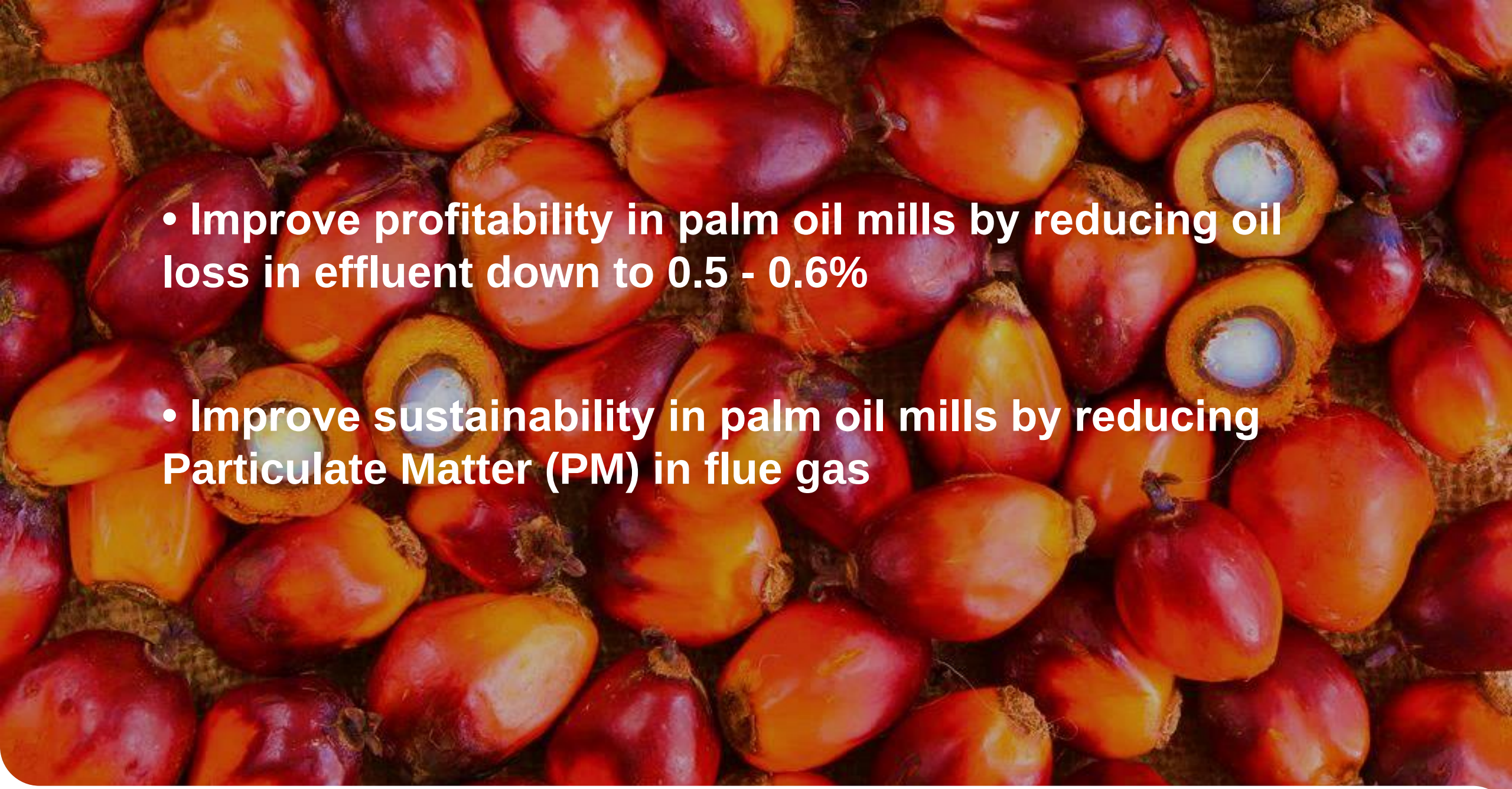
Improve sustainability and profitability in your palm oil mill

30 June & 14 July 2021


• Improve profitability in palm oil mills by reducing oil loss in effluent down to 0.5 - 0.6%
• Improve sustainability in palm oil mills by reducing Particulate Matter (PM) in flue gas

Our speakers

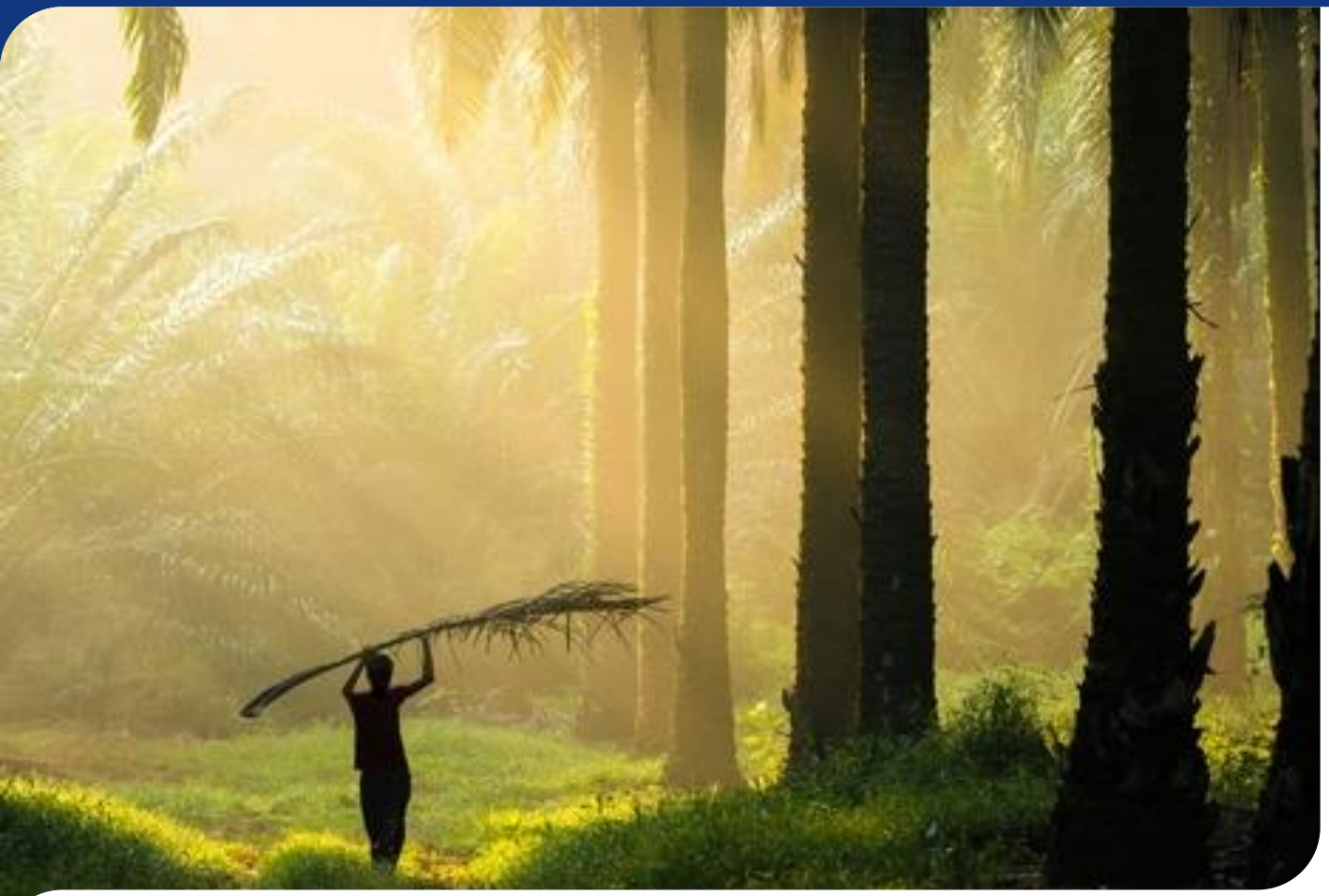
Hong Boon Kheng is a Global Sales Manager in Alfa Laval who focuses on crude palm oil and latex. He had a tertiary education in Mechanical and Automotive Engineering from Tunku Abdul Rahman College, Malaysia; and he has been with Alfa Laval for 32 years with massive experience and knowledge in high speed separators, decanter, and heat transfer business and technology under his belt.

