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AGRICULTURE • INNOVATION • LIFE

MICRONES- A More Efficient Palm Oil Extraction Method

SUSTAINABILITY | INSPIRED | INNOVATION

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FIBALOY INTERNATIONAL SDN BHD

NATIONAL KEY ECONOMIC AREA (NKEA)

Economic Transformation Program (ETP)

The aim of this program is to ensure productivity gains in palm oil industry have significant impact on GNI growth

8 EPPs (Entry Point Projects) are identified to grow incremental GNI of RM47.1 billion

EPP 4: INCREASING THE OIL EXTRACTION RATE

To increase OER to 23 percent by 2020:

1. Improve the quality of FFB at mill gate with the help of MPOB enforcement officers
2. Enforce proper grading on incoming FFB, based on MPOB's guidelines
3. Millers and dealers of FFB to employ competent graders, certified by MPOB
4. FFB price be valued according to the quality of FFB received

GNI from EPP 4: RM13.7 billion in 2020

EPP 1: Accelerating the replanting of oil palm

EPP 2: Improving fresh fruit bunch yield

EPP 3: Improving worker productivity

EPP4: Increasing the oil extraction rate (OER)

EPP 5: Developing biogas at palm oil mills

EPP 6: Developing oleo derivatives

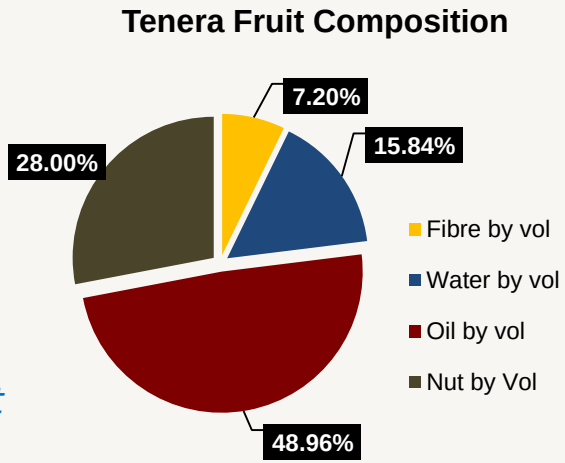
EPP 7: Commercialising second generation biofuels

EPP 8: Expediting growth in food and health-based downstream segments

CURRENT ISSUES

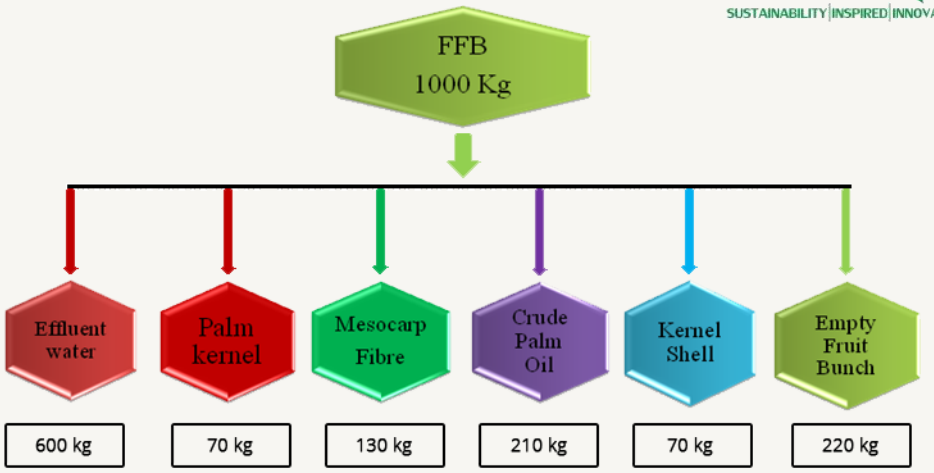
Average oil extraction rate (OER) is the amount of oil obtained from fresh fruit bunches (FFB). OER in Malaysian palm oil mills is below its optimum value;

- *Significant advances in "Genotyping" which are purportedly capable of increasing oil palm yields by up to 33 percent (Cold Spring Harbor Laboratory, 2015).*
- *Aggressive activities by MPOB enforcement officers to reject under-ripe/over-ripe FFB's arriving at the mill for processing (PEMANDU, 2014).*



