# Biomicrogels®

## Industrial Trials, Indonesia 2020-2021

Better chemistry for the better world

BIOMICROGEL®

# BIOMICROGEL® | About the company

**BIOMICROGEL** is the first Russian innovative company-developer and manufacturer of microgel products from natural raw materials (apple and beet pectin, cellulose).

Food Grade
CELLULOSE

Food Grade
APPLE PECTIN

Food Grade
BEET PECTIN

# BMG SAFETY DATA

**BMG IS 100% NATURAL**

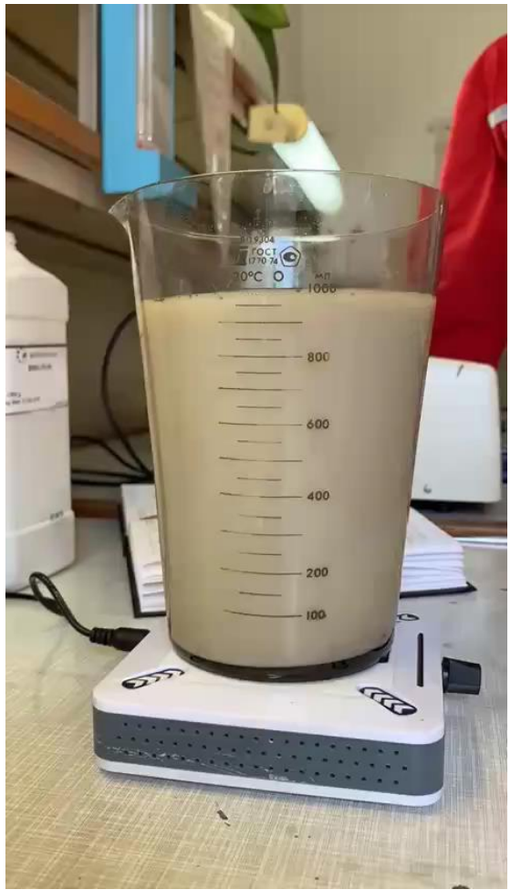
**PRODUCT PRODUCED FROM CELLULOSE**

**Data Safety Sheet:**

- Sodium carboxymethyl cellulose, (CAS-No.) 9004-32-4, (EC-No.) 618-378-6
- Food grade, Non-toxic, not classified, not dangerous for environment according to EC No.1272/2008
- Used as thickener and stabilizer for reagents in food, cosmetics, pharmaceutical industires

- **BMG safety was confirmed** by independent expertise in one of the leading test centers in Malaysia

# BMG Applications: Oil/waste water




* Please click this YouTube Video BMG application with **solid particles**

# BMG Applications: Oil/solid

* Please click this YouTube Video BMG application with **solid particles**

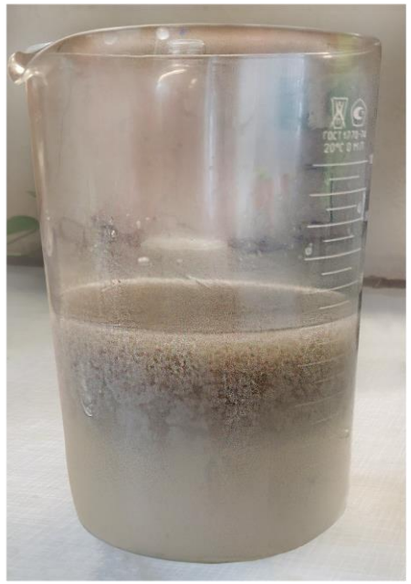
# REAL CASES: COOLANT SEPARATION

Северсталь

SEVERSTAL – one of the largest hot steel making group in Russia,  BMG tested in 2019 год

Coagulant  BMG-P2

1



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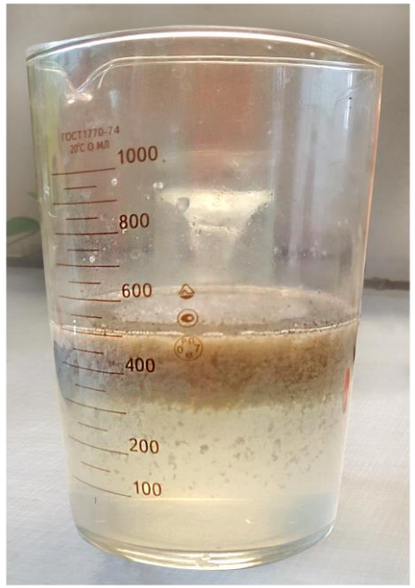


| Indicator | Waste Water | |
|---|---|---|
| | **BEFORE** | **AFTER** |
| pH | **5,7** | **7,3 - 8,9** |
| Petroleum products, mg/L | **up to 2600** | **0,041** |

**ООО НПП «Эксорб»**
**ЦЕНТР ХИМИКО-АНАЛИТИЧЕСКИХ ИСПЫТАНИЙ «ЭКСОРБ»**

620014, г. Екатеринбург, ул. 8 Марта, 5, оф. 218,
тел.371-25-30, факс. 371-20-20

**Протокол исследования воды № В-5290 от 16.12.2019**

| | |
|---|---|
| Заказчик: | ООО «НПО Биомикрогели», ИНН 6685023448 |
| Пробоотбор осуществлен: | заказчиком |
| Дата и время отбора пробы: | 09.12.2019, 15-30 |
| Место взятия пробы: | ПАО «Северсталь», г.Череповец |
| Объект исследования: | вода сточная (очищенная) |
| Дата и время поступления пробы: | 11.12.2019,13-15 |
| Дата начала анализа пробы: | 11.12.2019 |
| Способ консервации, хранения (при необходимости): | Проба на нефтепродукты консервировалась в соответствии с методикой |
| Номер (шифр) пробы: | **1** |
| Номер по журналу регистрации: | **5324** |

| № п/п | Наименование показателя | Ед. измер. | Результат измерений | Показатель точности (±Δ) | Наименование документа на МВИ | Метод исследования |
|---|---|---|---|---|---|---|
| 1 | Водородный показатель (pH) | ед. pH | 8,9 | 0,2 | ПНД Ф14.1:2:3:4.121-97 | Потенциометрический |
| 2 | Нефтепродукты | мг/дм³ | 0,041 | 0,018 | РД 52.24.476-2007 | ИК-фотометрический |

Руководитель Центра _____ Е.В. Желтоножко

Примечание: Центр за отбор проб ответственности не несет;
передача протокола или его копии другим лицам без согласия заказчика не допускается.

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# REAL CASES: COOLANT SEPARATION

Ч Т П З

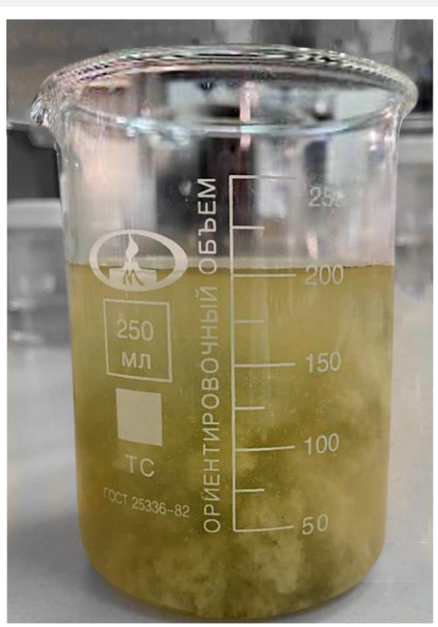
Chelyabinsk Pipe Rolling Mill – the biggest large diameter steel pipe factory in Russia, BMG tested in 2020 год

Coagulant BMG-P2

| Indicator | Waste Water | |
|---|---|---|
| | **BEFORE** | **AFTER** |
| pH | **11 - 10** | **6,5 ÷ 8,5** |
| Petroleum products, mg/L | **5000** | **0,05** |

1


2

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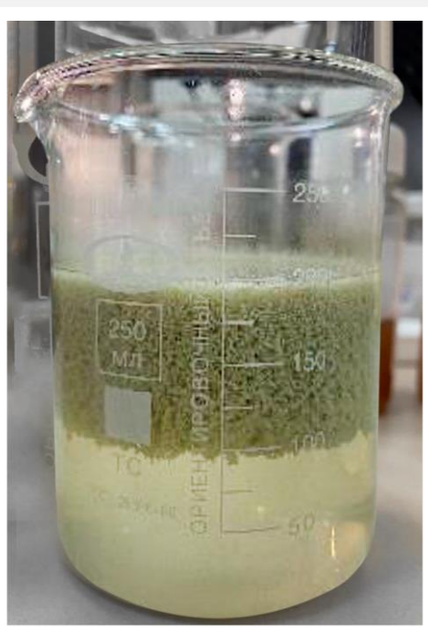


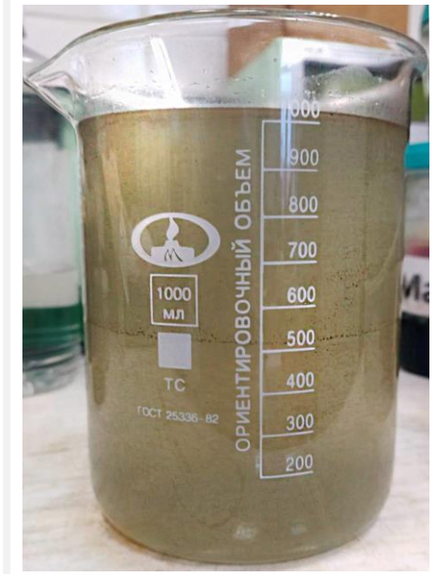
# REAL CASES: WASTE WATER TREATMENT – GREASE AND PETROLEUM PRODUCTS, TANKS CLEANING

Russian Railroad – the largest railroad company in Russia, BMG tested in 2020 год