Ir. Sellam Hmadouch received his Master's Degree in Electrical Engineering from Delft University of Technology, Netherlands. He is responsible for industrial air emission control markets for gas systems and has been with Alfa Laval for 3 years. Having developed new air emission control solutions and with more than a decade of experience in the industry, he is actively developing solutions to further improve air quality for the palm oil mill industry.

Improve profitability in palm oil mills by reducing oil loss in effluent down to 0.5 - 0.6%

Hong Boon Kheng
Global Sales Manager

Current challenges in palm oil mills



- Oil loss to effluent is average at 0.8-1.5%
- Low quality and value of sludge oil from pond
- Lack of final oil recovery mechanism to prevent oil spillage
- Efficiency oil recovery in De-oiling tank varies/fluctuate

Potentials of oil recovery in palm oil mills

Table 1 Estimation of oil losses in palm oil mills

Source	Oil loss (% on FFB)
Fruit trapped in empty fruit bunches (EFB)	0.02
Unstripped bunches (USB)	0.05
Oil absorbed on the surface of EFB	0.45
Condensate from sterilisation	0.10
Nut surface after pressing	0.05
Pressed fibre after pressing	0.55
Sludge from separator	0.45
General oil spillages or washing from tanks	0.10
Total oil losses	1.77

Total Oil Recovery Potential
= ~ 1.0% to fresh fruit bunches (FFB)

Source: International Journal of Biomass & Renewables, 9(1) : 10 - 24, 2020

Key technologies that enable efficient recovery

- Heat Treatment - enhancing emulsion breaking
- High G-force separation

Stokes´ Law

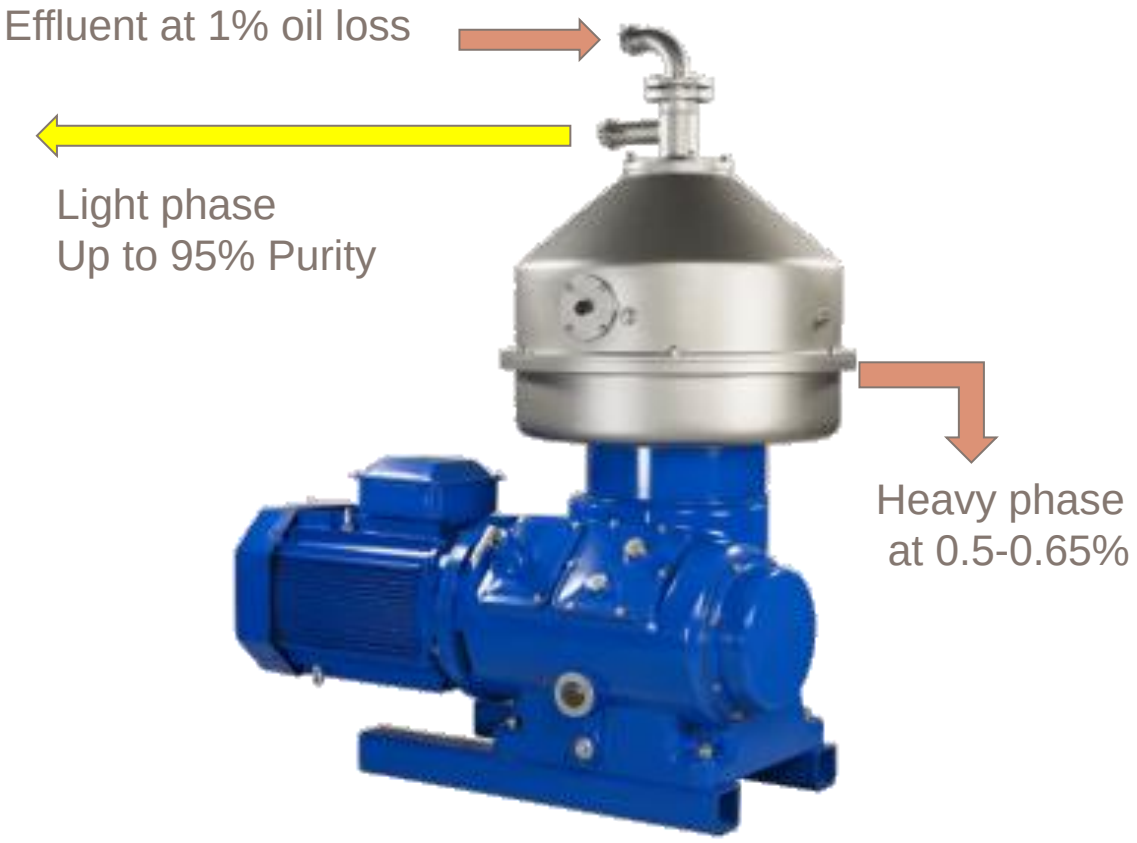
$$V_g = \frac{d^2(\rho_p - \rho_l)}{18\eta} g$$

- Chemical Treatment (optional)