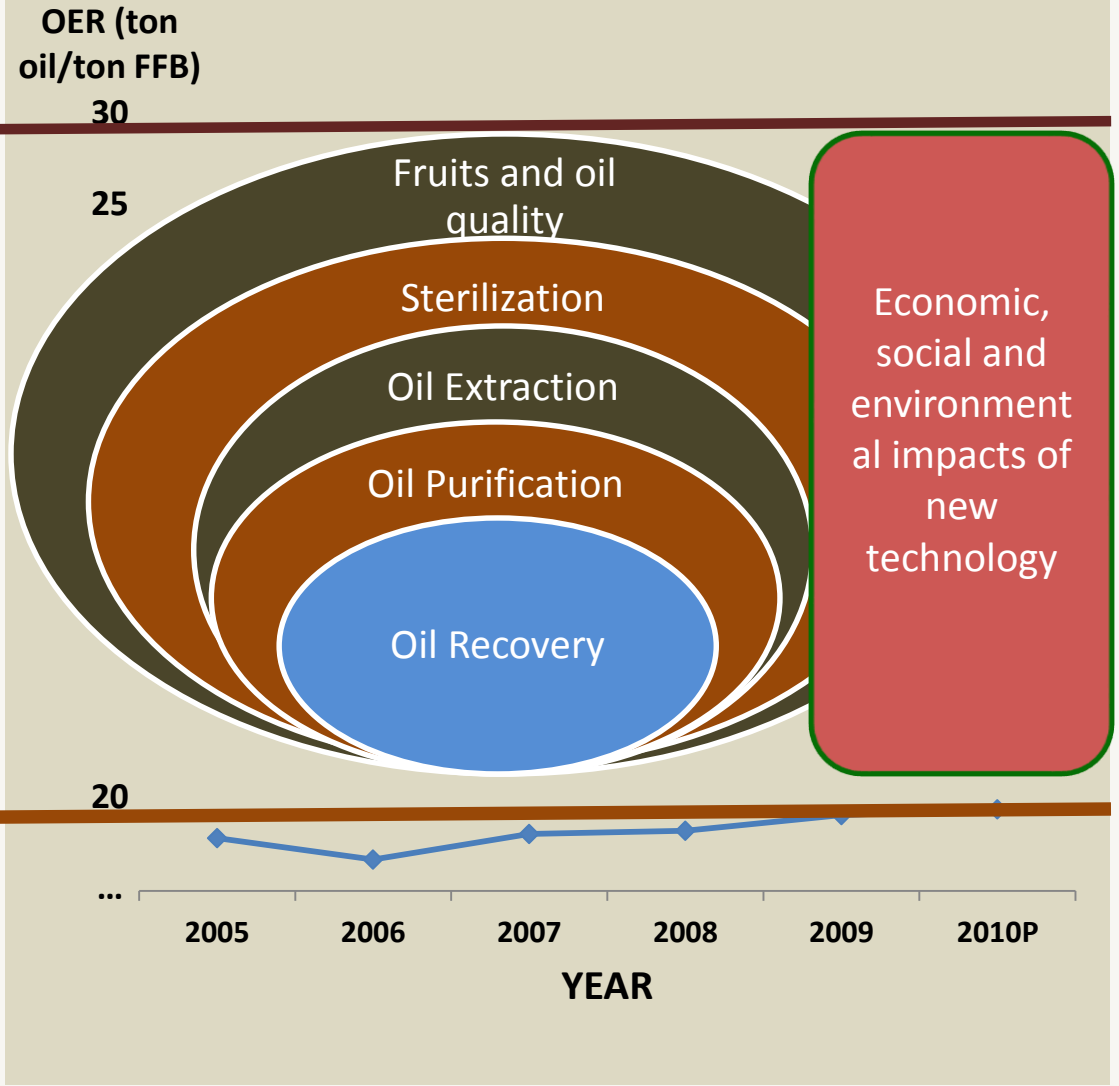
OIL LOSSES IN PALM OIL MILL

- Inefficient milling technology particularly poor oil extraction leads to oil losses.
  - Oil losses in unstripped FFB at 0.4% oil loss/FFB or RM 3.0 million/mill/year
  - 0.7% oil loss/FFB in press fiber and kernel loss, 0.32%/FFB (50% oil in kernel) at or RM 6.8 million/mill/year
  - Oil losses in sludge at 0.32% oil loss/FFB or RM 2.8 million/mill/year
- Major oil losses in palm oil mills occur in the Fibre, Sludge and Steriliser condensate (90 % of all oil losses)
- High oil loss and % of broken kernels in press fibre is due to inefficient sterilization, digestion and screw press.
- Formation of emulsions at the oil/water boundary in clarifier leads to more oil loss.
- Oil loss in condensate occurs due to longer than necessary steriliser cycle or due to over ripe fruit.