Coagulant BMG-P2

| Indicator | Waste Water | |
|---|---|---|
| | BEFORE | AFTER |
| pH | 3,2 | 6,5 |
| Petroleum products, mg/L | 61 | 0,15 |
| FNU | 130 | 4,0 |

1

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| ООО НПП «Эксорб»<br>ЦЕНТР ХИМИКО-АНАЛИТИЧЕСКИХ ИСПЫТАНИЙ «ЭКСОРБ» | 620014, г. Екатеринбург,<br>ул. 8 Марта, 5, оф. 218, тел. 8-(343)-371-25-30,<br>факс. 8-(343)-371-20-20 |
|---|---|

**Протокол исследования воды № В-5193 от 18.12.2020**

| | |
|---|---|
| Заказчик: | **ООО «НПО Биомикрогели», ИНН 6685023448** |
| Пробоотбор осуществлен: | Заказчиком |
| Дата и время отбора пробы: | 11.12.2020, 15-00 |
| Место взятия пробы: | Исходная вода на ОС |
| Объект исследования: | вода техническая |
| Дата и время поступления пробы: | 11.12.2020, 10-00 |
| Дата начала анализа пробы: | 11.12.2020, 10-20 |
| Способ консервации, хранения (при необходимости): | проба консервировалась |
| Номер (шифр) пробы: | 1 |
| Номер по журналу регистрации: | **5548** |

| № п/п | Наименование показателя | Ед. измер. | Результат измерений | Показатель точности (±Δ) | Наименование документа на МВИ | Метод исследования |
|---|---|---|---|---|---|---|
| 1 | Нефтепродукты | мг/дм³ | 61,0 | 8,5 | ПНД Ф 14.1:2:4.5-95 | ИК-спектрометрический |

Руководитель Центра _____ Е.В. Желтоножко

Примечание: Центр за отбор проб ответственности не несет;
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| ООО НПП «Эксорб»<br>ЦЕНТР ХИМИКО-АНАЛИТИЧЕСКИХ ИСПЫТАНИЙ «ЭКСОРБ» | 620014, г. Екатеринбург,<br>ул. 8 Марта, 5, оф. 218, тел. 8-(343)-371-25-30,<br>факс. 8-(343)-371-20-20 |
|---|---|

**Протокол исследования воды № В-5197 от 18.12.2020**

| | |
|---|---|
| Заказчик: | **ООО «НПО Биомикрогели», ИНН 6685023448** |
| Пробоотбор осуществлен: | Заказчиком |
| Дата и время отбора пробы: | 11.12.2020, 15-25 |
| Место взятия пробы: | Очищенная вода с ОС (коагулянт+флокулянт) |
| Объект исследования: | вода техническая |
| Дата и время поступления пробы: | 11.12.2020, 10-00 |
| Дата начала анализа пробы: | 11.12.2020, 10-20 |
| Способ консервации, хранения (при необходимости): | проба консервировалась |
| Номер (шифр) пробы: | 5 |
| Номер по журналу регистрации: | **5552** |

| № п/п | Наименование показателя | Ед. измер. | Результат измерений | Показатель точности (±Δ) | Наименование документа на МВИ | Метод исследования |
|---|---|---|---|---|---|---|
| 1 | Нефтепродукты | мг/дм³ | 0,15 | 0,05 | ПНД Ф 14.1:2:4.5-95 | ИК-спектрометрический |

Руководитель Центра _____ Е.В. Желтоножко

Примечание: Центр за отбор проб ответственности не несет;
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# BMG FOR PALM OIL

- Increases CPO extraction
- Reduces extraction time in Clarifier
- Reduces oil content in Clarifier Underflow and Feed Decanter/Centrifuge
- Reduces water consumption in COT tank up to 50%
- Reduces oil content in POME
- No changes in Mills operating procedures
- Low implementation and running costs
- BMG effectively works with Palm Kernel Oil in lab tests

**BMG Effect presents significant advantages for factories to increase productivity without CAPEX investments and translates in attractive Economic Value Added effect**

# BMG INDUSTRIAL TRIALS IN INDONESIA – KEY FIGURES AND SUMMARY

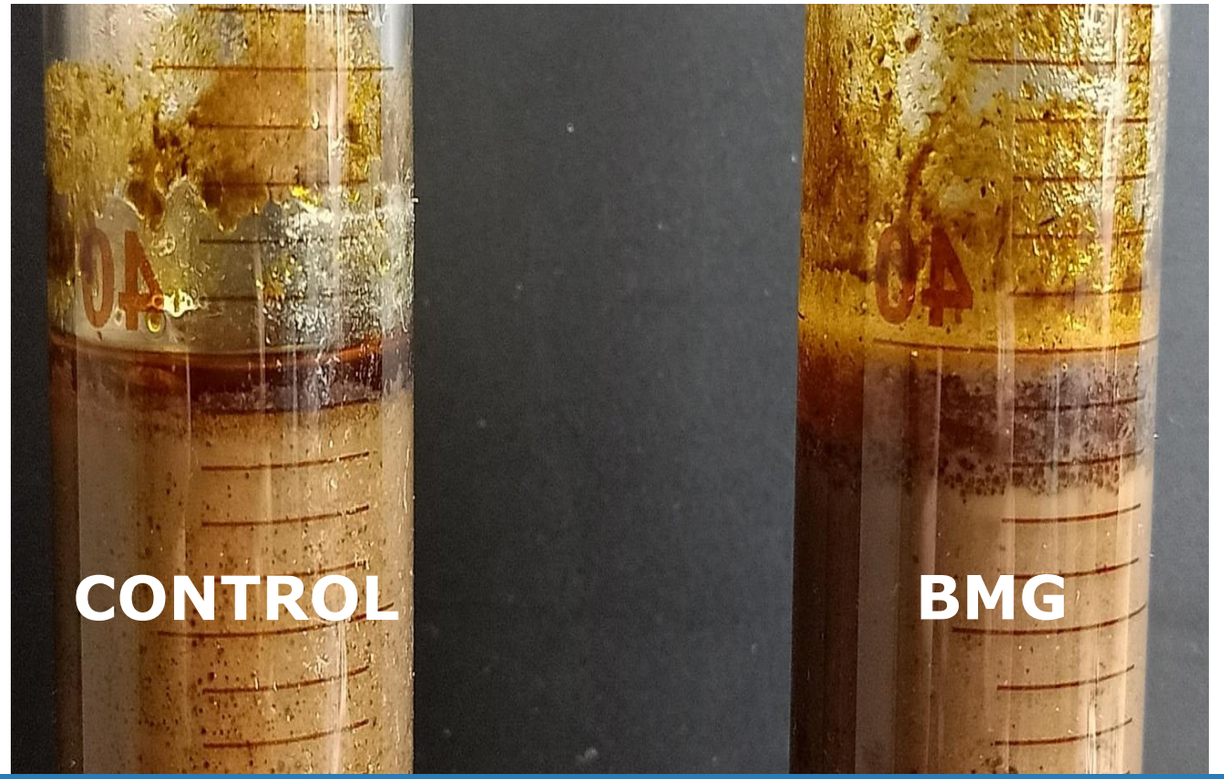
- **Biomicrogels Group** conducted **6 successful Industrial trials in Indonesia** in 2020-2021 – different geo areas, seasons
- **Biomicrogels Group** has built its **own regional team in Indonesia and Malaysia** with experts in Palm Oil production
- During Industrial Trials BMG was tested at different injection points and dosing concentration
- The **biggest BMG Effect was reached during BMG injection into Clarifier**, after the COT pump
- The following lab test is simulating the BMG effect in Clarifier and clearly shows the effectiveness of BMG application

**BMG effect was demonstrated at Palm Mills with different extraction rates, capacity FFB/Hr and EFB/Hr**

# LAB TESTS CONFIRMATION

## BMG effect demonstrated in a lab test with Underflow sludge samples placed in a bath tub

- From left to right: control and BMG injected tubes
- BMG dosing 1.0 g/l into Underflow, after 1 hour in 80°C bath tub



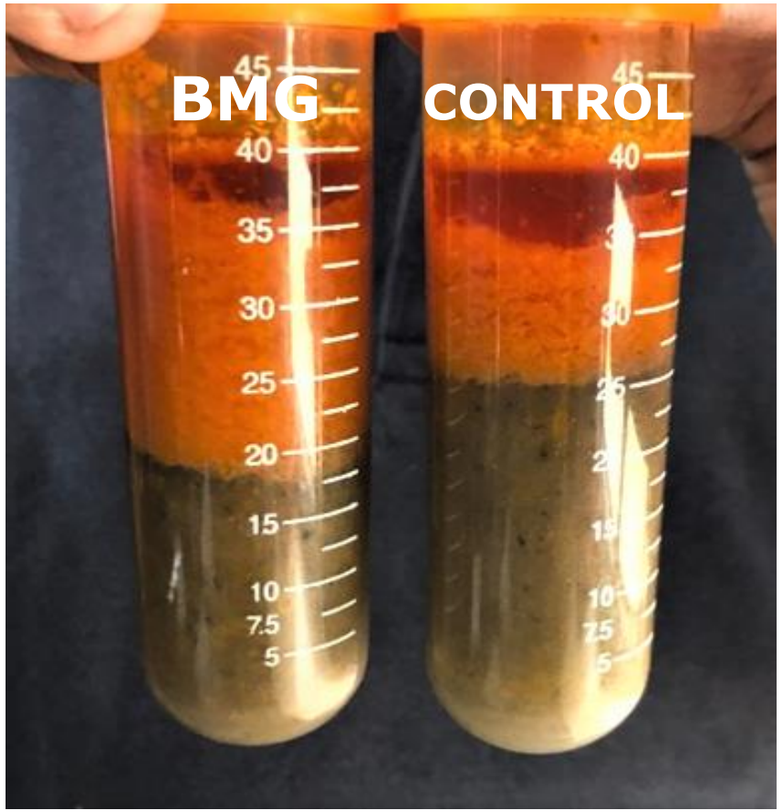

- BMG solution evenly distributed in the tube column – simulating Clarifier
- Estimated 5% of additional oil per hour in lab environment