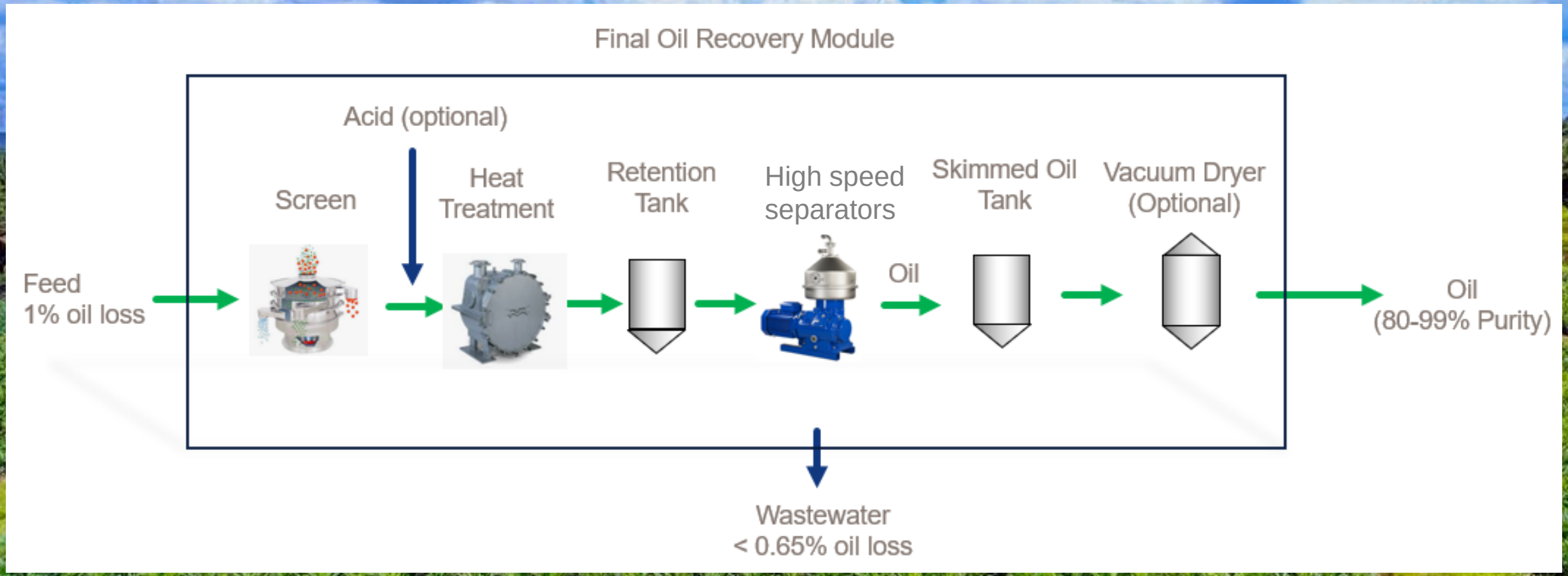
Oil recovery potential with Final Oil Recovery Module

From 1% oil loss to 0.5-0.65% oil loss:
(Assuming 0.65%)

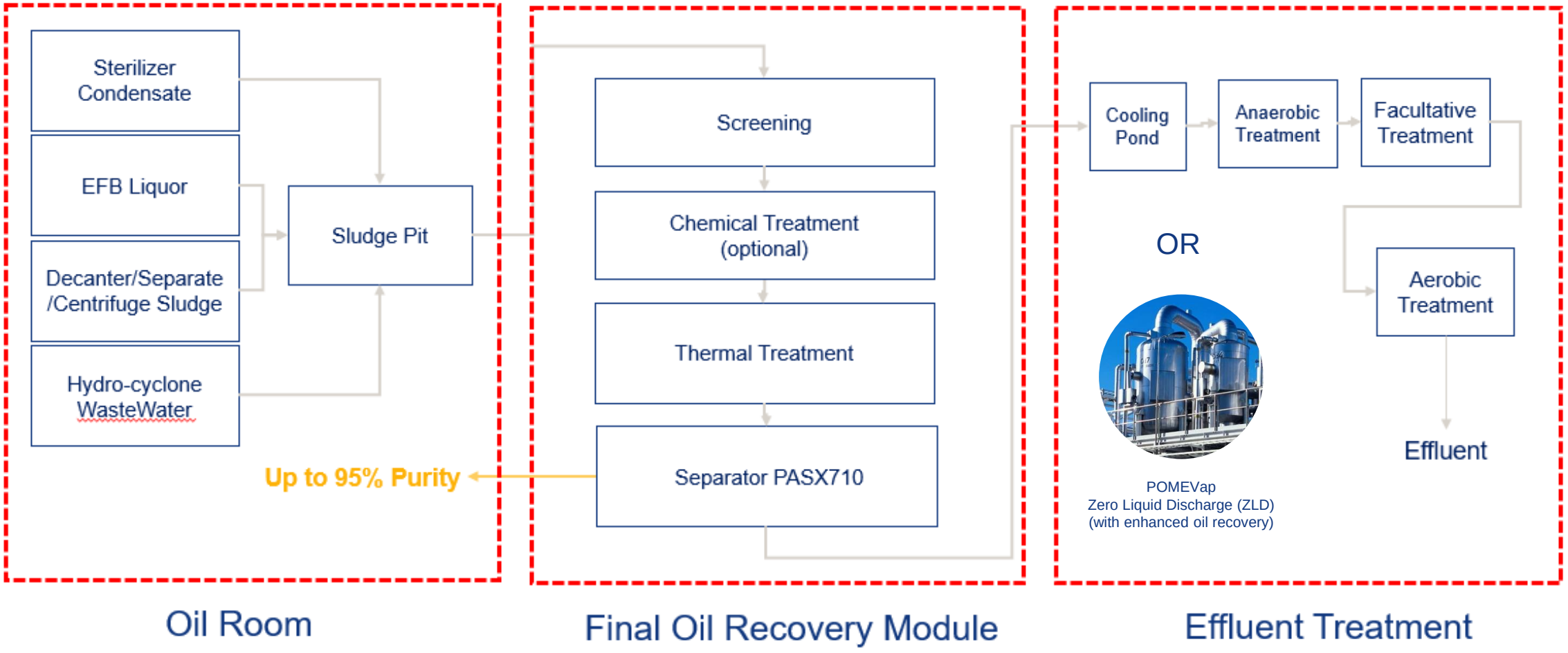
- Additional oil Recovery: approx. 0.35% on sample
- Effluent to FFB Volume : approx. 85%
- Total Oil Recovered : 85% x 0.35% x FFB
- OER% improvement : approx. 0.3%