LRGS PROGRAM

AVERAGE OER IN MALAYSIA



Potential yield

BRIDGING GAP

RM13.7 billion in GNI

National average OER

RM 5.858 million

UPM NEW TECHNOLOGIES

RM 12 mil per year

Oil losses in unstripped FFB amounts to RM 3.0 million/ mill/year (0.4%/FFB)

Oil losses in press fiber and kernel loss, amounts to RM 6.8 million/ mill/year (0.7%/FFB)

Oil losses in sludge oil amounts to RM 2.8 million/ mill/year (0.32%/FFB)

Sterilization

Extraction

Separation

HIGH PRESSURE STERILIZATION

Robo-REST

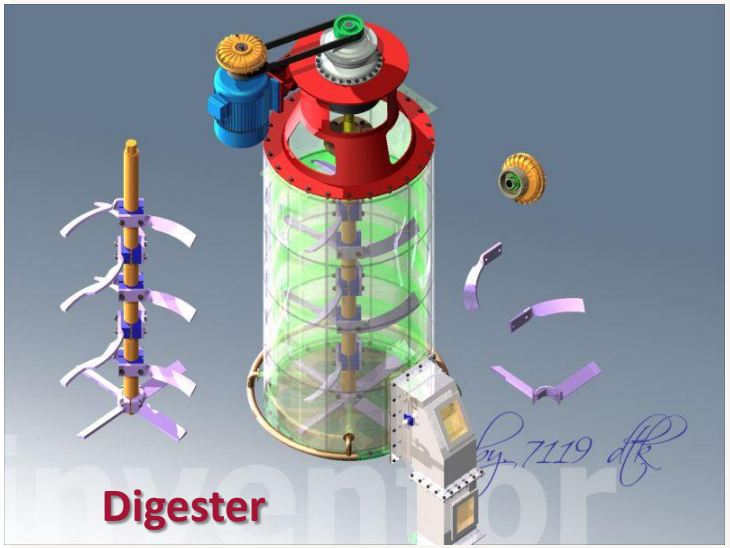
Kilang Sawit Bukit Kapah, Hulu Terengganu

In 2014/15 Fibaloy and Dolphin Application Sdn Bhd integrated UPM's Dr. Azis's High Pressure Sterilization patent and LRGS research into development of Dolphin's Robo-REST sterilization system.

70 psi , 30 minutes sterilization

40 psi , 30 minutes sterilization

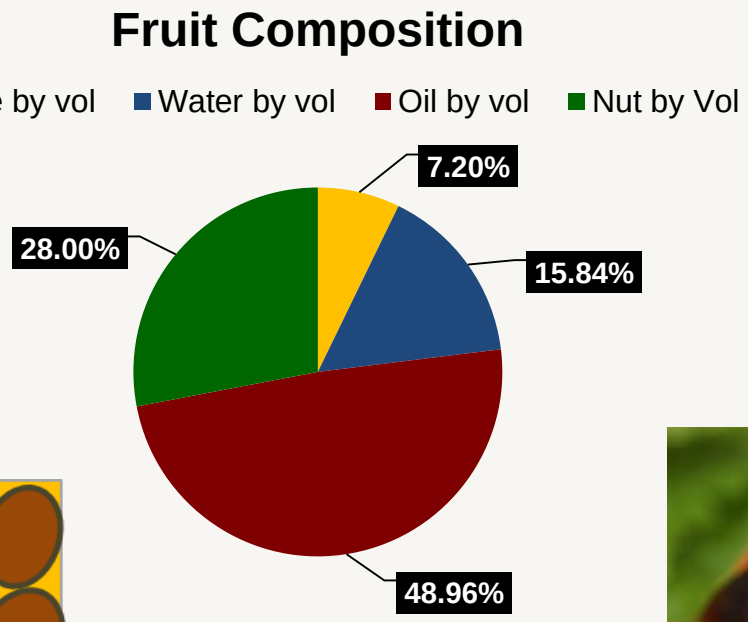
CONVENTIONAL PALM OIL EXTRACTION TECHNOLOGY



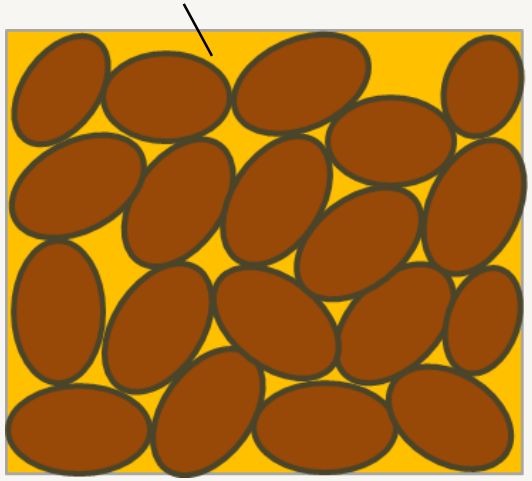
- Insufficient residence time, temperature and water in digester reduce cells ability to rehydrate. Thus, it is difficult to remove oil during pressing.
- 15 % of kernel nuts are broken and is lost with mesocarp fibre.
- High % of CPO remains in fibre resulting in 0.35 to 0.9 % in lost OER.
- According to Mongana, losses in screw press ranges between 7-15 % for 15 FFB t/h twin screw presses and are higher in bigger press .