**BMG extracts additional 5-30% oil in 1 hour in lab tests**

# LAB TESTS CONFIRMATION

## BMG effect demonstrated in a lab test with COT samples placed in a bath tub

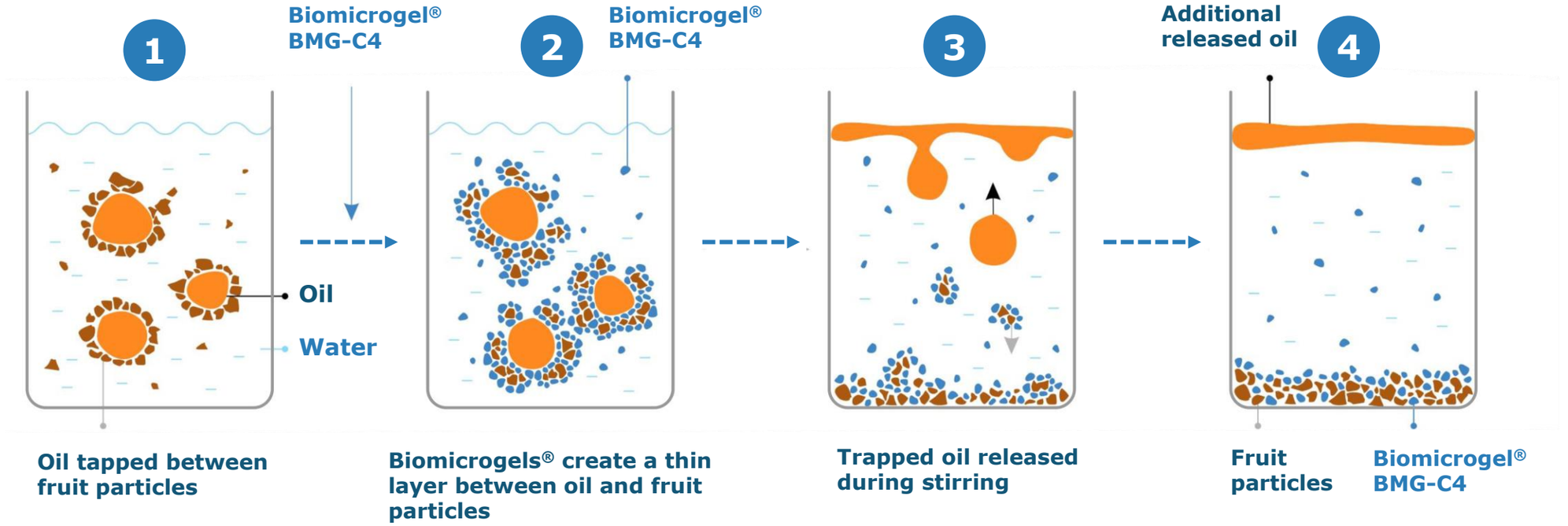
- From left to right: BMG and control tubes
- BMG dosing 1.0 g/l into Underflow, after 1 hour in 80°C bath tub




- BMG solution evenly distributed in the tube column – simulating Clarifier
- Extraction temperature 10C lower than mill standard in Clarifier

**BMG extracts additional 58% oil after 1 hour and 88% after 2 hours in lab tests**

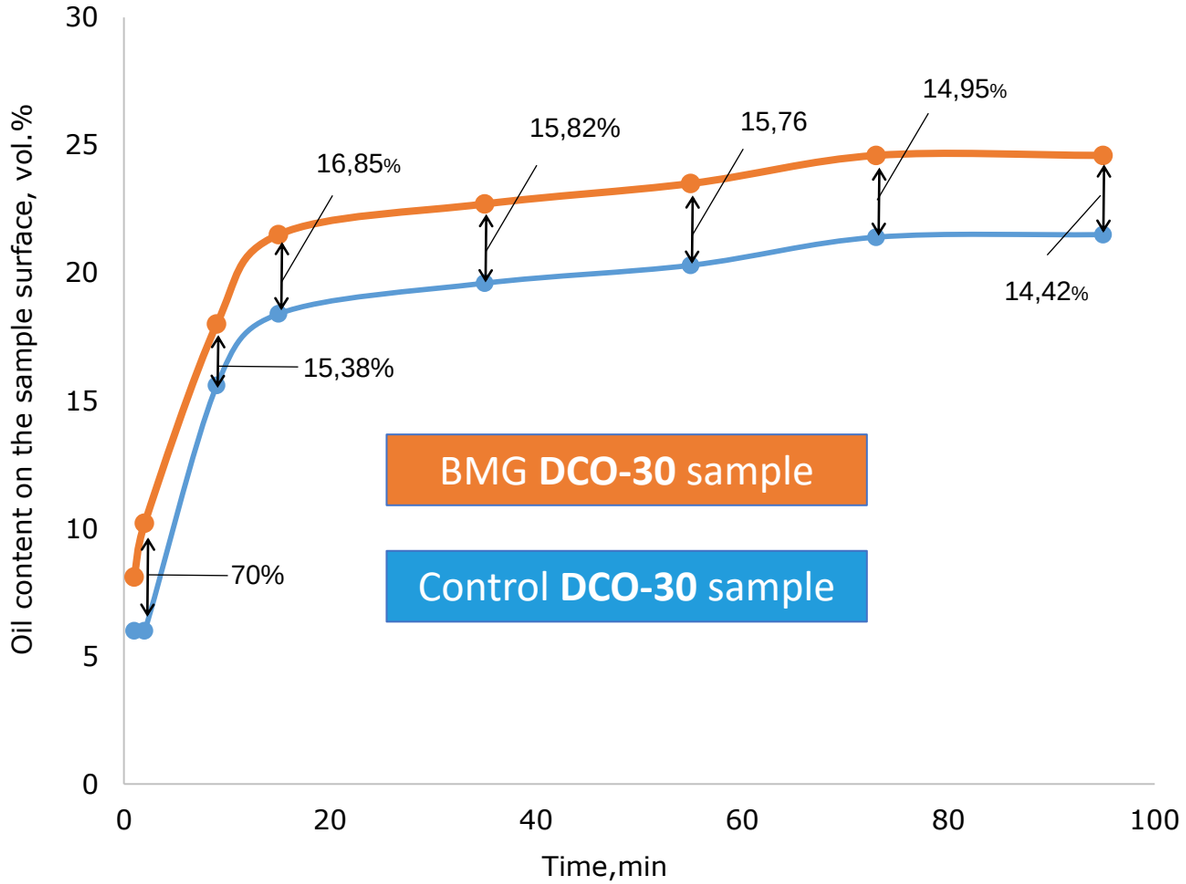
# BMG FOR PALM OIL – HOW IT WORKS




- When Biomicrogel® solution is added to the Underflow, the microgel particles displace all these substances (crushed fruits and the surfactants) from the surface of the oil droplets

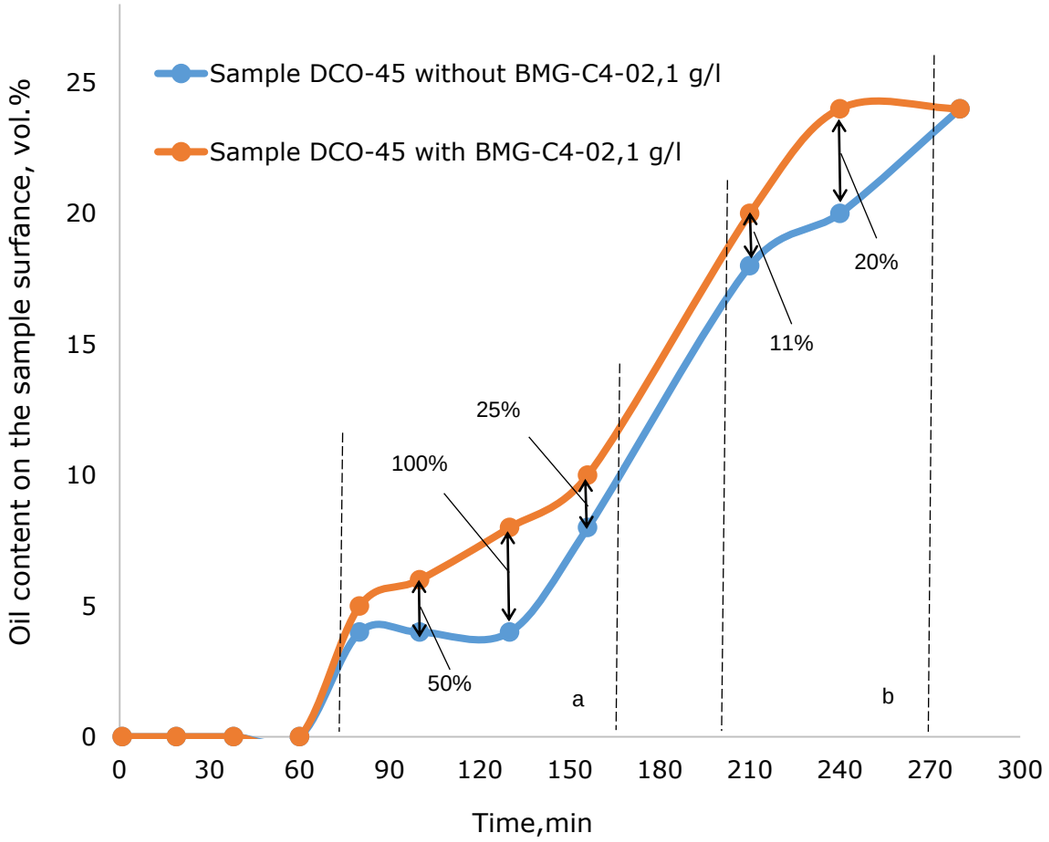
**BMG particles help to release oil trapped between fruits residue**