Recovering more oil with Final Oil Recovery Module

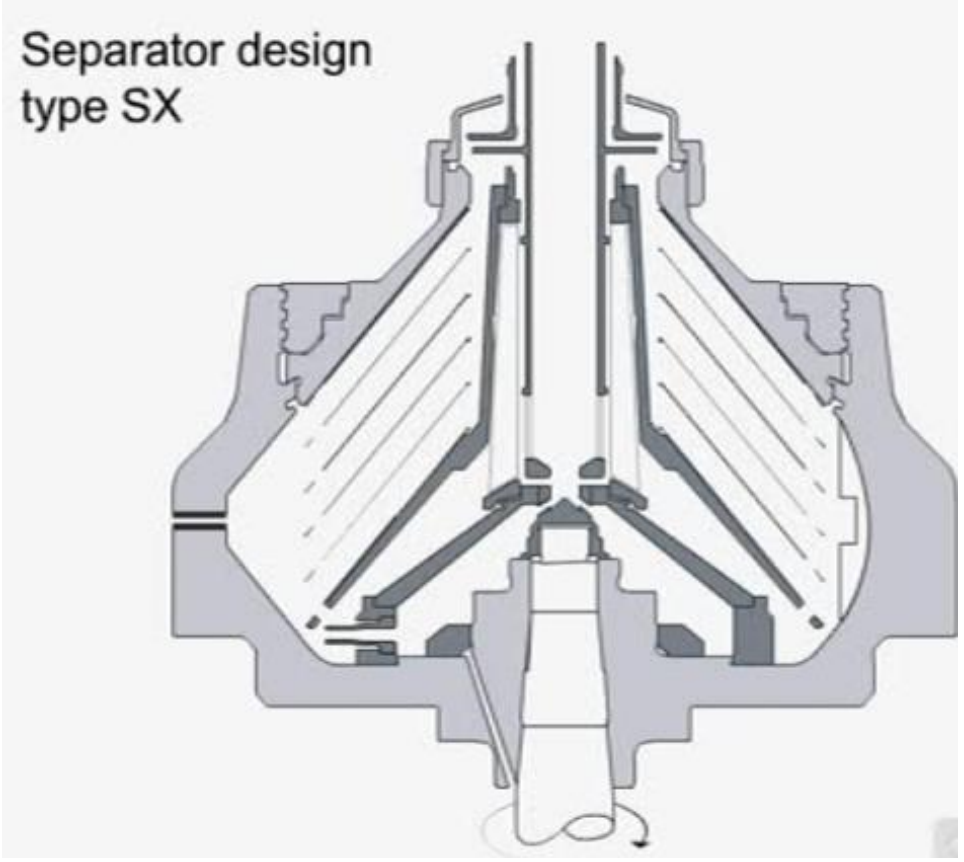


Complete processes of Final Oil Recovery Module



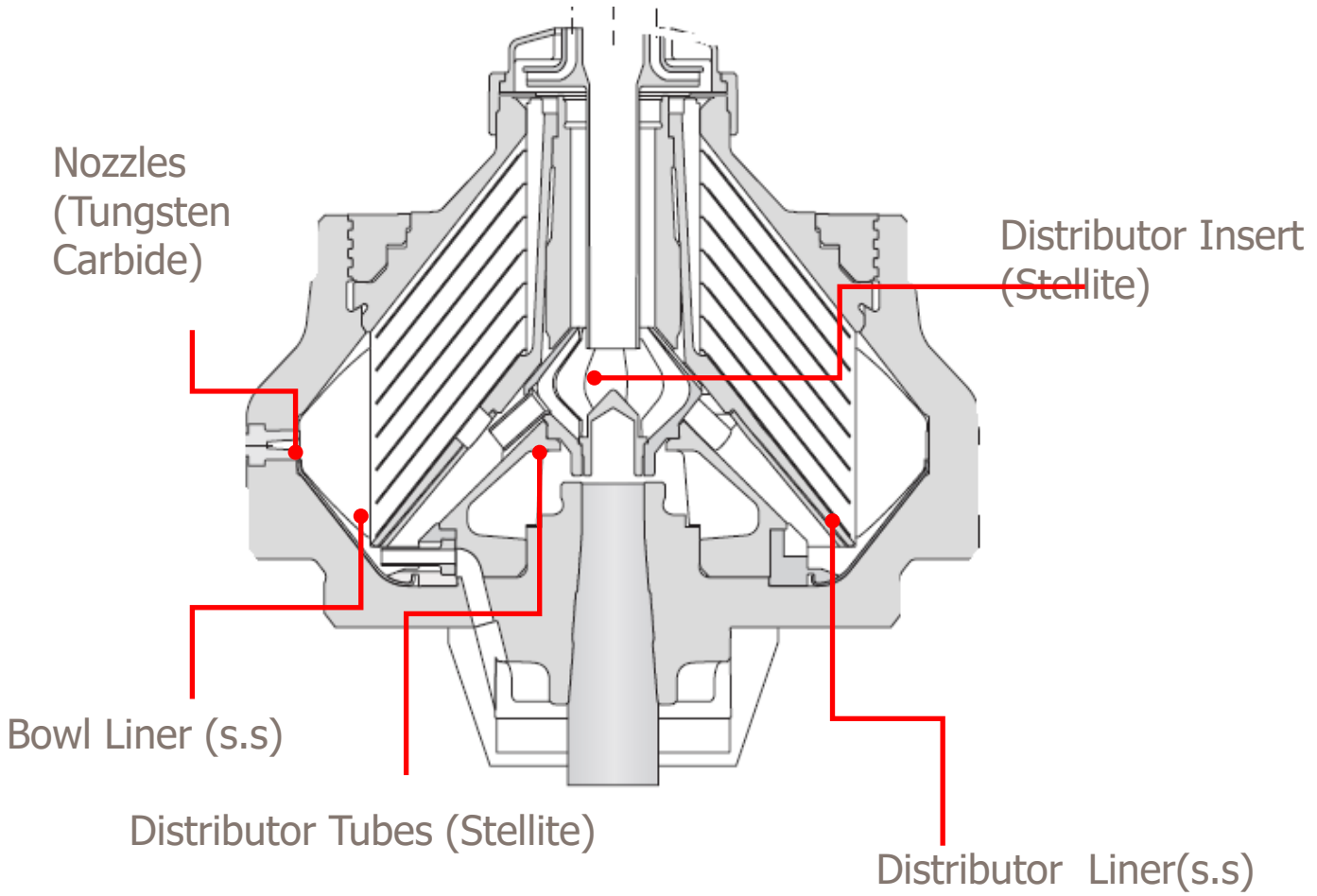
Efficient oil separation with specially designed SX710+

- Improved effective area for separation
- Improved G-force with higher speed
- VFD startup to reduce power consumption
- Vibration monitoring