Palm Tenera – Fruit Morphology

In the traditional twin screw press kernel nut and oil loss is inevitable due to the morphology of the fruit



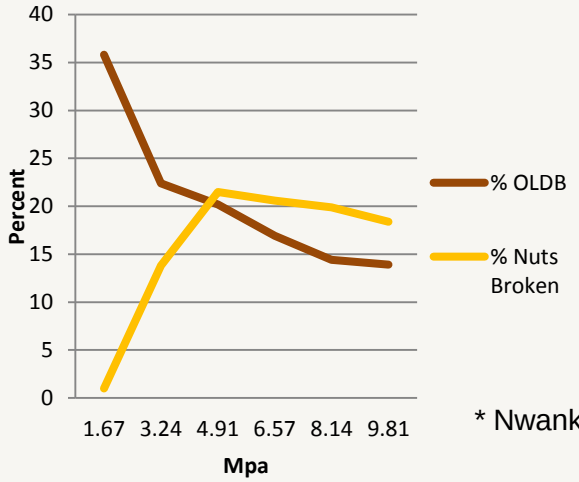
The void space between nuts
1.52m^3/t - 0.874m^3/t = 0.65m^3/t
0.65/1.52=42.5%



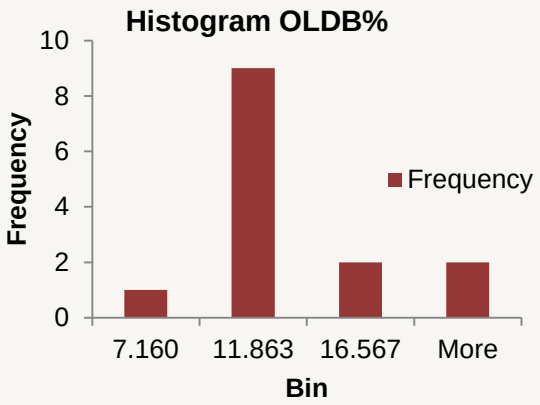
If fibre occupies 7.2% of the void then 42.5%-7.2%=**35.3 %** of oil + water will also fill the void. Nuts will have to break to access and remove this fraction

Field study- Press oil losses

- Using the traditional method Oil / Nut loss is inevitable
- At best it's a trade-off between how much CPO to lose or how much kernel to lose



* Nwankwojike, et al., 2011



Despite what is reported even best mills are losing 0.5 % OLWB of CPO during extraction

Tamaco is a three times winner of MPOB's highest OER award

2015	SAMPLE	OLWB%	OLDB%
	4-Jan	0.88	25.29
	5-Jan	0.78	7.38
	6-Jan	0.65	16.75
	7-Jan	0.6	9.77
	8-Jan	0.41	7.16
	9-Jan	0.59	10.28
	10-Jan	0.61	10.34
	11-Jan	0.73	11.97
	12-Jan	0.67	11.69
	13-Jan	0.63	21.27
	14-Jan	0.67	10.28
	15-Jan	0.55	9.02
	16-Jan	0.66	11.52
	17-Jan	0.71	12.52
	18-Jan	0.62	11.17
Mean		0.65%	12.43%
Count		15	15
Std Dev		0.11	5.01
Confidence		0.002	0.081
Flow Rate t/h			54
Crush Rate t/h			90
[1]%FFB Dry basis			**0.54%**

Sample of press cake fibre taken at Tamaco Mill II Sabah, 2015

What has gone wrong?

