# Desmet Ballestra Group

## *IChemE POP SIG evening – 29th Feb 2016 Kuala Lumpur*

■ Oils & Fats Processes ■

■ Detergents, Chemicals & Oleochemicals Technologies ■

■ Oilseeds & Feedmill Equipment ■

*Science behind Technology*

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# Crude Palm Oil Processing

- **PHYSICAL REFINING**
- **DRY FRACTIONATION**

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# Overview

Crude Palm Oil

Physical Refining Plant

Palm Fatty Acid Distillate

Bulk Oil

RBD Palm Oil

Dry Fractionation Plant

RBD Olein

RBD Stearin

Bottled Oil

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# Typical Properties of Crude Palm Oil

| PROPERTIES | MEAN VALUES |
|---|---|
| Saponification Value (mg KOH/g oil) | 197 |
| Unsaponification Matters (%) | 0.70 |
| Iodine Value (Wijs) | 52.5 |
| Slip Melting Points ( $^0$C) | 36.4 |
| Peroxide Value (meq/kg) | 2.80 |
| Anisidine Value | 3.3 |
| Carotenoids (ppm) | > 600 |
| DOBI | 2.70 |
| Copper (ppm) | 0.12 |
| Iron (ppm) | 4.0 |
| Phosphatides (ppm) | 700 |
| Free Fatty Acid (% as palmitic) | 5 |

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# STAGES IN PHYSICAL REFINING

**CPO**

Pretreatment

Bleaching

Deodorisation

**RBDPO**

**PFAD**

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***Dry Fractionation*: separation of solid and liquid portion of the oil via crystallisation and filtration**

Crystallisation

Filtration

**FRACTIONATION**

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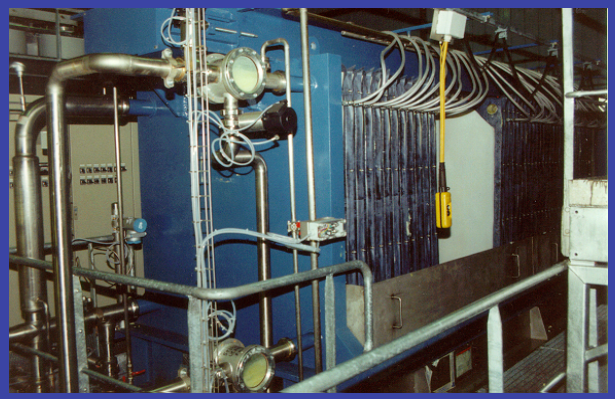
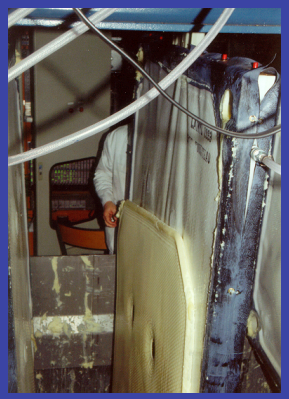
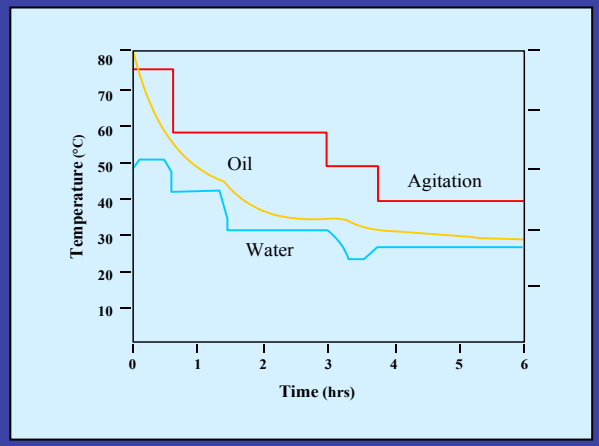




RBD PO → Crystallisation → Filtration → Solid Stearin

Filtration → Liquid Olein



# FRACTIONATION

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# *CONTINUOUS FRACTIONATON*

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# POINTS TO NOTE:

- Fractional crystallisation is basically a process of heat and mass transfer
- traditional Palm Oil Dry fractionation has been carried out in batch process with CSTR
- Homogenous oil is subjected to pre-set cooling program to crystallise the required solid fractionation to the desire product quality
- Process not optimised and subject to batch variation

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## Equipment Design:

-Process adapt to crystalliser design Vs crystalliser design for process

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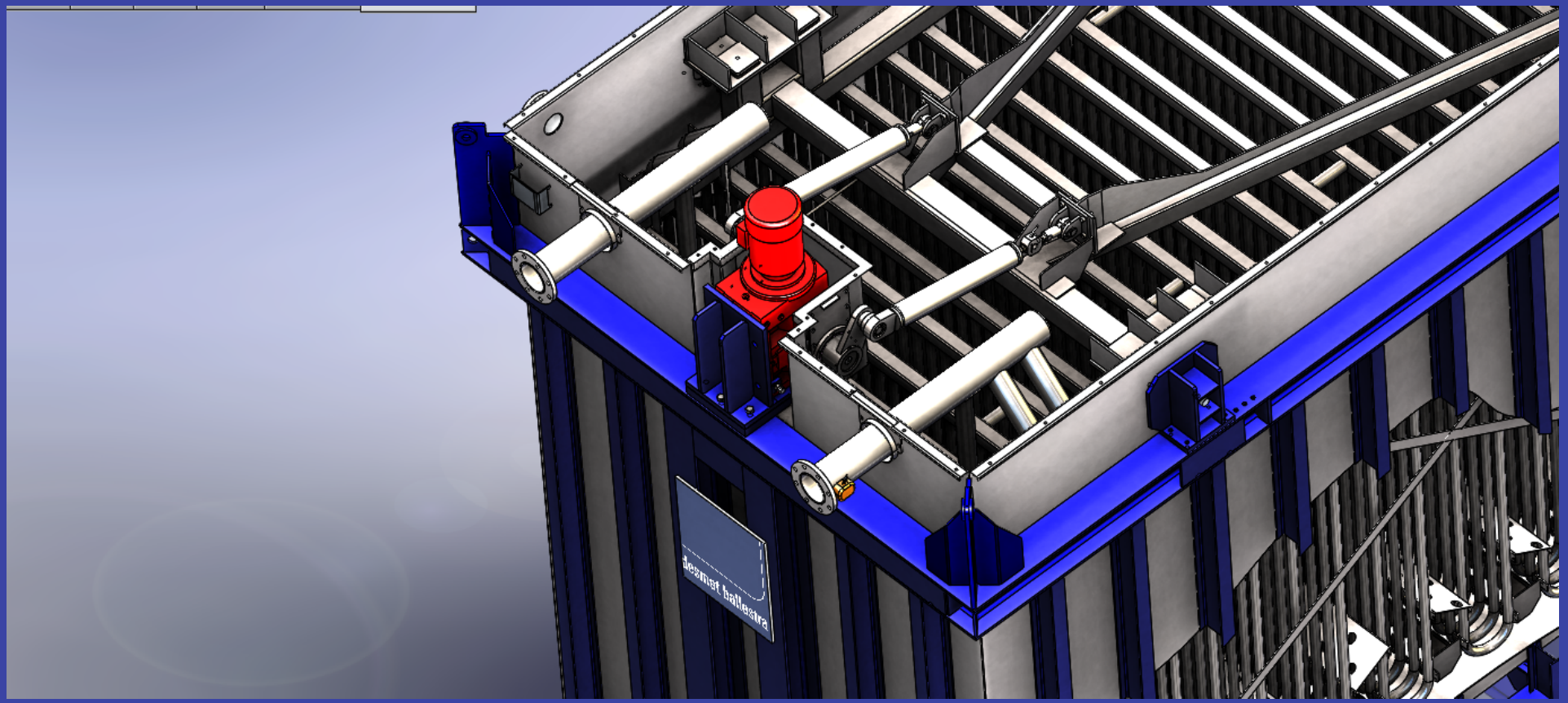