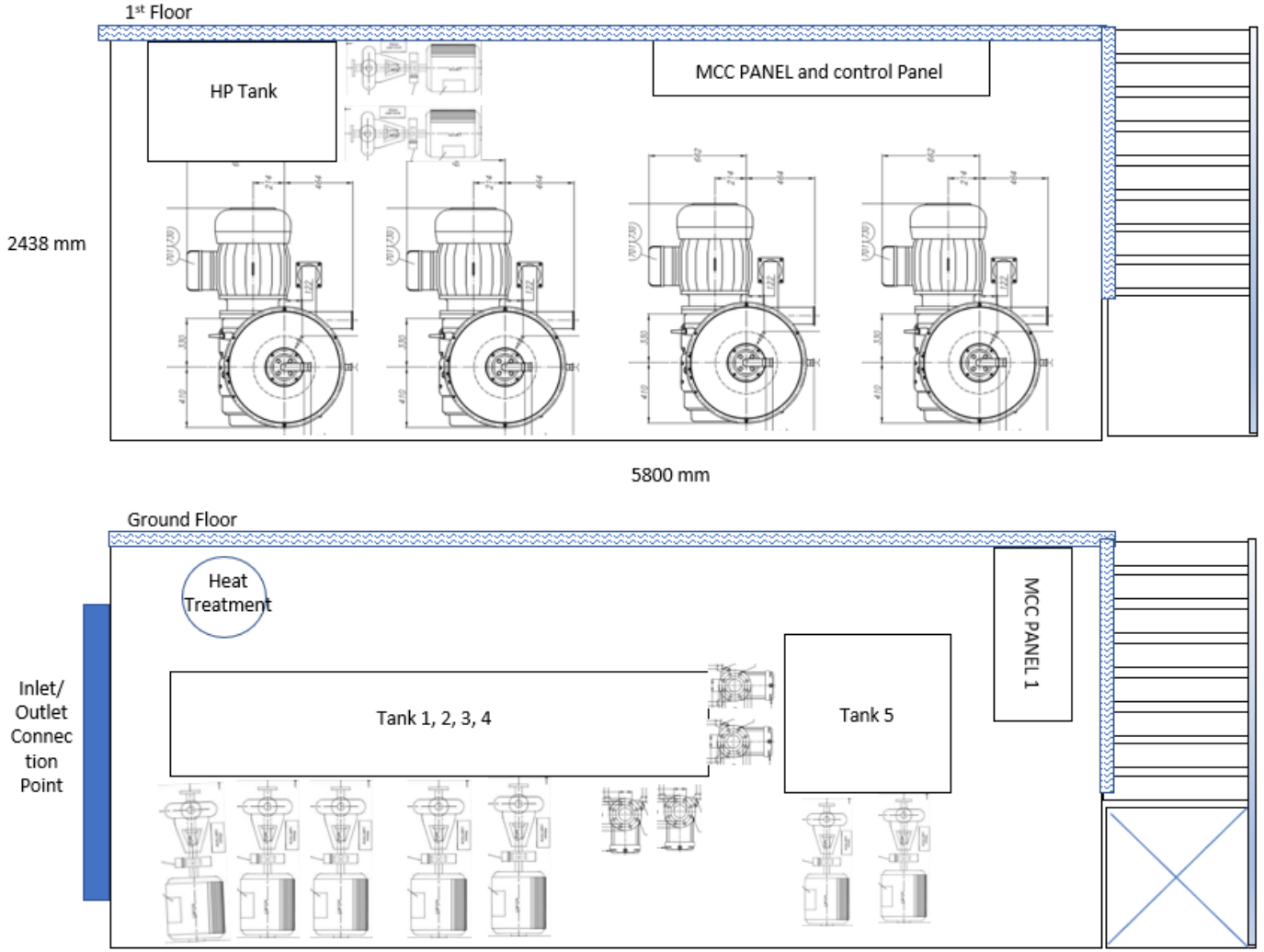


Wear protection to reduce wear and tear

− Designed to include wear protection to handle erosion



Saving footprints and installation cost with modular design



Models –

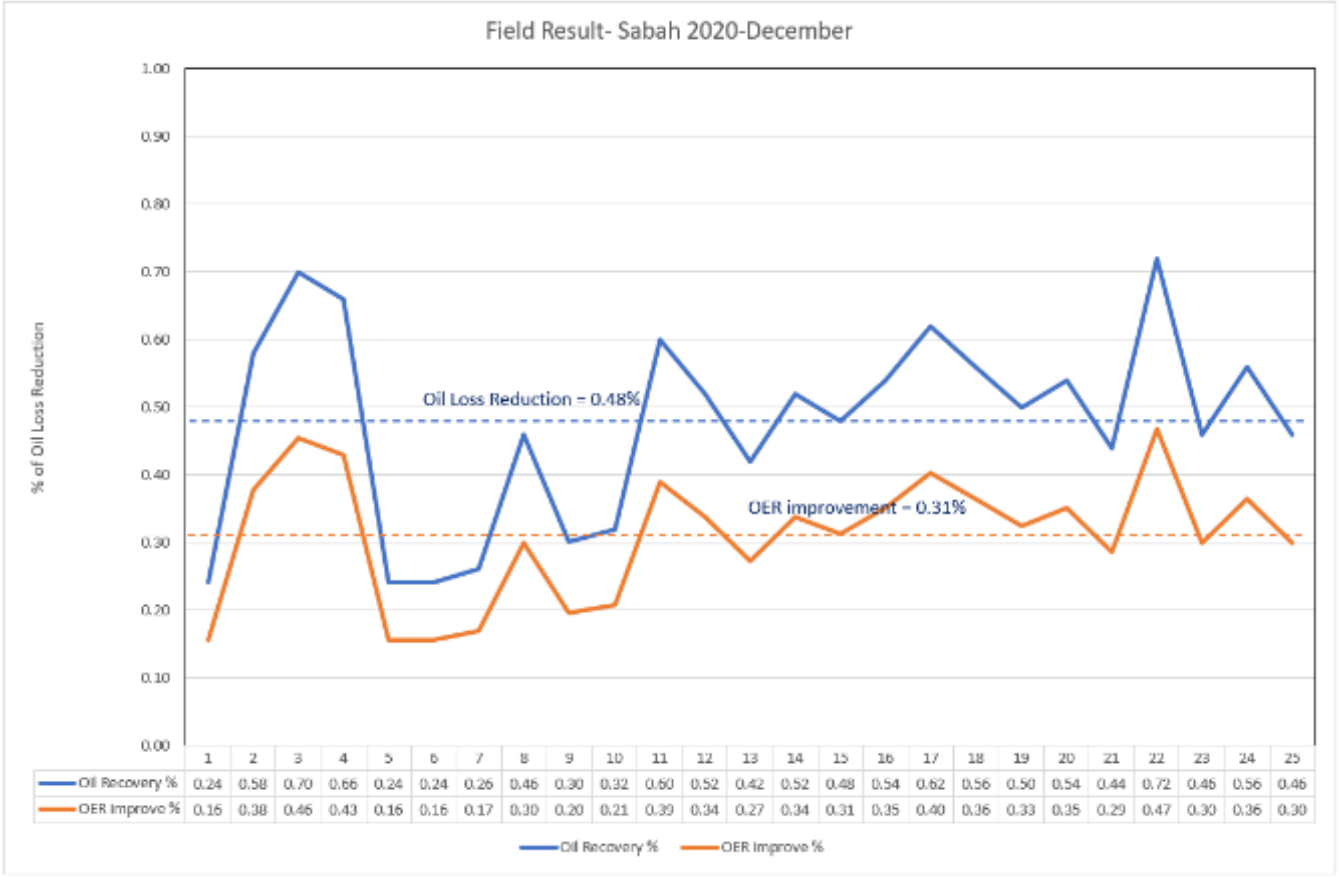
1. ALFORM-45 (45 m^3/h)
2. ALFORM-30 (30 m^3/h)
3. ALFORM-15 (15 m^3/h)