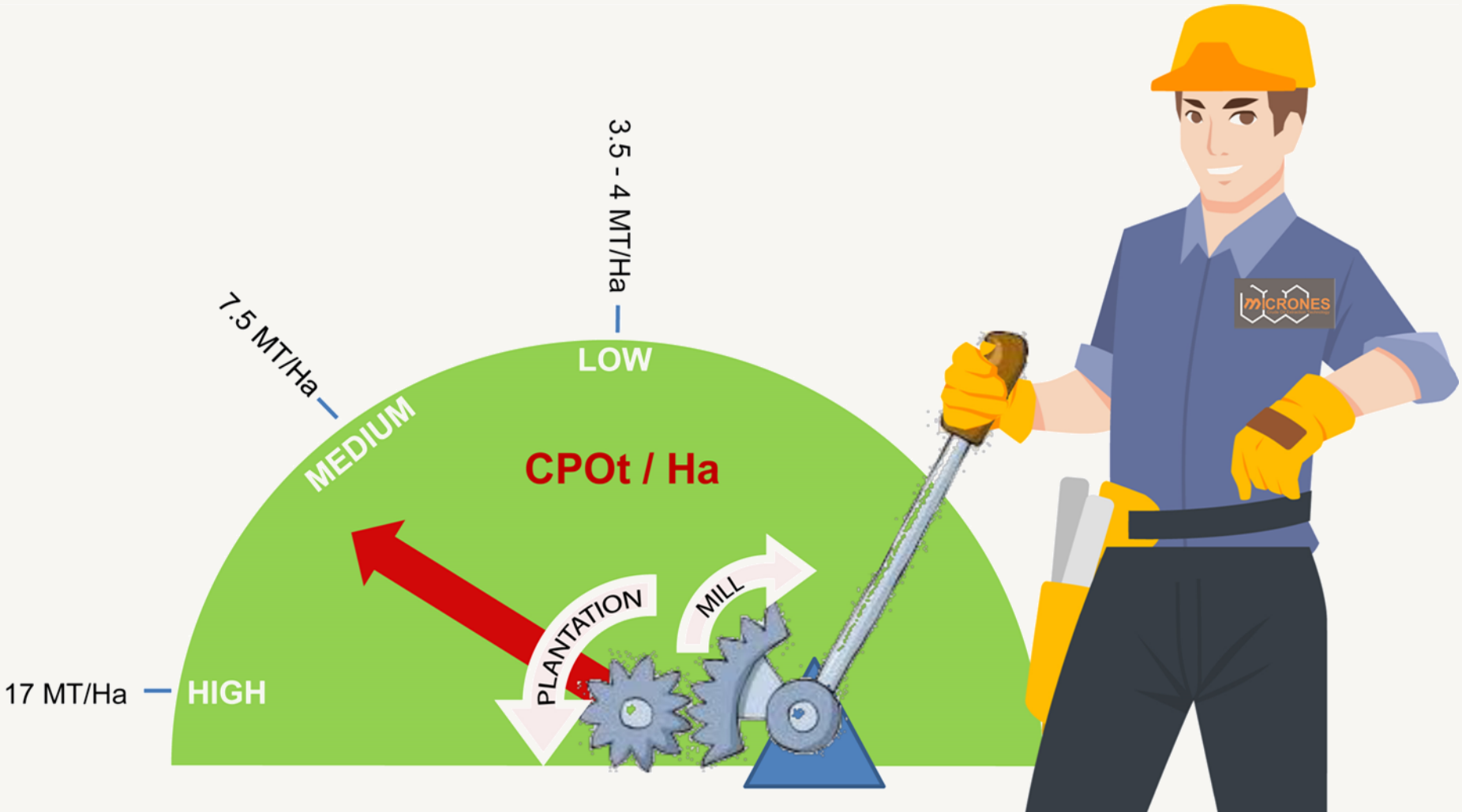
As presses get bigger oil loss and nut breakage increases yet screw press manufacturers are developing and pushing bigger presses 20-30 FFBt/h

According to Mongana, small capacity presses cause 4 percent loss (OLDB) as compared to 7-8 percent loss (OLDB) associated with larger presses. However in reality OLDB often ranges between 7-15 percent for conventional 15t FFB/h twin screw presses.

What about **CPOt/Ha??**

Leveraging effect of OER on yield

At 20% OER an increase in OER of 0.4%, increases CPOt / Ha by 2%



MICRONES Crude Oil Extraction Technology

“The future of palm oil extraction has arrived”

MICRONES is an acronym for **M***aceration* **I***nduced* **C***ell* **R***upturing* **O***il* **N***ut* **E***xtraction* **S***ynthesis*

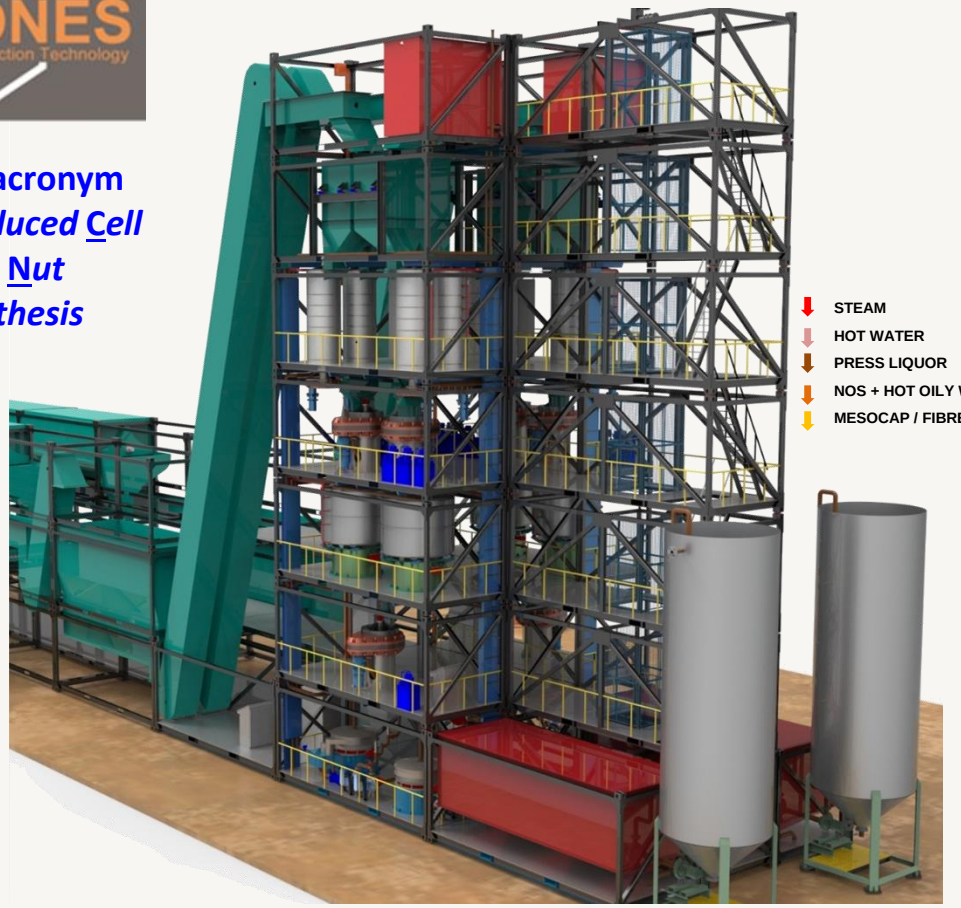
Methods of extraction have not changed since the pioneering work of United Plantation’s Tan Sri Bek-Nielsen and Axel Lindquist who were inspired by Mongana CONGOPALM Society report in 1955 and later collaborated with Usine de Wecker screw press company-Luxenbourg