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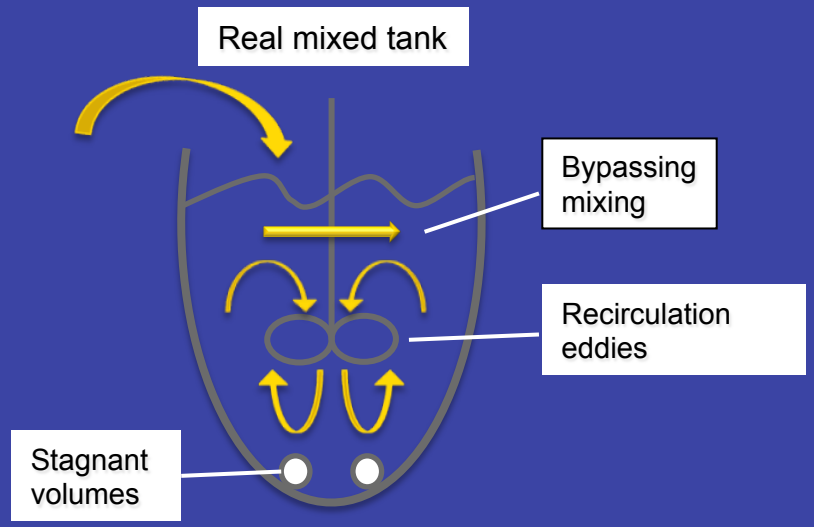
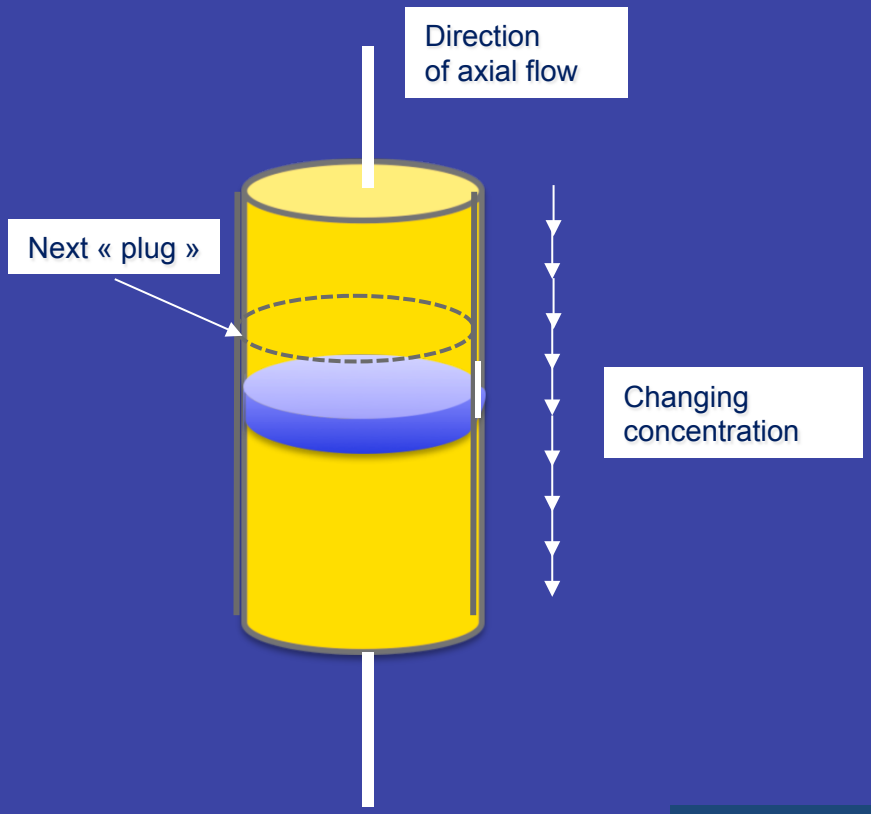
# Reactor Designs

- Stirred Tank Reactor (STR) vs. Plug Flow Reactor (PFR)