# BMG Tests Results: Oil volume % vs time

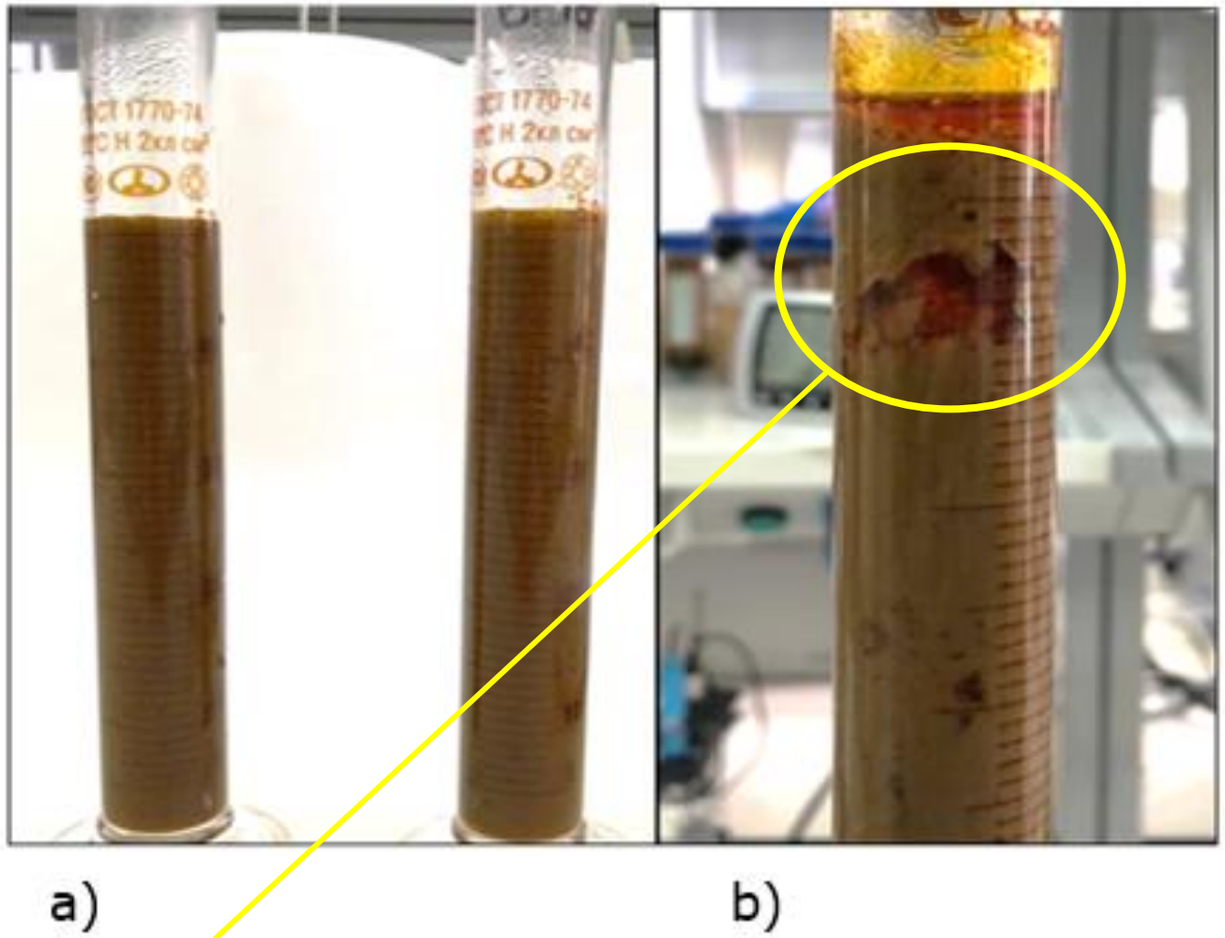



**Oil level-vs-time curve DCO-30 (BMG-C4-02 1 g/l)**

# BMG Tests Results: Extraction gravitational vs dynamic

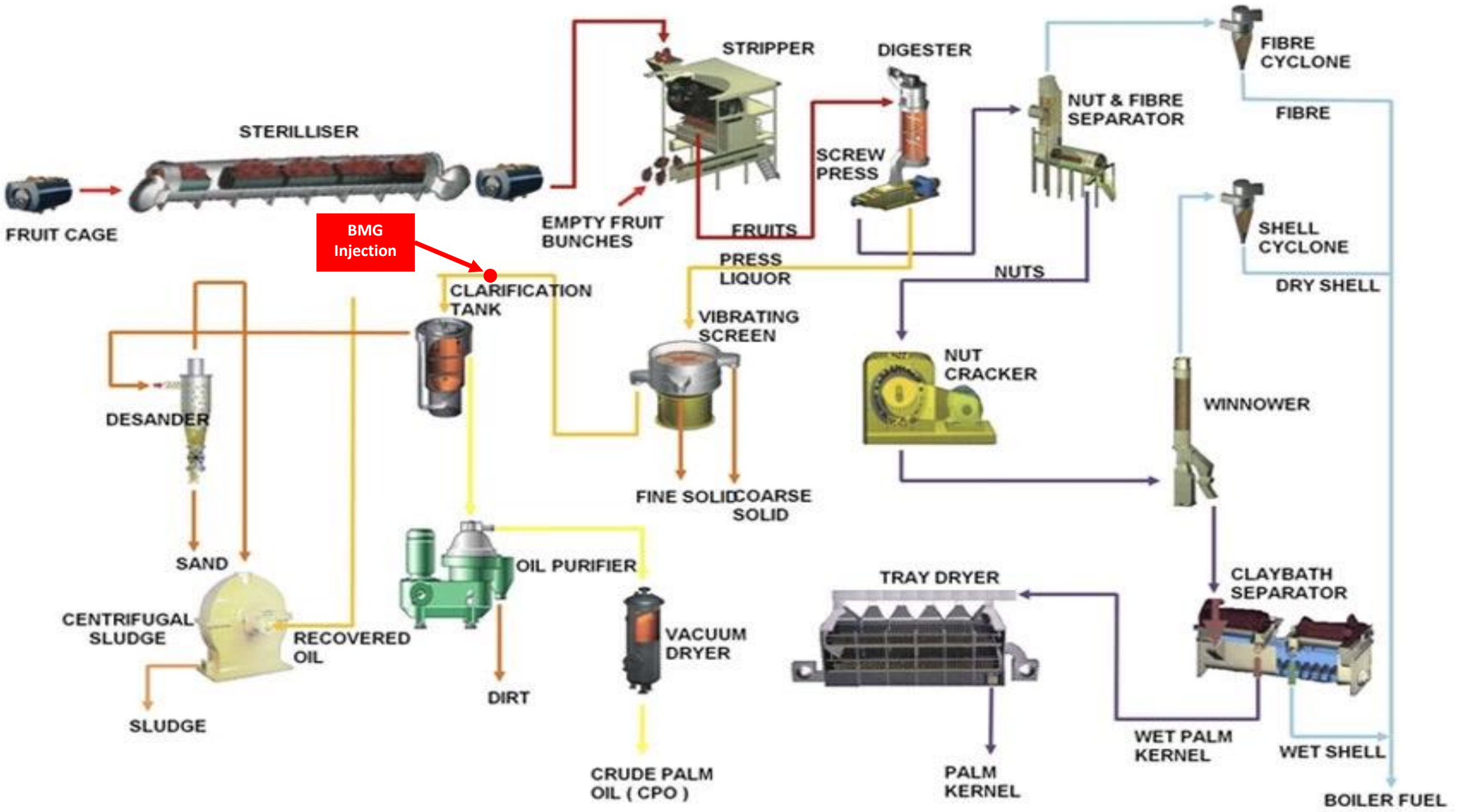



**Oil/sludge ratio in DCO-45 samples** (left-without BMG-C4-02, right-with BMG-C4-02, 1 g/l): a) in 60 minutes, b) DCO-45 samples with BMG-C4-02, 1 g/l in 70 minutes




**After 70 minutes and further BMG forms oil layer on the surface and large oil droplets in sludge that can be easily extracted by decanter/separator**