NEW CPO EXTRACTION TECHNOLOGY

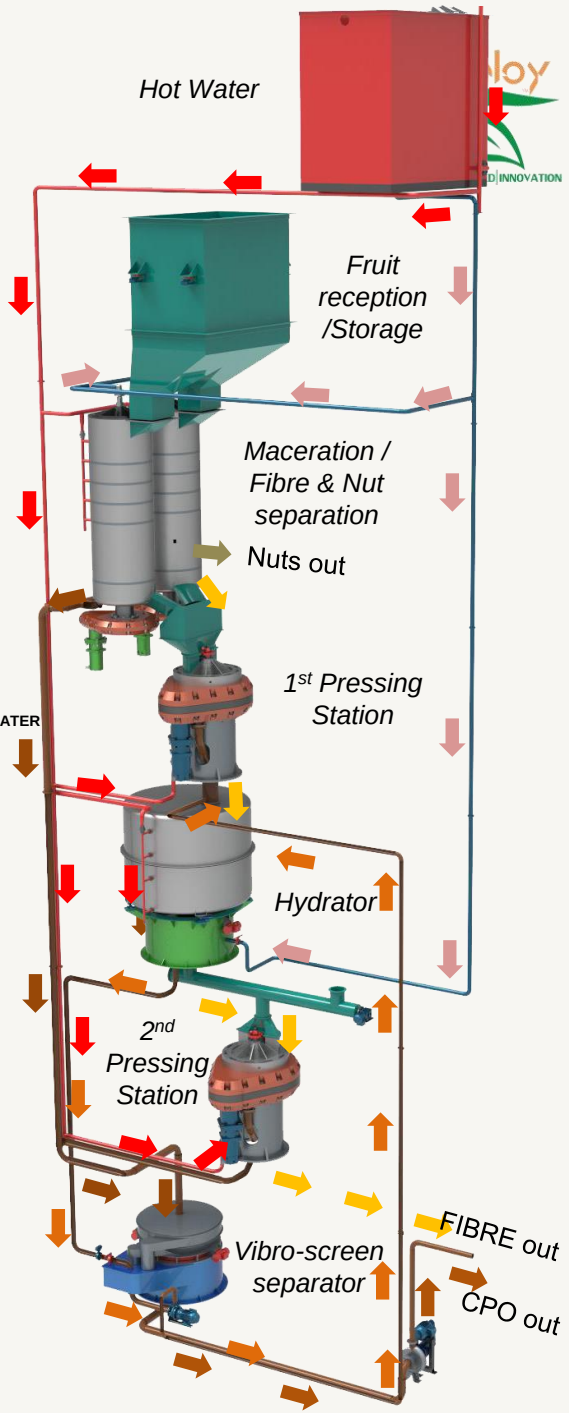
MICRONES is an acronym for *M*aceration *I*nduced *C*ell *R*upturing *O*il *N*ut *E*xtraction *S*ynthesis

Micrones is designed to work with;

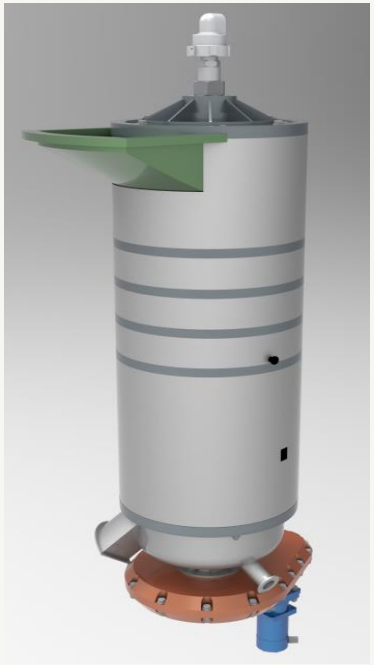
- Conventional sterilisers
- Continuous sterilizers.