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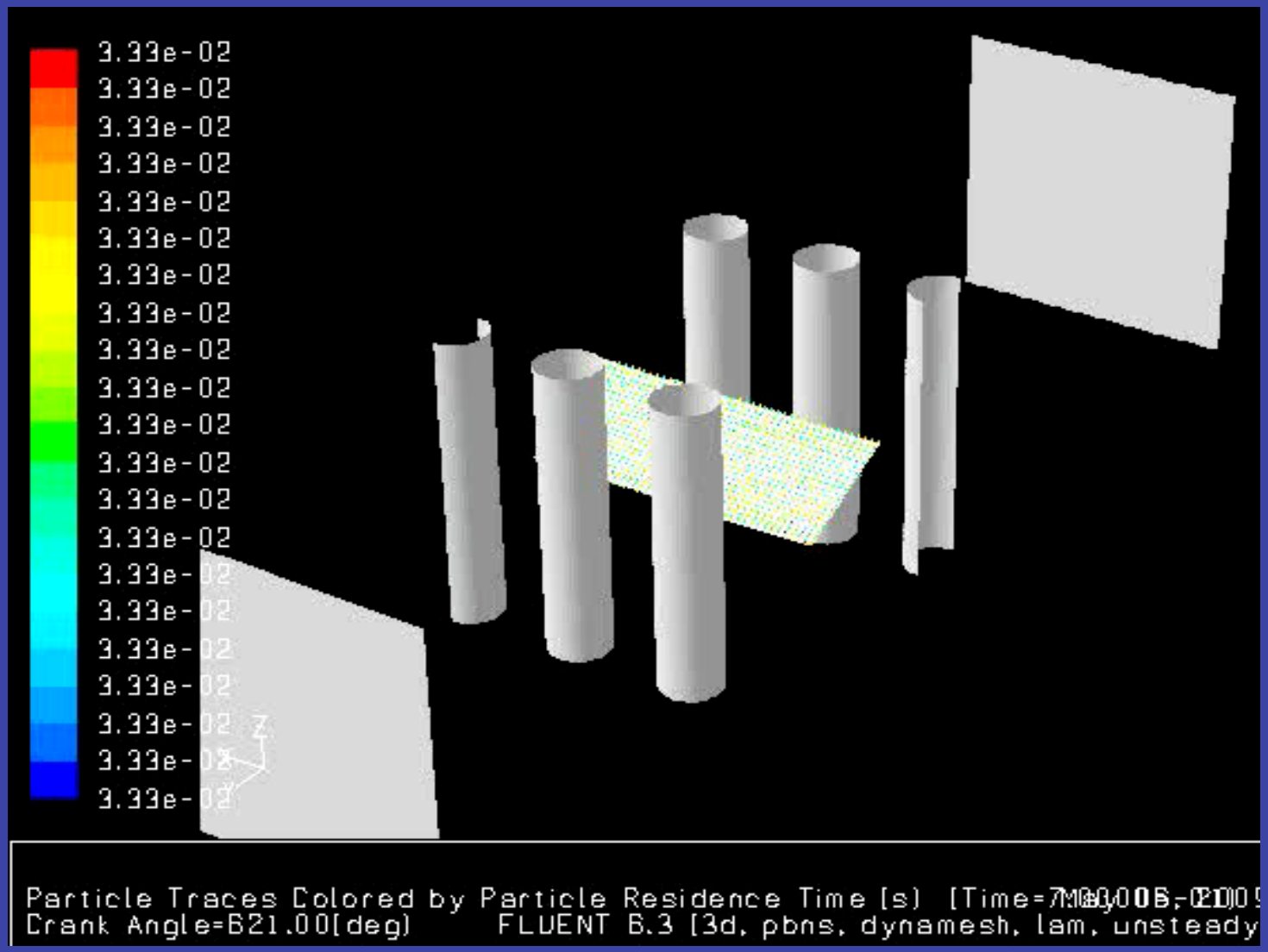


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# *INDUSTRIAL RESULTS and EXPERIENCES*

