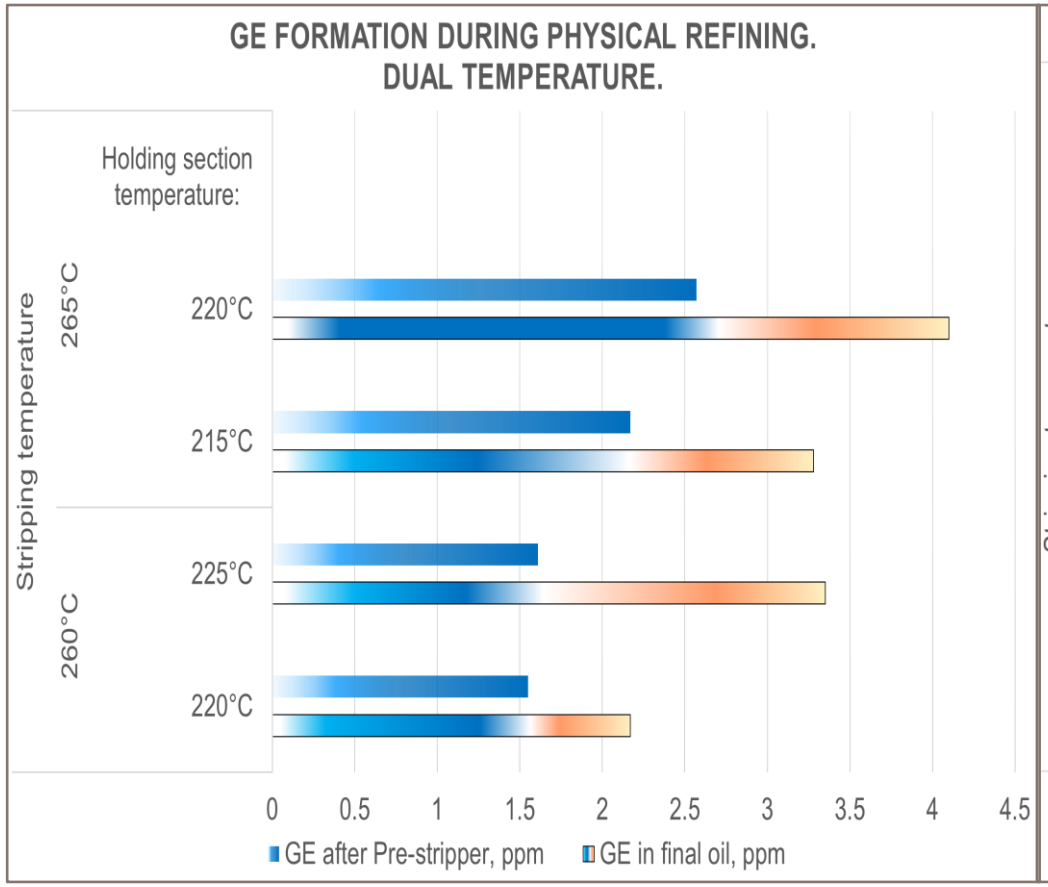
- GE Stripping

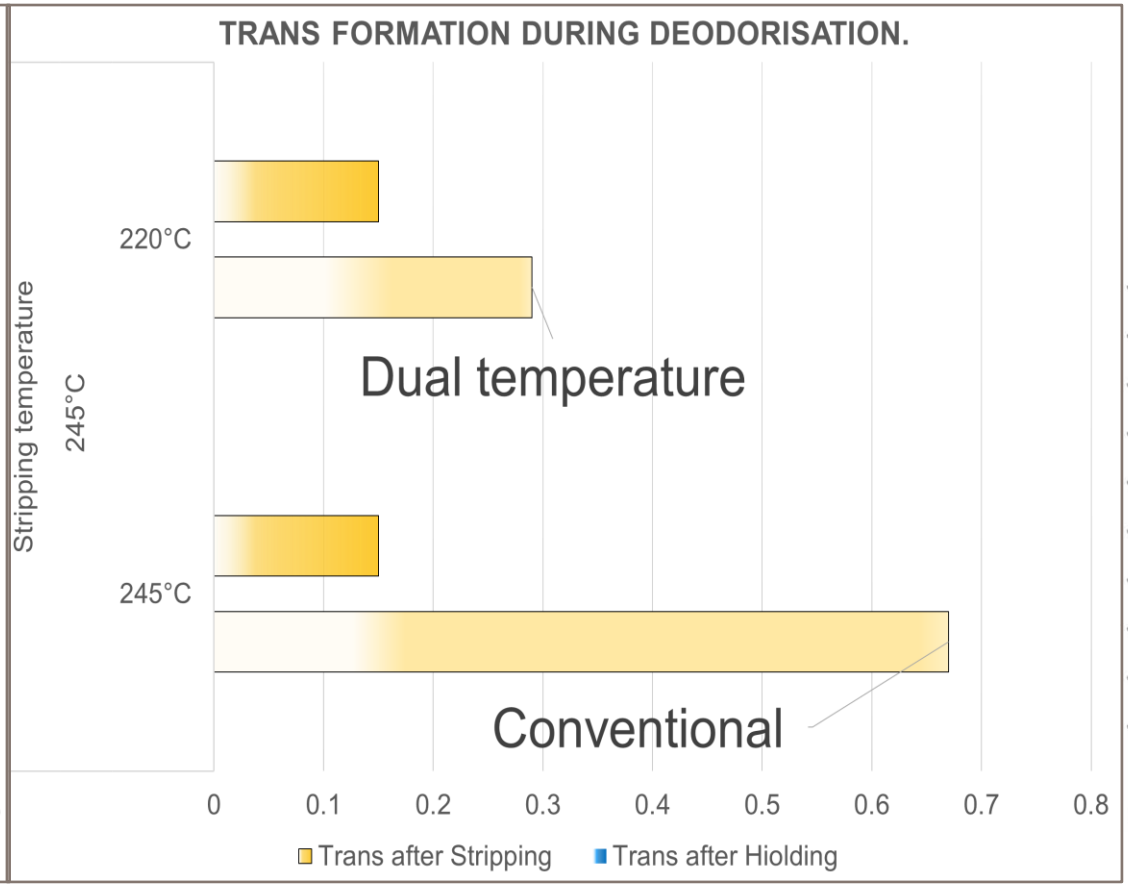
Fourth

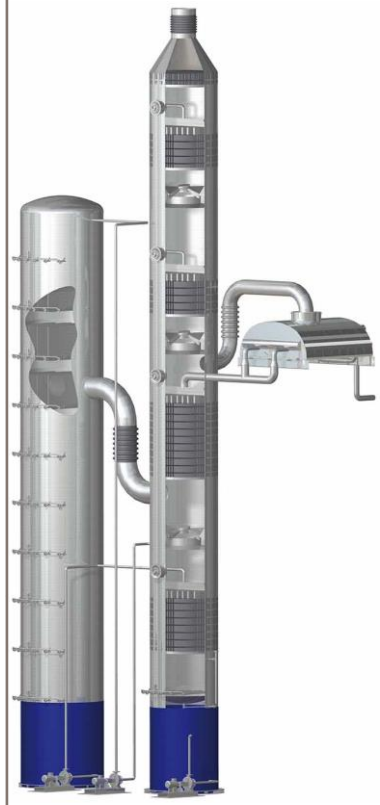
- Alfa Laval ZeroGE ™

GE Vs Trans

– Temperature is critical







Summary

– A simple solution to global challenges

3-MCPD < 2.5 ppm

- Neutralization
- Water washing of Oil

GE < 1 ppm

- Post Bleaching and Mild Deodorization
- GE Stripping
- ZeroGE™

Trans < 2%

- Soft Column Deodorizer
- Dual temperature Deodorization