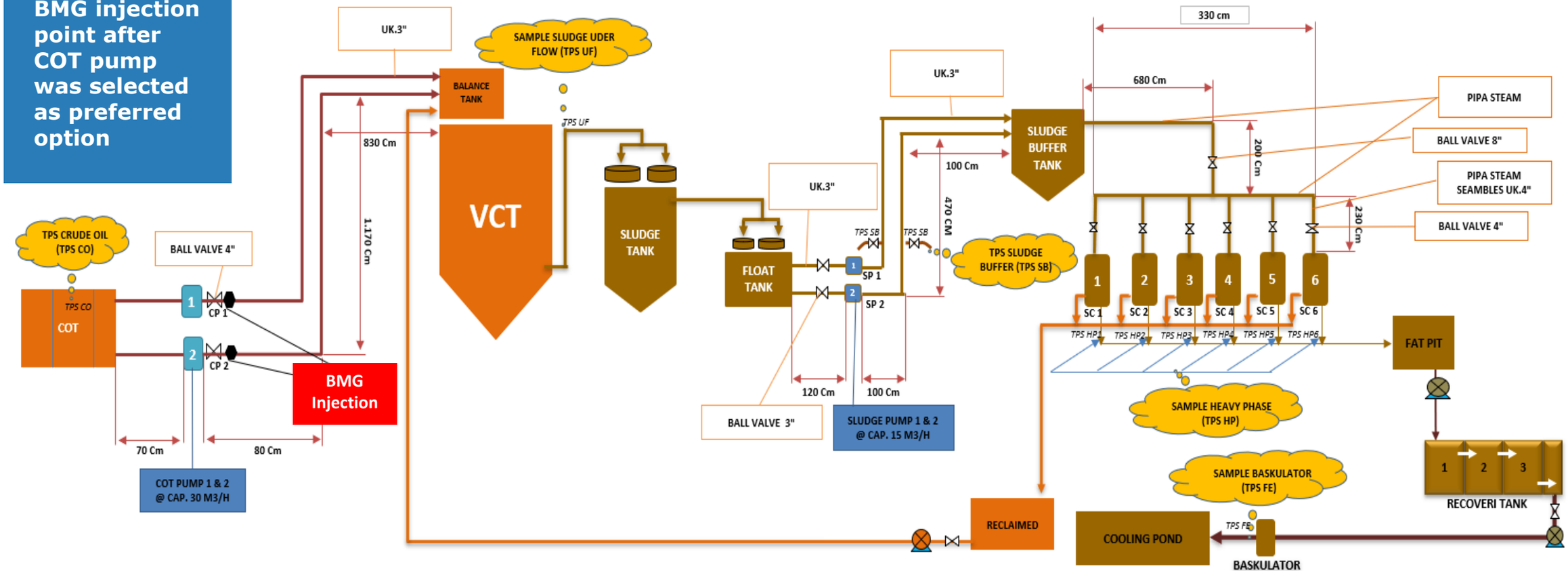
# PALM OIL MILL PROCESS FLOW DIAGRAM



# BMG INJECTION POINTS AT PALM MILL – REAL CASE EXAMPLES

**After several factory trials BMG injection point after COT pump was selected as preferred option**

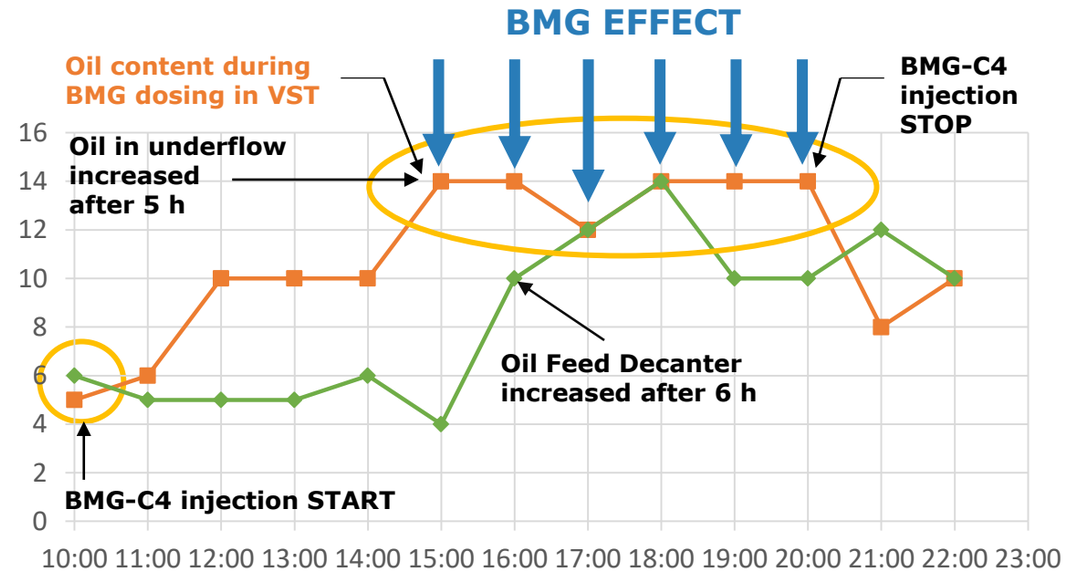
## DIAGRAM FLOW SLUDGE ST. CLARIFICATION



# FACTORY A – BMG INJECTION INTO CLARIFIER

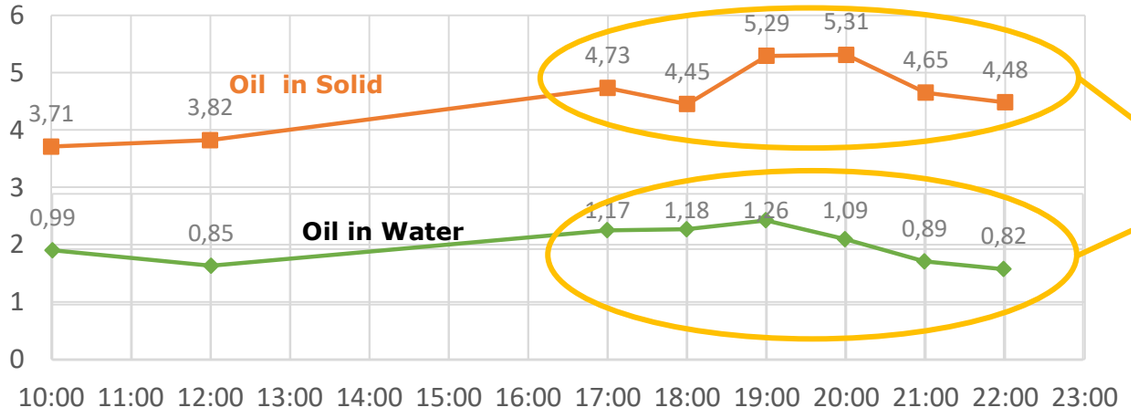
- Oil content in VST underflow increased after 5 hours of BMG injection when BMG feed 100% Clarifier volume
- BMG extracted additional 5% oil = 32 cm >> 2 times normal >> 2 times Feed Decanter
- Oil Skimmer was not adjusted during the day
- Additional oil went into underflow sludge and safely collected by Decanter

**BMG increased oil extraction resulted in > 2 times oil content in Underflow**



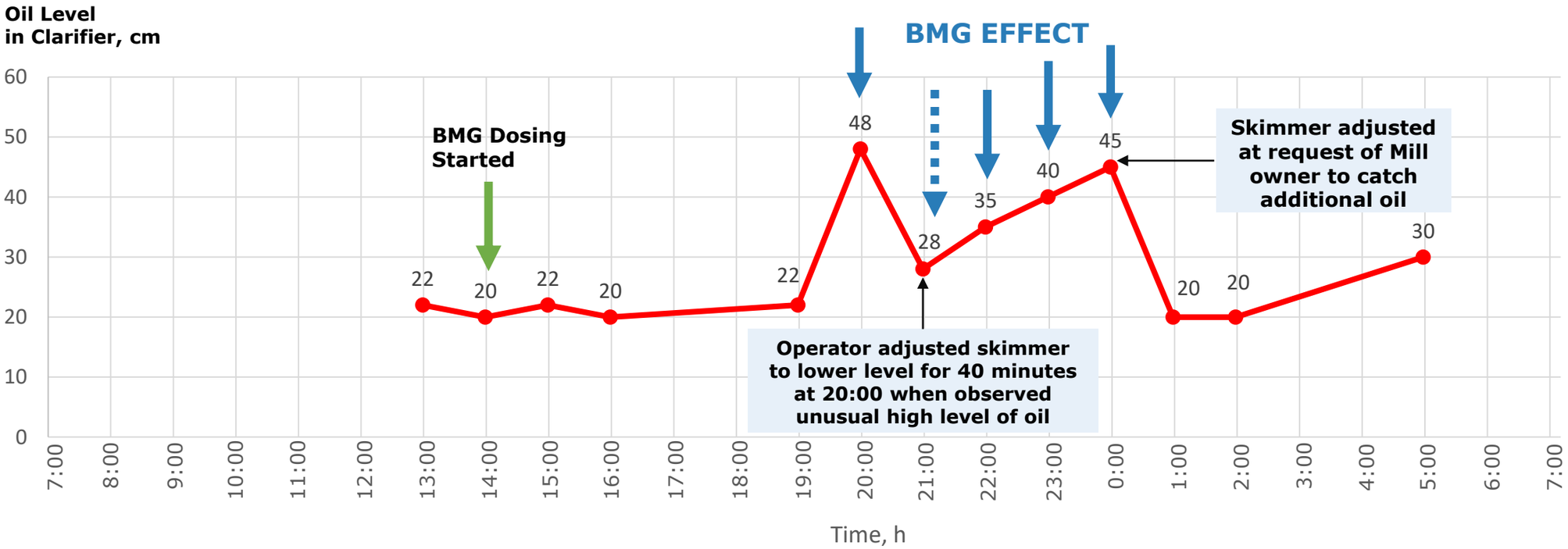

**BMG INJECTION**

- After COT pump
- Dosing 1 g/l COT sludge
- BMG 3% solution in water to minimize additional volume effect at Clarifier




Oil content in Solid and Heavy Phases: no significant change from normal operations

# FACTORY B – BMG INJECTION INTO CLARIFIER




**BMG INJECTION:**

- After COT pump
- Dosing 1 g/l COT sludge
- BMG 3% solution in water to minimize additional volume effect at Clarifier

- BMG extracted additional oil in Clarifier exactly after 5 hours of dosing of all Clarifier volume
- Oil level increased 2 times from average operational levels, exactly after BMG feeding 100% Clarifier volume
- At the request of the owner skimmer was adjusted at 24:00 not to further loose oil into the pond