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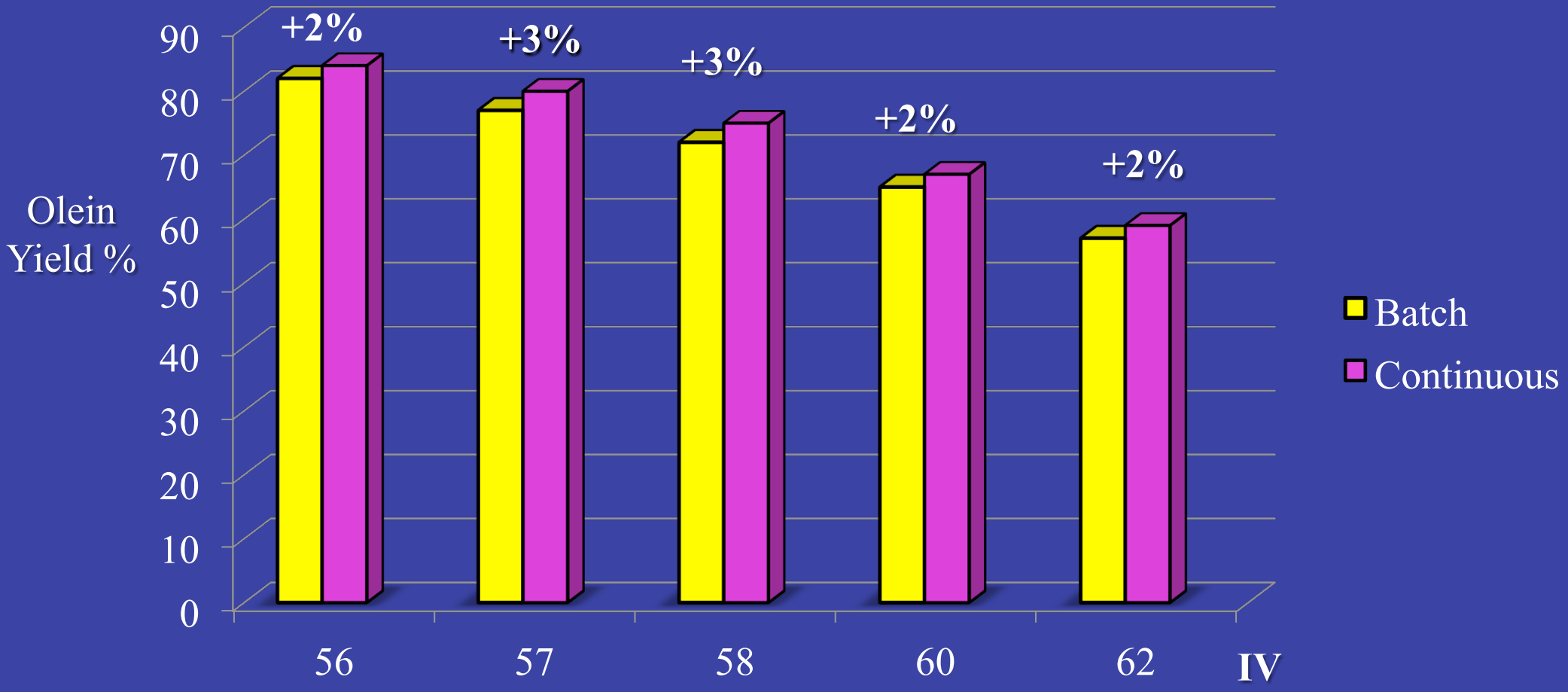
# OLEIN YIELD FOR RBD PALM OIL