Improvement of performance with Final Oil Recovery Module

- **Reference from palm oil mill in Sabah**

  - average oil loss reduction by 0.48%

  - average oil extraction rate (OER) percentages improved by 0.31%



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Oil Recovery %	0.24	0.58	0.70	0.66	0.24	0.24	0.26	0.46	0.30	0.32	0.60	0.52	0.42	0.52	0.48	0.54	0.62	0.56	0.50	0.54	0.44	0.72	0.46	0.56	0.46
OER Improve %	0.16	0.38	0.46	0.43	0.16	0.16	0.17	0.30	0.20	0.21	0.39	0.34	0.27	0.34	0.31	0.35	0.40	0.36	0.33	0.35	0.29	0.47	0.30	0.36	0.30

Fast payback in less than 1 year

- Average oil extraction rate (OER) percentages improved by 0.3%
- Oil recovered per day ~ 3.6 ton per day (20 working hour)

- Estimated annual income (60 tonnes FFB/h) = 0.3% x 60 t FFB/h x 6000 working hours x USD850 / ton
- = **USD918k per annum**

- **Payback <1 year including maintenance cost**

Summary of the key benefits of Final Oil Recovery Module

- Simple, efficient and quantifiable recovery (with flowmeter)
- Containerized Module – save footprints
- Recovering oil at high quality
- Fast payback < 1 year
- Act as final oil gatekeeper

Reducing particulate matter (PM) emissions in palm oil mills with Alfa Laval MultiScrubber PM

Ir. Sellam Hmadouch
Product Expert – Exhaust Gas Cleaning

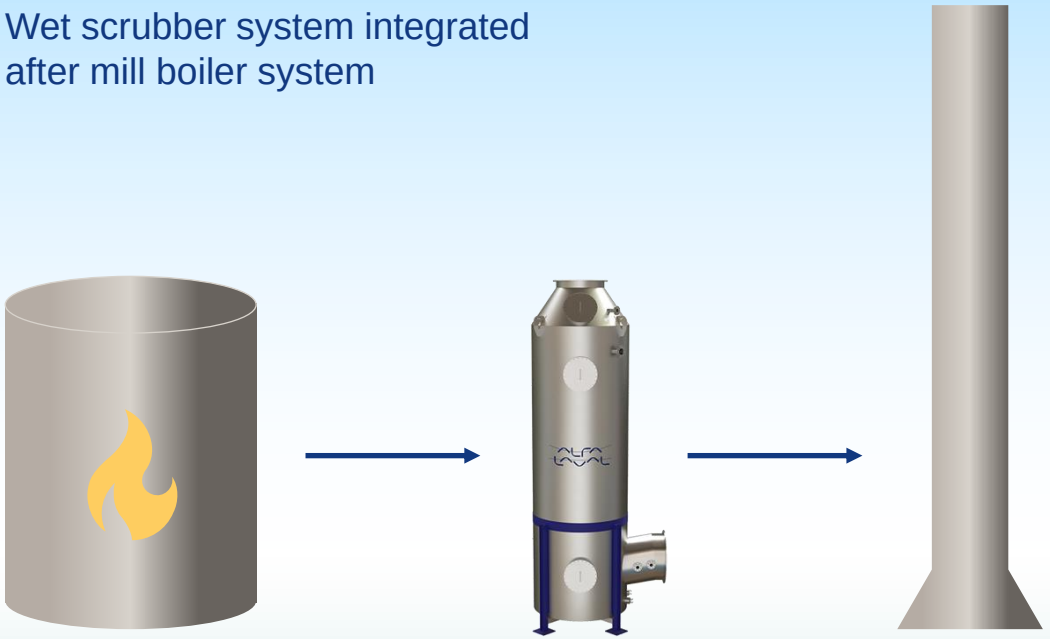
Industry challenges in the palm oil industry

- Yield of palm oil and biofuel
- Sustainability
  - Waste and effluent
  - Emissions
- Maintaining profitability
- Malaysian Department of Environment

  - Environmental Quality:
    Clear Air Regulation (CAR) 2014
  - PM emissions limit 150 mg/Nm^3
  - POM compliance deadline

Reducing particulate matter from POM emissions

Wet scrubber system integrated
after mill boiler system



Main PM emissions reduction technologies available to POMs

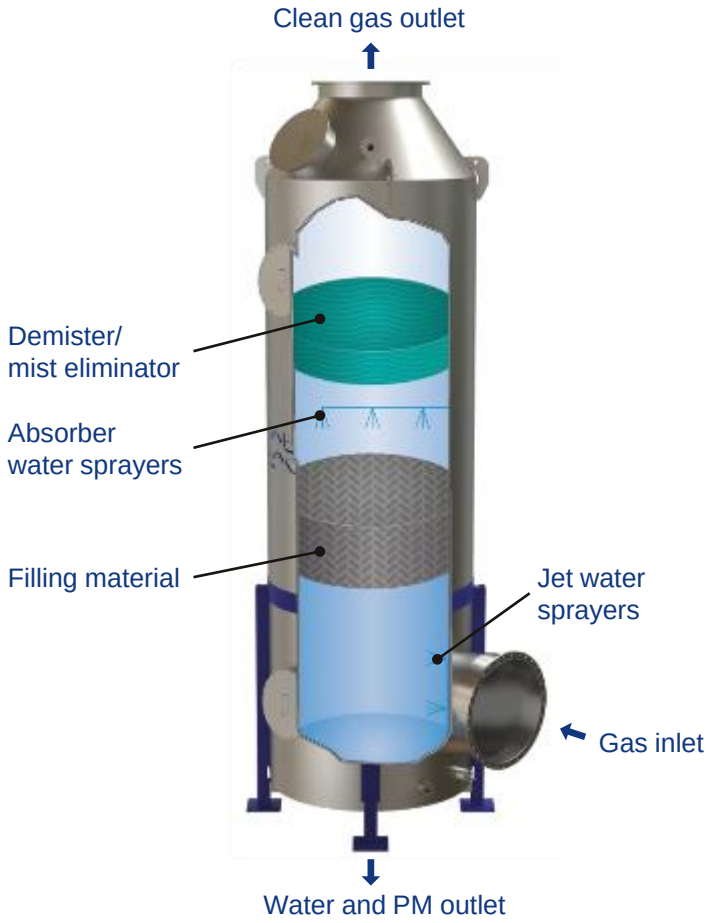
1. Wet scrubber systems
2. Electrostatic precipitators (ESP)
3. Bag filters
4. Vortex tube separators