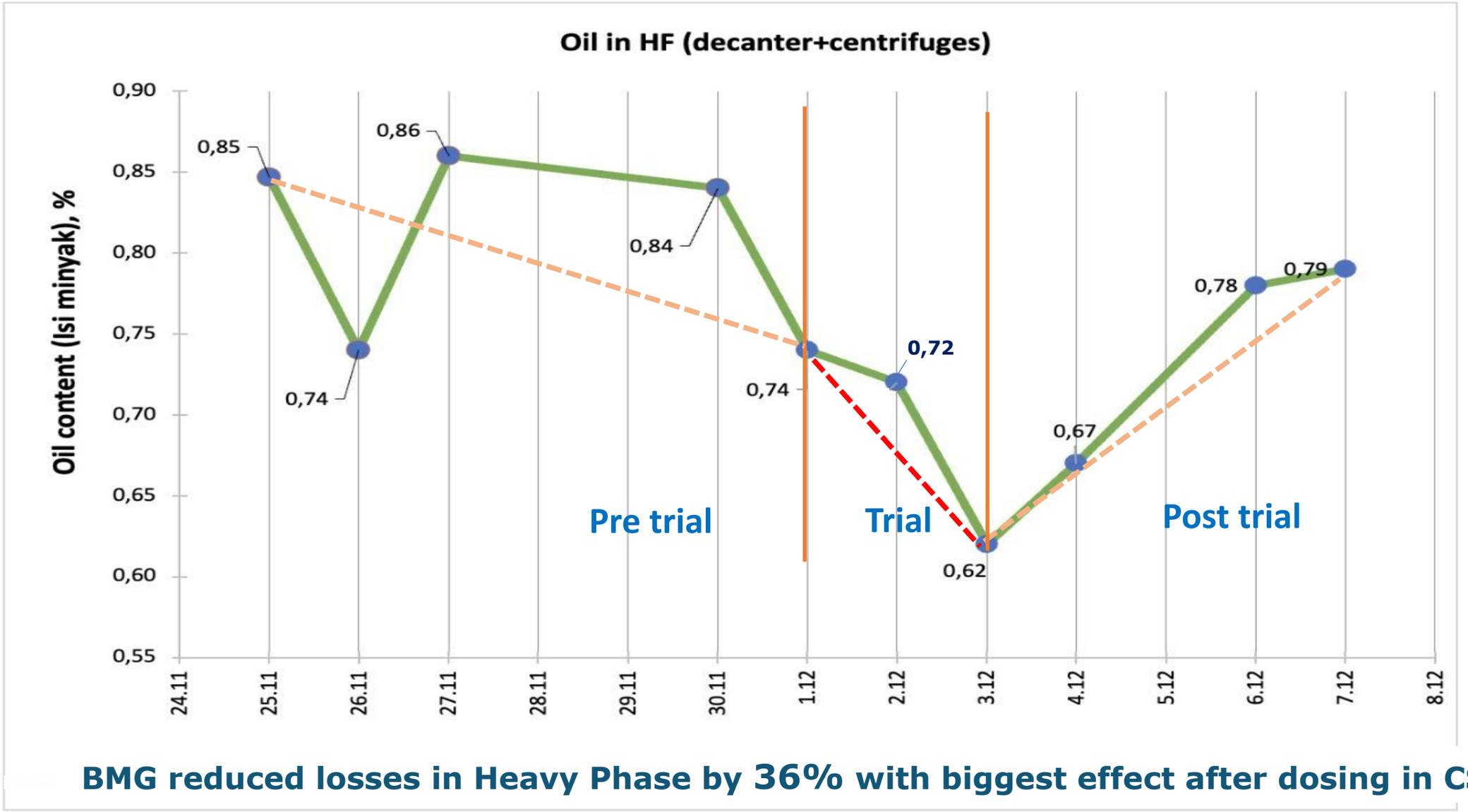
**BMG increased oil extraction resulted in > 2 times higher oil level in Clarifier**

# Total losses Decanter + Centrifuge + Solid vs 10 days

| | 21-30.11. - 01.12. | 21-30.11. - 02.12. | 21-30.11. - 03.12. | Trials Success Criteria |
|---|---|---|---|---|
| Reduction oil in HF (decanter, centrifuges), % | 15,4 | 17,1 | 35,7 | |
| Reduction oil in Solid (decanter, centrifuges), % | 13,2 | 20,5 | 28,7 | |
| TOTAL reduction oil in HF+Solid (decanter, centrifuges), % | 14,6 | 18,3 | 33,2 | ≥30% |

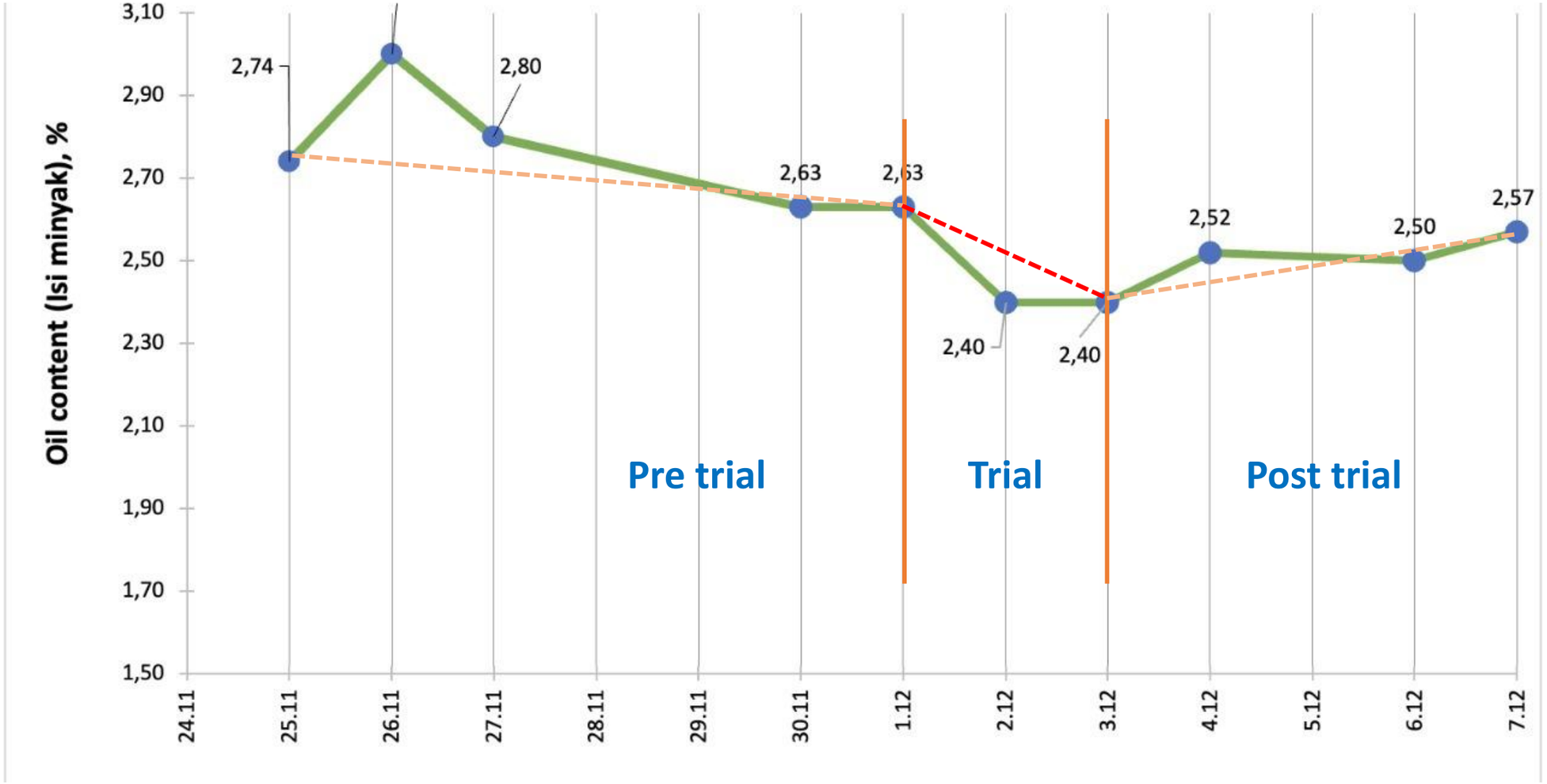
**BMG reduced losses both in Heavy Phase and in Solid, meeting trials success criteria, with best results after dosing in CST3**

# Decanter and Centrifuge Heavy Phase




**BMG reduced losses in Heavy Phase by 36% with biggest effect after dosing in CST3**

# Decanter Solid Phase




**BMG reduced losses in Solid phase by 29% with biggest effect after dosing in CST3**

# BMG MIXING AND DOSING STATION – REAL CASE EXAMPLES


**BMG Dosing Station – designed specifically for BMG dosing at Palm Oil Mills with automatic feeding and dosing**

- BMG Mixing and Dosing Station – one and two-level execution
- BMG mixing and dosing station proved to be efficient  and reliable solution in all the trials
- BMG application in industrial environment is simple and results are evident without changes in existing technology and equipment