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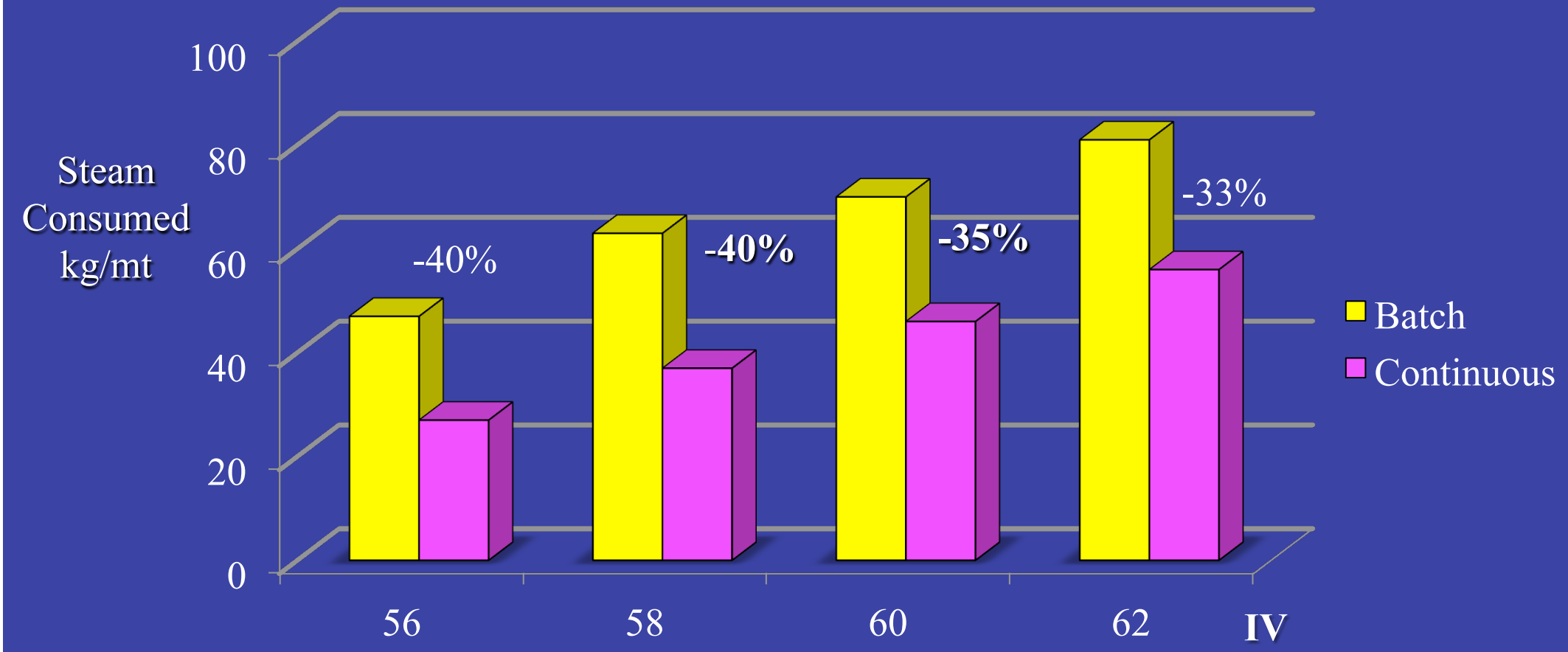
# STEAM CONSUMPTION FOR RBD PALM OIL