60 ton FFB MICRONES System

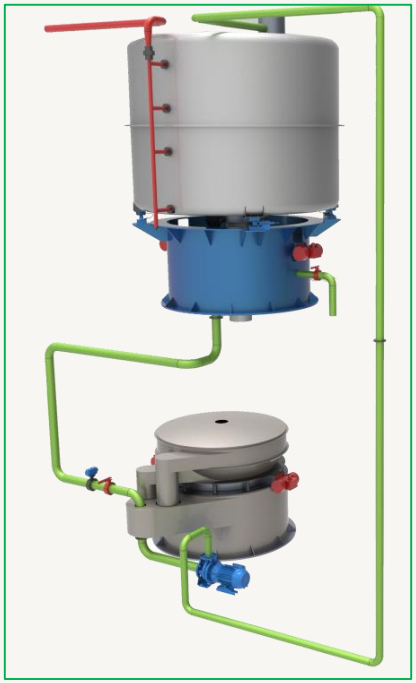


MICRONES - Four Stages Process



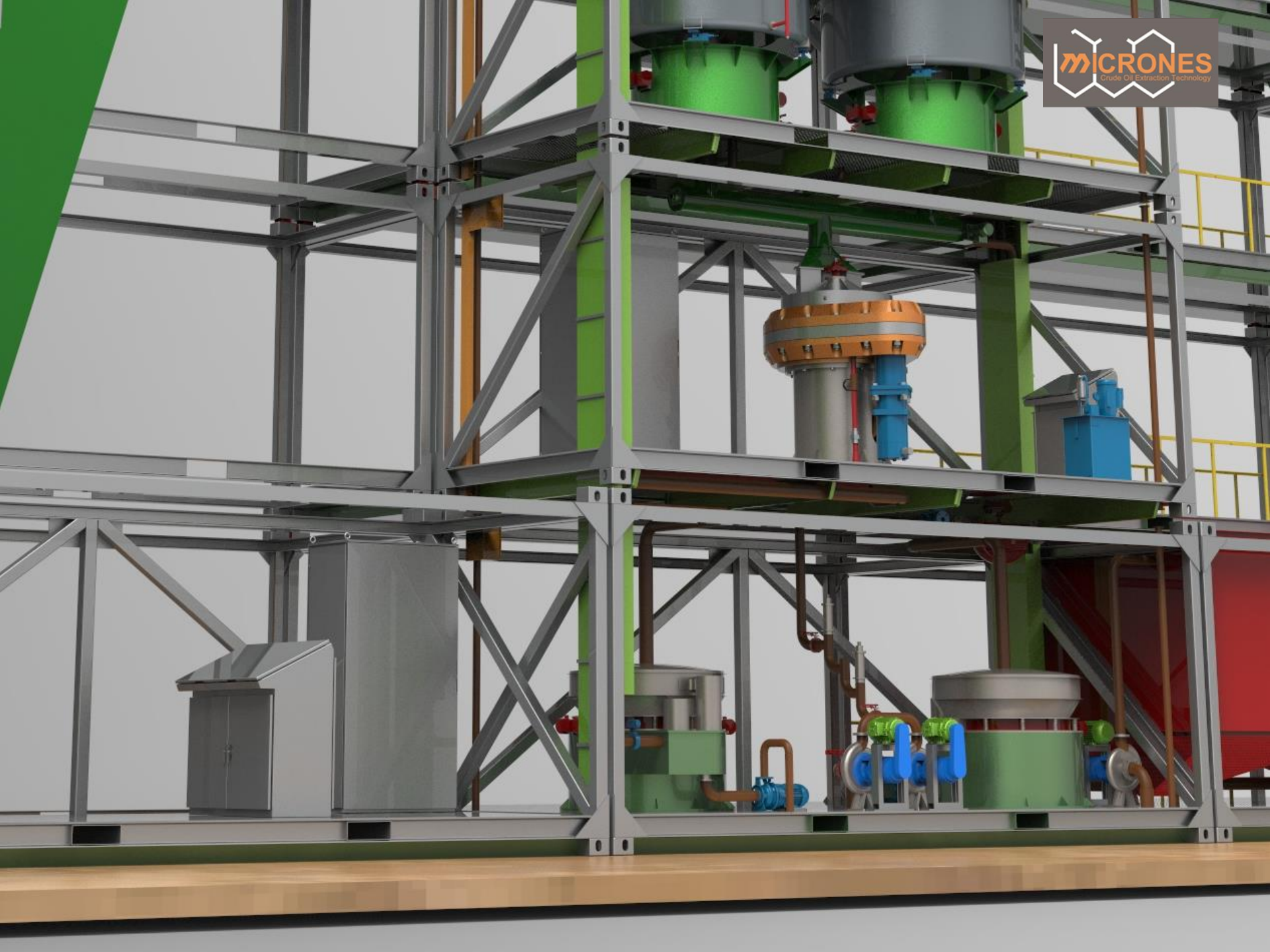
Stage I
Fiber & Nut separation

Stage II
Second stage pressing



Stage III
Gravitational leaching of oil from cells, cell re-hydration and NOS recycling

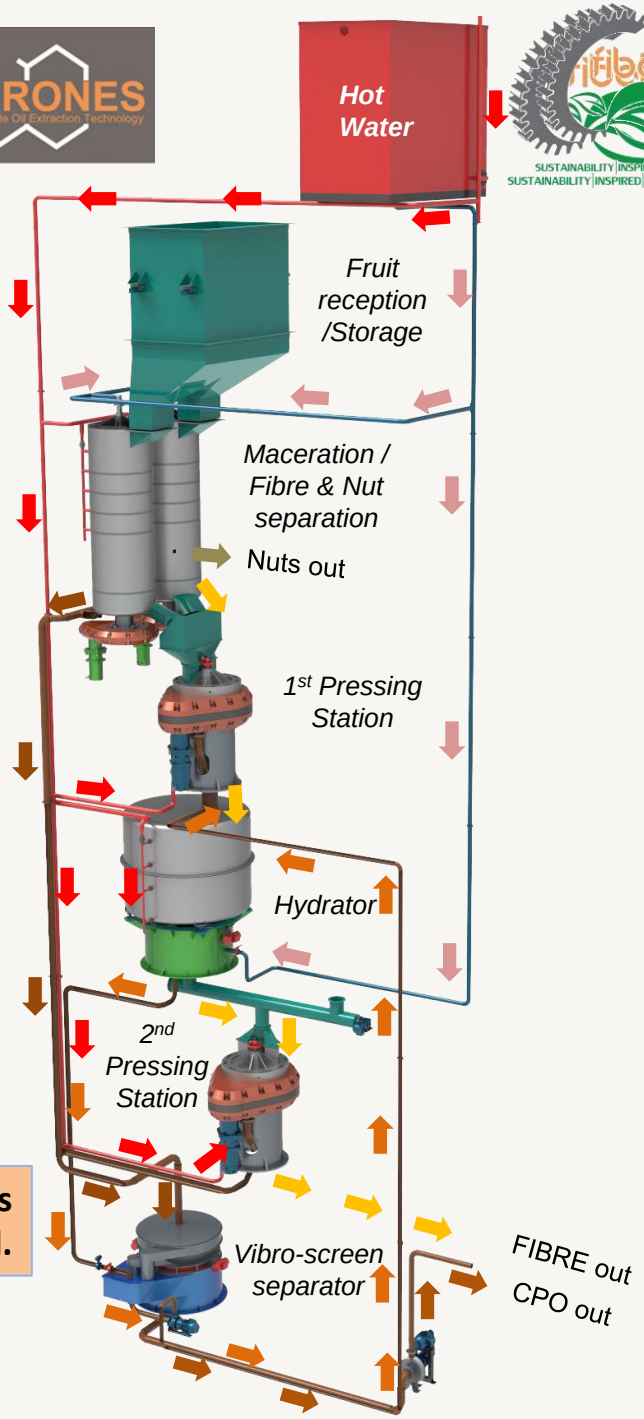
Stage IV
Final stage pressing


MICRONES
Crude Oil Extraction Technology

TECHNOLOGY COMPARISON

CONVENTIONAL TECHNOLOGY

Press fibres together with nuts to extract oil out, causing kernel/nut breakage and oil loss.



Only nut-free fibres are sent to the press while the clean nuts are collected.

Conclusion

- ✓ MICRONES isolates and removes kernel nuts before they enter the press to ensure nuts are not broken and kernel is not lost
- ✓ MICRONES induces maceration to ensure oil bearing cells are ruptured and virgin oil is decanted early in the process
- ✓ MICRONES directs the mesocarp through 2 separate and dedicated pressing stages with a hydration phase in between to ensure the purging effect of the second pressing stage is optimal.
- ✓ MICRONES requires less power as energy is not expended breaking kernel nuts or separating kernel from mesocarp fibre
- ✓ MICRONES delivers measurable Triple Bottom Line Outcomes