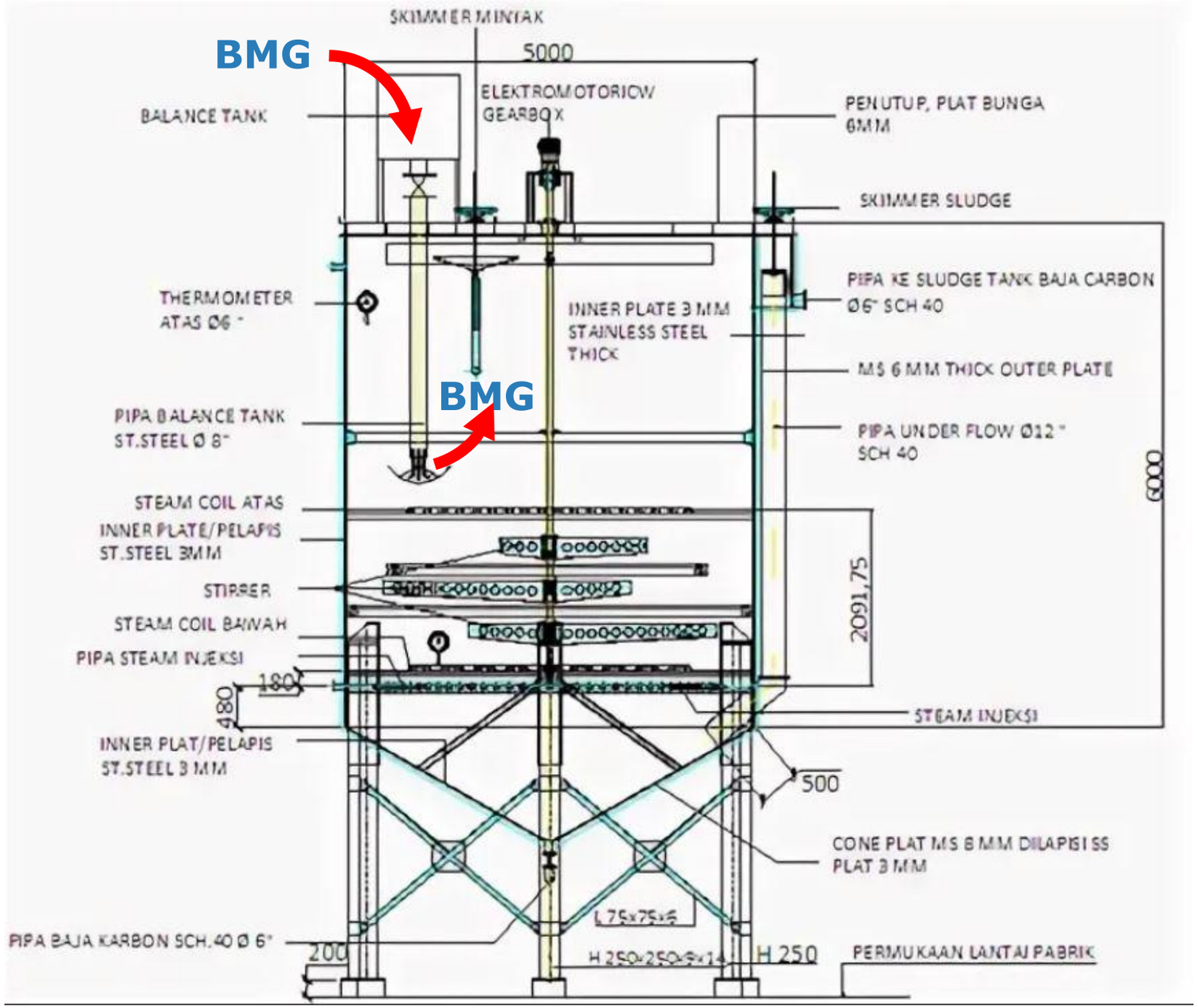
# BMG Economic Value Added (EVA) for 75 TPH Mill

| **Economic Value Calculations (EVA)** | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CPO price/tn (high Grade), USD | 800.00 | * Conservative est based on 2022 forecast | | | | | | | | | | | | | | | | |
| BMG Price DDP, USD | 8.00 | | | | | | | | | | | | | | | | | |
| **Factory 90 TPH (Fruit Bunches) Extraction rate 18%** | | | | | | | | | | | | | | | | | | |
| Max Capacity, FFB tns/hr | 75 | 75 | 75 | | 75 tns/hr is a maximum capacity, but actual is less, so we take actual 60 tns/hr | | | | | | | | | | | | | |
| Actual Capacity, FFB tns/hr | 60 | 60 | 60 | | | | | | | | | | | | | | | |
| Capacity, FFB tns/day | 1,080 | 1,080 | 1,080 | | | | | | | | | | | | | | | |
| Extraction rate, % | 18 | 18 | 18 | | We take conservative 18% as a median for Malaysia | | | | | | | | | | | | | |
| Oper hrs per day | 18 | 18 | 18 | | Mills with this high capacity have 20 hrs operating time per day, but we take concervatively 18 hrs | | | | | | | | | | | | | |
| Working days/mth | 25 | 25 | 25 | | | | | | | | | | | | | | | |
| Sludge to FFB, % | 60 | 60 | 60 | | We take conservatively sludge 60%, while industry standard is 55% sludge to FFB | | | | | | | | | | | | | |
| **BMG Additional oil, %** | **3** | **4** | **5** | | | | | | | | | | | | | | | |
| **Factory C (Fruit Bunches) Extraction 18%** | | | | | | | | | | | | | | | | | | |
| BMG Additional oil/day, tn Clarifier | 5.8 | 7.8 | 9.7 | | | | | | | | | | | | | | | |
| BMG Additional oil/day, tn POME | 1.75 | 1.75 | 1.75 | | 30% oil loss reduction in POME, normally oil loss in POME is 0.54% to FFB, we took here 0.54% from real case Mill | | | | | | | | | | | | | |
| Total BMG additional oil/day | 7.6 | 9.5 | 11.5 | | | | | | | | | | | | | | | |
| BMG Additional oil/yr, tn | 2,274 | 2,858 | 3,441 | | | | | | | | | | | | | | | |
| BMG per day, kg | 270 | 270 | 270 | | | | | | 25 | m3/h | 33.3 | g/l | 30 | convertion 3% solution into dry BMG (kg) | | | | |
| BMG per year, kg | 80,919 | 80,919 | 80,919 | | | | | | | | | | | | | | | |
| **BMG Add Value, USD** | **1,819,584** | **2,286,144** | **2,752,704** | | CPO price conservatively at USD 800 per ton | | | | | | | | | | | | | |
| BMG cost per year, USD | 647,352 | 647,352 | 647,352 | | | | | | | | | | | | | | | |
| **EVA** | **1,172,232** | **1,638,792** | **#########** | | | | | | | | | | | | | | | |
| CPO tn/day | 194 | 194 | 194 | | | | | | | | | | | | | | | |
| CPO tn/mth | 4,860 | 4,860 | 4,860 | | | | | | | | | | | | | | | |
| CPO tn/yr | 58,320 | 58,320 | 58,320 | | | | | | | | | | | | | | | |
| **BMG kg per 1CPO tn** | | | **1.4** | | | | | | | | | | | | | | | |
| **BMG kg per 1FFB tn** | | | **0.250** | | | | | | | | | | | | | | | |
| **BMG price per 1FFB tn** | | | **2.00** | | | | | | | | | | | | | | | |

# BMG INJECTION INTO CLARIFIER – REAL CASE EXAMPLES

Procedure:

3% BMG Solution mixed with COT sludge injected after the COT pump into the sludge pipe that goes into COT sludge inlet pipe 130-200 cm, with deflector at the end for better distribution of sludge inside Clarifier



# BMG LEADERSHIP IN NEW TECHNOLOGY OF ADDITIONAL PALM OIL EXTRACTION

- **Biomicrogels group**, based on **successful** Industrial **trials**, received orders for first containers with BMG for Indonesian and Malaysian customers **delivered in November 2021 – January 2022**
- **BMG Dosing stations** optimized for various mills capacity delivered to customers
- Currently the **2022 quotas discussed** and production schedule coordinated
- To ensure **your company leadership** in the application of BMG – the most innovative and effective solution for additional palm oil extraction we – **urge you to place your orders for BMG in the shortest possible time**

**BMG team is ready to support you in all the steps of implementing BMG technology at your Palm Oil Mills**

# BMG IMPLEMENTATION – STEP BY STEP APPROACH

- Select **Palm Oil Mill** for BMG introduction
- **Collect** the Palm Mill **technical data** to select the right BMG Mixing & Dosing Station, we will share the best and cost effective experience
- We are ready to supply BMG Dosing Station for commercial application within 1 month after placing an order
- Our support team will provide BMG application Specifications, Operational Manuals, Lab tests procedures
- **BMG** is shipped in 20 or 40 ft **sea containers** to your closest sea port; BMG is packed in 25 kg polybags loaded on pallets
- Depending on existing **COVID-19 quarantine** procedures **BMG** support team **can assist** both online and offline in successful implementation of BMG at the Palm Mill

# BMG SAFETY DATA

- **BMG does not affect quality and main characteristics of Crude and Refined Palm oil as it does not stick to oil and remains in sludge and mill effluent**

**Crude and Refined Oil Analysis after BMG Application – Malaysia, independent lab test report (1)**

| SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **SAMPLE ID** | CPO I(RN) | CPO II(RN) | CPO III(RN) | CPO IV(RN) | CPO V(RN) | RBDPO I(RN) | RBDPO II(RN) | RBDPO III(RN) | RBDPO IV(RN) | RBDPO V(RN) |
| **FFA%** | 1.39 | 1.25 | 1.16 | 1.31 | 1.16 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| **PV (meq/kg)** | na | na | na | na | na | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **IV-FAC** | 56.58 | 56.11 | 56.40 | 55.41 | 55.14 | 56.00 | 56.97 | 57.63 | 58.00 | 55.70 |
| **Color ( 51/4" cell ) Red** | na | na | na | na | na | 1.00 | 1.20 | 1.00 | 1.00 | 1.00 |
| **Color ( 51/4" cell ) Yellow** | na | na | na | na | na | 14.00 | 13.00 | 20.00 | 20.00 | 15.60 |
| **Color ( 51/4" cell ) ~~White~~ blue** | na | na | na | na | na | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **AnV** | 6.91 | 5.46 | 6.85 | 3.37 | 3.91 | 1.42 | 1.21 | 1.24 | 2.18 | 1.96 |
| **UV by TOTOX (E233 +E269)** | 1.85 | 1.89 | 1.88 | 1.87 | 2.01 | 1.79 | 2.02 | 1.95 | 2.18 | 1.96 |
| **Smoke Point (°C)** | na | na | na | na | na | 218.00 | 220.00 | 220.00 | 220.00 | 222.00 |
| **Rancimat IP (120°C)** | na | na | na | na | na | 12.26 | 13.18 | 12.68 | 13.82 | 13.32 |
| **Moisture (%)** | 0.09 | 0.11 | 0.07 | 0.14 | 0.08 | 0.05 | 0.05 | 0.05 | 0.04 | 0.05 |
| **Impurities (%)** | 0.03 | 0.02 | 0.02 | 0.02 | 0.03 | 0.01 | 0.00 | 0.01 | 0.02 | 0.01 |
| **Total tocols (ppm)** | 1157.00 | 1088.00 | 1146.00 | 1135.00 | 1145.00 | 171.00 | 270.00 | 284.00 | 318.00 | 221.00 |