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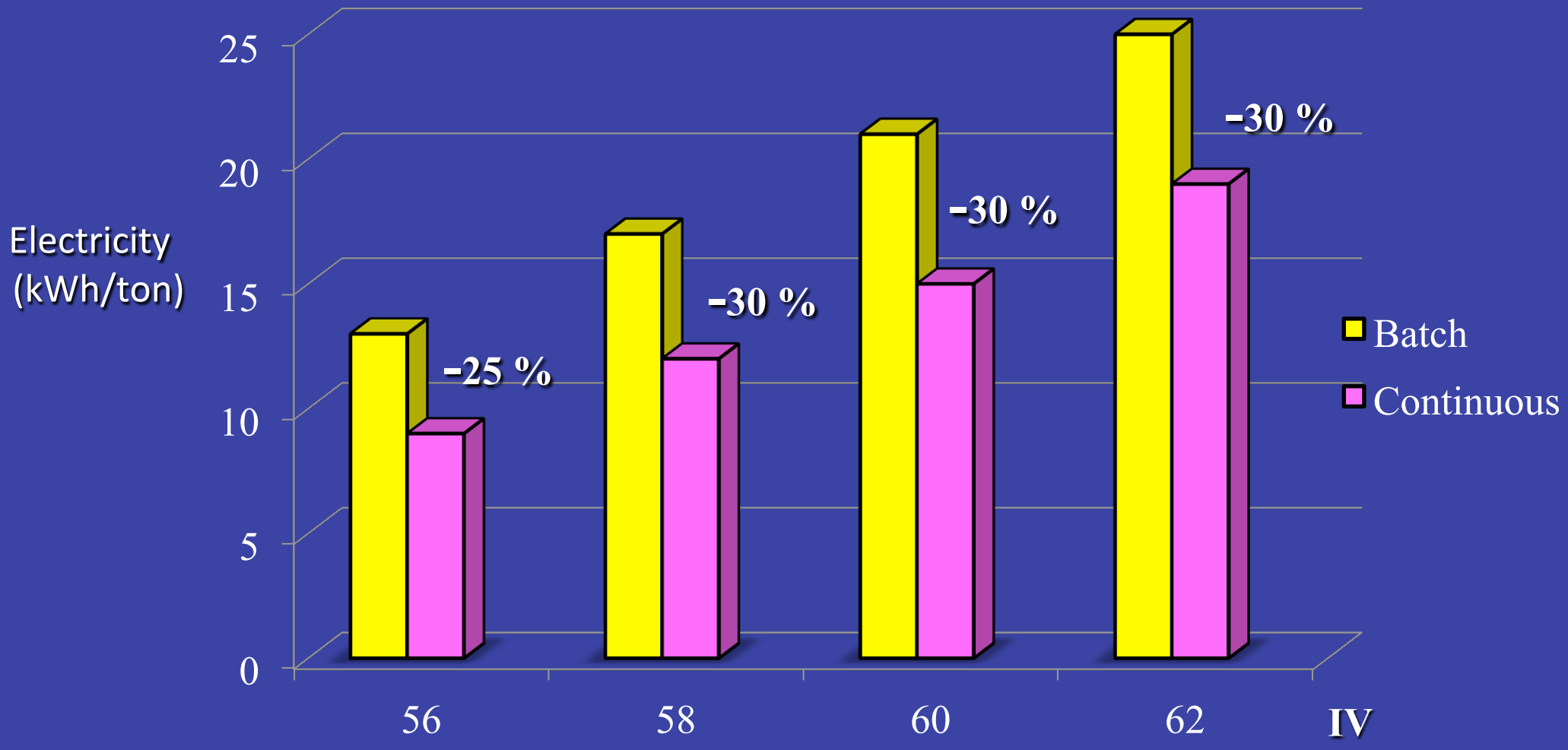
# ELECTRICITY CONSUMPTION FOR RBD PALM OIL