1. Wet scrubber systems

− Reducing particulate matter from POM emissions

Flue gas sprayed with water to capture PM, which is separated from the water enabling water reuse

- Up to 99% removal of PM
- Requires high grade material
- Very simple and stable system
- Particle removal efficiency unaffected by fluctuating gas load
- Relatively low capital cost
- Relatively low pressure drop



2. Electrostatic precipitators (ESP)

− Reducing particulate matter from POM emissions

Particles are separated from flue gas stream by very high voltage and collect on plates, which are periodically cleaned

- Sensitive to fluctuation of PM concentration
- Relatively large footprint
- High capital cost
- Requires educated staff specializing in high voltage systems to operate and maintain

3. Bag filters

− Reducing particulate matter from POM emissions

Particles are captured in filter fabric, which is automatically cleaned at regular intervals

- Simple technology
- High PM reduction efficiency
- Flue gas often needs pre-treatment
- Limited gas temperatures
- Relatively high pressure drop

4. Vortex tube separator

− Reducing particulate matter from POM emissions

Centrifugal force swirls the gas instream in the tubes, pushing PM to the outside

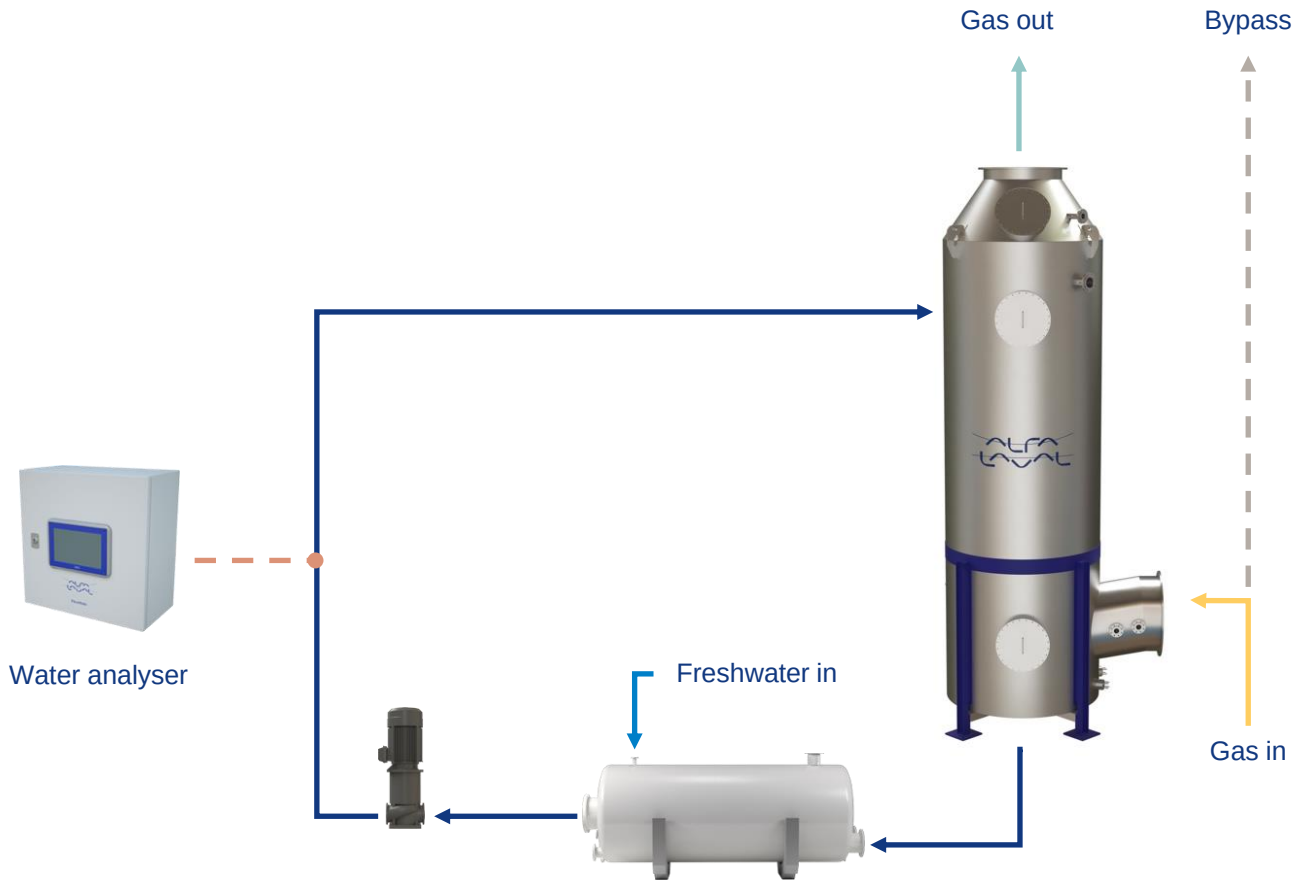
- Ideal for high temperatures, high dust loads
- Minimal velocity required for proper operation
- Training required for staff to operate and maintain
- Less efficient in removing PM than wet scrubbers or ESPs

Alfa Laval Multiscrubber PM

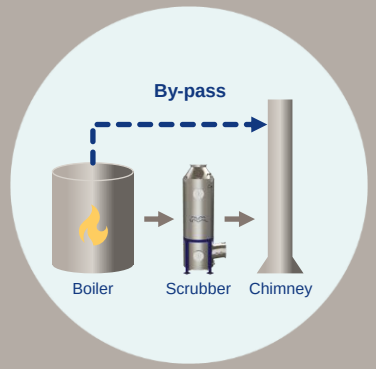
- A complete solution for POM emissions compliance
- Based on proven, reliable technologies
- Simple to install, operate and maintain
- Good for new and existing plants
- Helps palm oil mills achieve sustainable operations