# BMG SAFETY DATA

## Crude and Refined Oil Analysis after BMG Application – Malaysia, independent lab test report (2)

| SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | CPO I(RN) | CPO II(RN) | CPO III(RN) | CPO IV(RN) | CPO V(RN) | RBDPO I(RN) | RBDPO II(RN) | RBDPO III(RN) | RBDPO IV(RN) | RBDPO V(RN) |
| 3-MCPD (ppm) | nd | nd | nd | nd | nd | 0.53 | 0.62 | 0.41 | 1.23 | 0.75 |
| TG by GC (%) | 96.43 | 96.27 | 96.39 | 96.10 | 96.02 | 95.29 | 97.05 | 97.18 | 96.97 | 97.11 |
| DG by GC (%) | 2.64 | 2.62 | 2.66 | 2.89 | 2.67 | 4.70 | 2.89 | 2.81 | 3.04 | 2.89 |
| MG by GC (%) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FFA by GC (%) | 0.83 | 0.98 | 0.86 | 0.92 | 1.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PTG by HPLC (%) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.19 | 0.07 | 0.23 | 0.06 |
| TG by HPLC (%) | 95.58 | 95.57 | 95.53 | 95.33 | 95.61 | 95.56 | 95.55 | 95.86 | 95.41 | 95.84 |
| DG by HPLC (%) | 3.45 | 3.56 | 3.57 | 3.58 | 3.42 | 4.29 | 4.25 | 4.07 | 4.30 | 4.10 |
| MG by HPLC (%) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FFA by HPLC (%) | 0.97 | 0.87 | 0.89 | 1.09 | 0.97 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| TPC by HPCL (%) | 4.42 | 4.43 | 4.47 | 4.67 | 4.39 | 4.44 | 4.45 | 4.14 | 4.59 | 4.16 |
| Total Chlorine (ppm ) | na | na | na | na | na | na | na | na | na | na |
| Corotene (ppm) | 635.00 | 631.00 | 625.00 | 642.00 | 632.00 | na | na | na | na | na |
| DOBI | 3.34 | 3.33 | 3.21 | 3.06 | 3.11 | na | na | na | na | na |
| Fatty Acid Composition % | | | | | | | | | | |
| C8 | - | - | - | - | - | | | | - | - |
| C10 | - | - | - | - | - | | | | - | - |

# BMG SAFETY DATA

## Crude and Refined Oil Analysis after BMG Application – Malaysia, independent lab test report (3)

| SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **SAMPLE ID** | CPO I(RN) | CPO II(RN) | CPO III(RN) | CPO IV(RN) | CPO V(RN) | RBDPO I(RN) | RBDPO II(RN) | RBDPO III(RN) | RBDPO IV(RN) | RBDPO V(RN) |
| **C12** | **0.29** | **0.28** | **0.29** | **0.32** | **0.32** | **0.28** | **0.28** | **0.28** | **0.27** | **0.30** |
| **C14** | 0.94 | 0.91 | 0.93 | 0.98 | 0.97 | 0.96 | 0.93 | 0.93 | 0.92 | 1.00 |
| **C16** | 39.11 | 39.38 | 39.22 | 40.12 | 40.51 | 39.70 | 38.77 | 38.85 | 38.71 | 40.83 |
| **C16-1** | 0.14 | 0.13 | 0.14 | 0.15 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.15 |
| **C18** | 4.77 | 4.88 | 4.82 | 4.69 | 4.68 | 4.68 | 4.75 | 4.75 | 4.76 | 4.55 |
| **C18:1** | 43.29 | 43.09 | 43.23 | 42.49 | 42.25 | 42.84 | 43.52 | 43.52 | 43.49 | 41.99 |
| **C18:2T** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 0.26 | 0.30 | 0.35 | 0.30 |
| **C18:2** | 10.64 | 10.49 | 10.51 | 10.45 | 10.34 | 10.37 | 10.63 | 10.52 | 10.59 | 10.20 |
| **C18:3** | 0.30 | 0.29 | 0.34 | 0.24 | 0.29 | 0.19 | 0.21 | 0.51 | 0.58 | 0.48 |
| **C20** | 0.53 | 0.54 | 0.53 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.58 | 0.48 |
| **IV-FAC** | 56.58 | 56.11 | 56.40 | 55.41 | 55.14 | 56.00 | 56.97 | 57.63 | 58.00 | 55.70 |
| **Glyceride Composition by GC %** | | | | | | | | | | |
| **FFA1** | 0.42 | 0.49 | 0.43 | 0.46 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **FFA2** | 0.41 | 0.49 | 0.43 | 0.46 | 0.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **MG1** | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **MG2** | 0.09 | 0.11 | 0.09 | 0.08 | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **C34-D1** | 0.35 | 0.23 | 0.36 | 0.42 | 0.37 | 0.72 | 0.39 | 0.38 | 0.44 | 0.38 |
| **C36-D2** | 1.44 | 1.45 | 1.42 | 1.57 | 1.42 | 2.68 | 1.54 | 1.50 | 1.62 | 1.54 |
| **C38-D3** | 0.85 | 0.94 | 0.88 | 0.90 | 0.88 | 1.30 | 0.96 | 0.93 | 0.98 | 0.97 |
| **C46** | 0.94 | 0.78 | 0.87 | 0.91 | 0.82 | 1.44 | 0.78 | 0.76 | 0.78 | 0.75 |
| **C48** | 10.26 | 8.15 | 10.21 | 10.82 | 8.23 | 13.67 | 8.19 | 8.04 | 8.22 | 8.96 |
| **C50** | 40.65 | 38.10 | 39.55 | 41.27 | 37.53 | 61.38 | 37.81 | 38.38 | 38.16 | 37.88 |
| **C52** | 35.01 | 38.35 | 35.82 | 33.85 | 38.52 | 0.66 | 39.23 | 38.95 | 38.77 | 38.55 |
| **C54** | 9.00 | 10.27 | 9.35 | 8.69 | 10.31 | 17.14 | 10.41 | 10.42 | 10.42 | 10.35 |
| **C56** | 0.57 | 0.62 | 0.59 | 0.56 | 0.61 | 1.00 | 0.63 | 0.63 | 0.62 | 0.62 |
| **TG by GC (%)** | 96.43 | 96.27 | 96.39 | 96.10 | 96.02 | 95.29 | 97.05 | 97.18 | 96.97 | 97.11 |
| **DG by GC (%)** | 2.64 | 2.62 | 2.66 | 2.89 | 2.67 | 4.70 | 2.89 | 2.81 | 3.04 | 2.89 |
| **MG by GC (%)** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **FFA by GC (%)** | 0.83 | 0.98 | 0.86 | 0.92 | 1.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# BMG SAFETY DATA

## Crude and Refined Oil Analysis after BMG Application – Malaysia, independent lab test report (3)

### Heat stability analysis

| Sample ID | Date | Day | FFA (%) | PV (meq/kg) | AnV | Color | | UV Totox | Rancimat 120 C (hr) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Red | Yellow | | |
| RBDPO I (RN) | 15/10 | 0 | 0.025 | 0 | 1.42 | 1 | 14 | 1.79 | 13.26 |
| | 18/10 | 3 | 0.713 | 9.58 | 2.22 | 2.2 | 23 | 2.6 | 6.31 |
| | 20/10 | 5 | 0.926 | 15.07 | 5.68 | 2.9 | 28 | 3.12 | 2.9 |
| RBDPO II (RN) | 15/10 | 0 | 0.028 | 0 | 1.21 | 1.2 | 13 | 2.02 | 13.18 |
| | 18/10 | 3 | 0.653 | 8.88 | 3.95 | 2.5 | 38 | 2.7 | 8.71 |
| | 20/10 | 5 | 0.918 | 15.43 | 6.78 | 3 | 20 | 3.3 | 4.7 |
| RBDPO III (RN) | 15/10 | 0 | 0.025 | 0 | 1.24 | 1 | 20 | 1.95 | 12.68 |
| | 18/10 | 3 | 0.586 | 9.17 | 3.72 | 2.1 | 20 | 2.58 | 7.77 |
| | 20/10 | 5 | 0.853 | 15.37 | 5.63 | 2.9 | 20 | 3.13 | 4.1 |
| RBDPO IV (RN) | 15/10 | 0 | 0.03 | 0 | 1.653 | 1 | 20 | 2.18 | 13.82 |
| | 18/10 | 3 | 0.759 | 10.15 | 3.116 | 2.4 | 29 | 2.64 | 7.71 |
| | 20/10 | 5 | 0.961 | 13.66 | 6.366 | 3.1 | 29 | 3.04 | 3.86 |
| RBDPO V (RN) | 15/10 | 0 | 0.027 | 0 | 1.82 | 1 | 16 | 1.96 | 13.32 |
| | 18/10 | 3 | 0.753 | 9.37 | 3.58 | 2 | 25 | 2.73 | 9.44 |
| | 20/10 | 5 | 1.019 | 13.95 | 6.27 | 3.1 | 37 | 3.34 | 5.62 |