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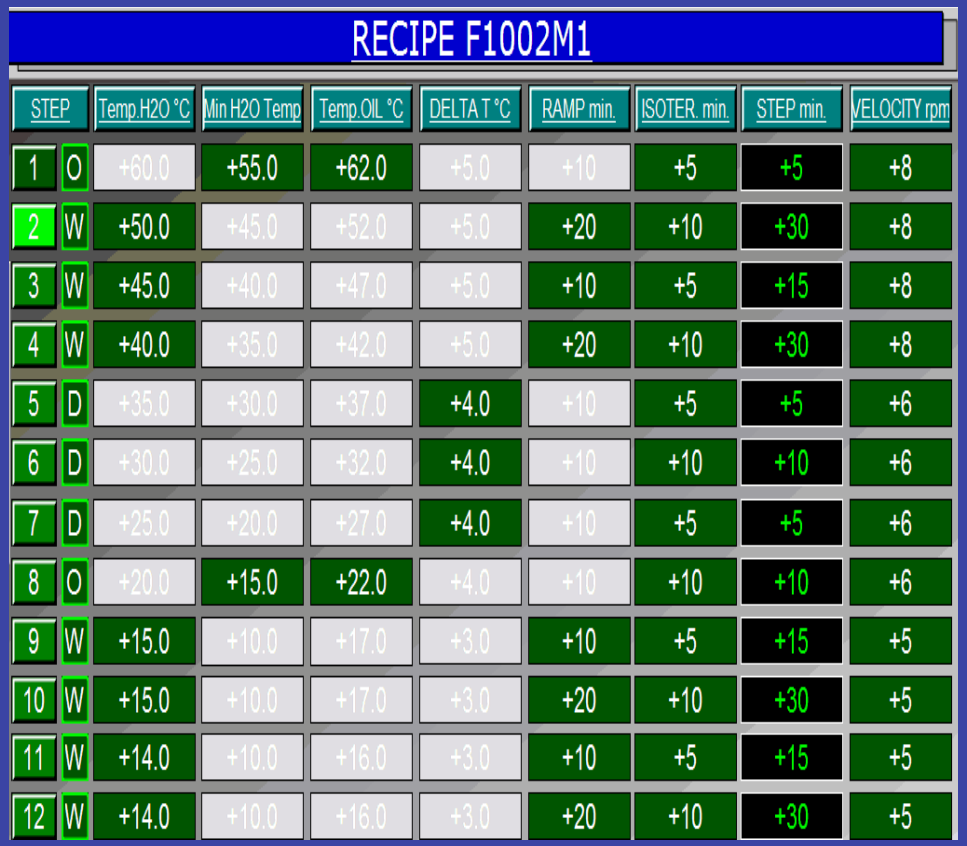
# Ease of Operation: simple automation



RECIPE F1002M1

| STEP | | Temp.H2O °C | Min H2O Temp | Temp.OIL °C | DELTA T °C | RAMP min. | ISOTER. min. | STEP min. | VELOCITY rpm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | O | +60.0 | +55.0 | +62.0 | +5.0 | +10 | +5 | +5 | +8 |
| 2 | W | +50.0 | +45.0 | +52.0 | +5.0 | +20 | +10 | +30 | +8 |
| 3 | W | +45.0 | +40.0 | +47.0 | +5.0 | +10 | +5 | +15 | +8 |
| 4 | W | +40.0 | +35.0 | +42.0 | +5.0 | +20 | +10 | +30 | +8 |
| 5 | D | +35.0 | +30.0 | +37.0 | +4.0 | +10 | +5 | +5 | +6 |
| 6 | D | +30.0 | +25.0 | +32.0 | +4.0 | +10 | +10 | +10 | +6 |
| 7 | D | +25.0 | +20.0 | +27.0 | +4.0 | +10 | +5 | +5 | +6 |
| 8 | O | +20.0 | +15.0 | +22.0 | +4.0 | +10 | +10 | +10 | +6 |
| 9 | W | +15.0 | +10.0 | +17.0 | +3.0 | +10 | +5 | +15 | +5 |
| 10 | W | +15.0 | +10.0 | +17.0 | +3.0 | +20 | +10 | +30 | +5 |
| 11 | W | +14.0 | +10.0 | +16.0 | +3.0 | +10 | +5 | +15 | +5 |
| 12 | W | +14.0 | +10.0 | +16.0 | +3.0 | +20 | +10 | +30 | +5 |

**Batch: can be over 50 process settings!**

| | |
|---|---|
| Oil Flowrate (tph) | 10 |
| Water Temperature (°C) | 21 |
| Agitation (rpm) | 6 |

**iConFrac: only 3 process settings!**

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# SUMMARY: Industrial Results and Experiences

- PERFORMANCE
- VERSATILITY OF OPERATION
- EASE OF OPERATION

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# And so, iConFrac was introduced in 2011:

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# iConFrac is a globally applied technology:

4 years later, more than 20 installations have been sold over 4 continents

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# **Future Applications:** Push things forward

1. Optimized MoBulizer design further
   - Enhance distribution and baffle geometric

2. New Products and Applications
   - Production of superolein and superstearin
   - Other vegetable oils applications

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