Proven solution with Alfa Laval MultiScrubber PM

- Reductions in PM emissions well below 150 mg/Nm^3
- Full CAR 2014 compliance
- Closed loop system
- Minimal effluent
- Low-cost investment
- Safe and simple to install, operate and maintain with only basic training
- Optional deplume application



Some options of Alfa Laval MultiScrubber PM



Bypass mode

Ensures more uptime

Decanter

De-waters sludge on site

DeSOx

Reduces emissions SOx content

DePlume

Reduces or removes visible plume

Benefits of Alfa Laval MultiScrubber PM

CAR 2014 compliance

PM reduction well below 150 mg/Nm^3

Minimal effluent

Closed system, less wastewater

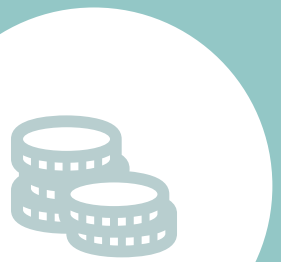
Less space

Up to four times more compact than other technologies

Simplicity

Easy to install, operate and maintain

Benefits of Alfa Laval MultiScrubber PM (cont.)



Economical

Up to two times more economical than other technologies

One-stop shop

Broad product portfolio

Local when you need us

SE Asia presence and service network

Global when it counts

Global expertise, financially stable

Reference case: 45 t/h biomass boiler

− Alfa Laval MultiScrubber PM

PM at outlet

< 150 mg/Nm³

Water consumption

1 m³/h

Power consumption

40 kWh

Cr

Material

High-grade stainless steel

Scrubber production of Alfa Laval MultiScrubber PM

- Manufactured at our own dedicated scrubber production facility
- Quality production
  - Onsite laboratory ensures steel & weld quality for corrosion-resistant scrubber
  - Inhouse welding school
- Short lead times due to well-established supply chain

Scrubber production facility in Alfa Laval

Dedicated scrubber production facility

In-house welding school

Alfa Laval quality control

Global knowledge centre in Netherlands and R&D in Denmark

Alfa Laval Test & Training Centre

- R&D
- Full-sized scrubber available
- Demos and trials upon request

Global scrubber development centre in the Netherlands

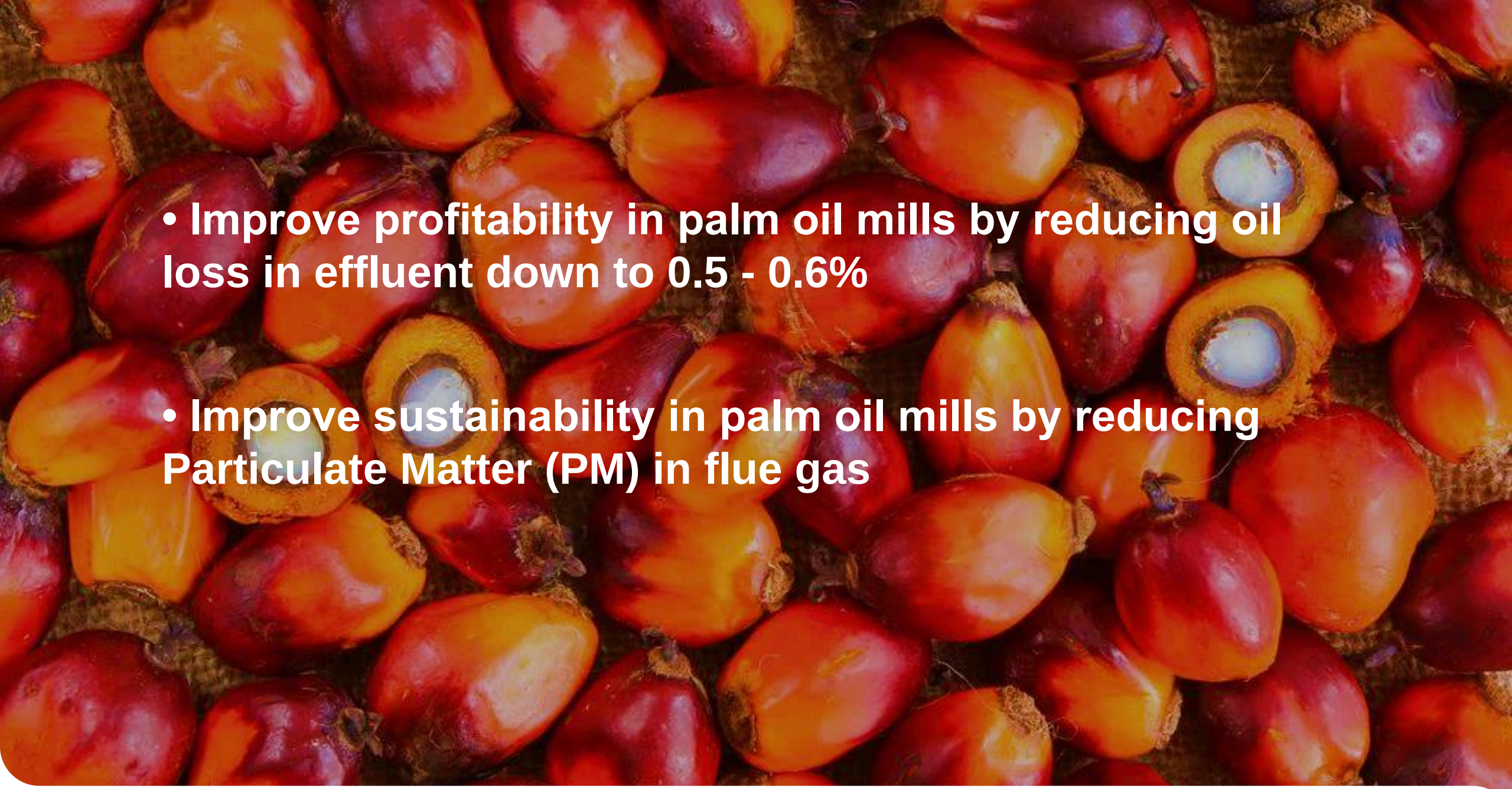
Alfa Laval Test & Training Centre in Aalborg, Denmark

Why Alfa Laval?

- World leader in separation, heat transfer and fluid handling
- Trustworthy, financially stable partner
- Global expertise, local presence
- Reducing PM emissions to well below 150 mg/Nm^3
- > 500 scrubber installations worldwide
- Commitment to sustainability

Summary of the key benefits of Alfa Laval Multiscrubber PM

- Proven and reliable
- Economical
- Easy to operate and maintain
- Cleaner air – good for people, good for your business, good for our planet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