The application of Purifine® enzymes in soybean oil processing

Rob Rasing
Indore/MP, 7-8 October 2023

12-10-2023

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We're a trusted partner to global companies operating in high-growth and resilient markets.

We're innovators in nutrition, health, and beauty

~30,000

passionate, talented, and diverse people in our global team

150+ years

of combined scientific discovery and innovation heritage

€12+ bn

combined revenue

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Market dynamics are changing …

Production yield and plant profitability are under pressure

WDG = yield loss
from Oil-in-gums

Lecithin
market demand &
prices dropped

Drive
to use less
effluents

How to mitigate these risks?

Enzymes are a solution.
What are benefits and trade-offs?

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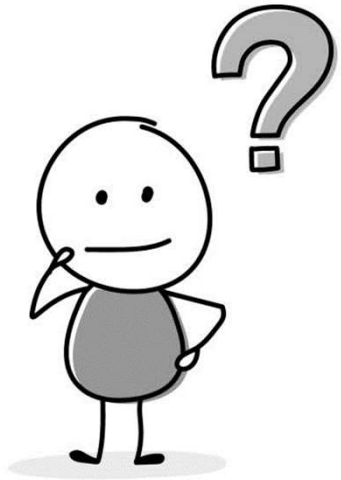
Purifine® enzymes bring multiple solutions to SBO processing



- I want to **increase yield** and am ready to invest in Capex

Purifine® 3G

Up to 2% higher oil yield
No lecithin (gum to meal)
Capex required

- I want to **increase yield**, but am not ready (yet) to invest in Capex

Purifine® LM

0.5-1% higher oil yield
Lysolecithin
No Capex; plug-n-play

- How do I prepare for **physical refining**?

Purifine® PLA1

Up to 2% higher oil yield
Reach P-level
for physical refining
Capex required

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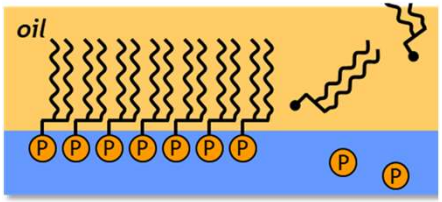
Purifine® 3G for enzyme-assisted Water Degumming (WDG) of Soybean Oil

How it works?

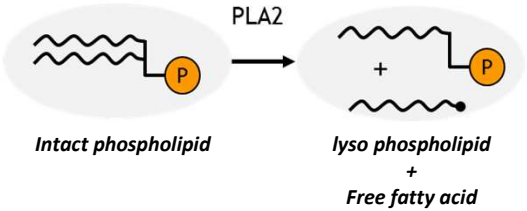
Purifine® 3G enzymatic-assisted Degumming

Breakdown of PLs, producing DAG (form of neutral oil)



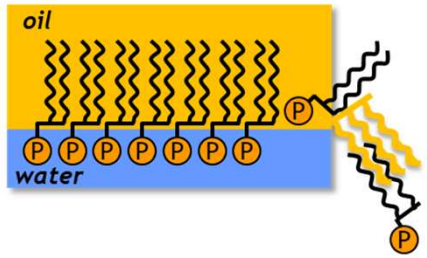
Phospholipase C

Phospholipase A2



Water Degumming (WDG)

High oil-loss-in-gums
Intact lecithin



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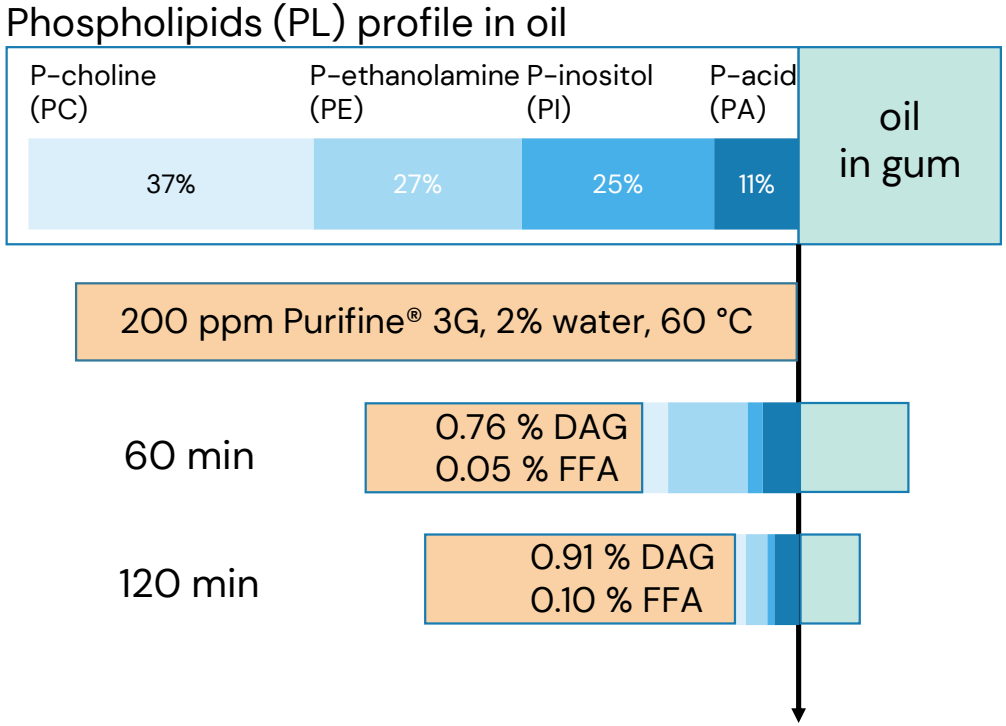
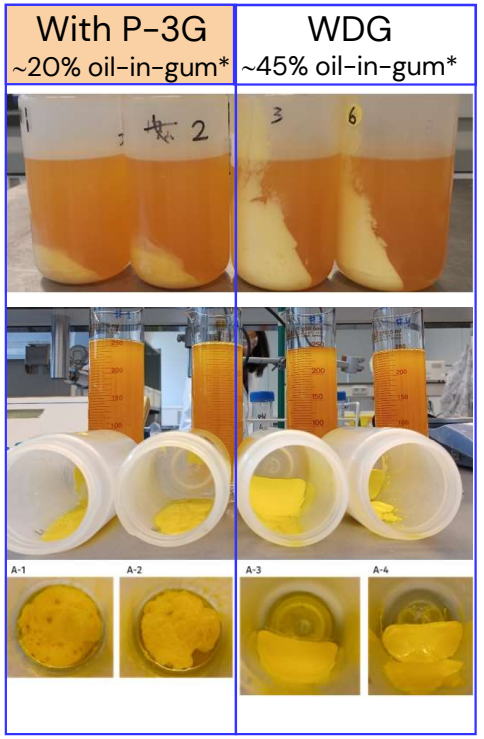
How Purifine® 3G increases oil yield?

Laboratory results show how conversion of phospholipids works in SBO processing (700 ppm P-content)





*lab table-top centrifuge, no disc centrifuge

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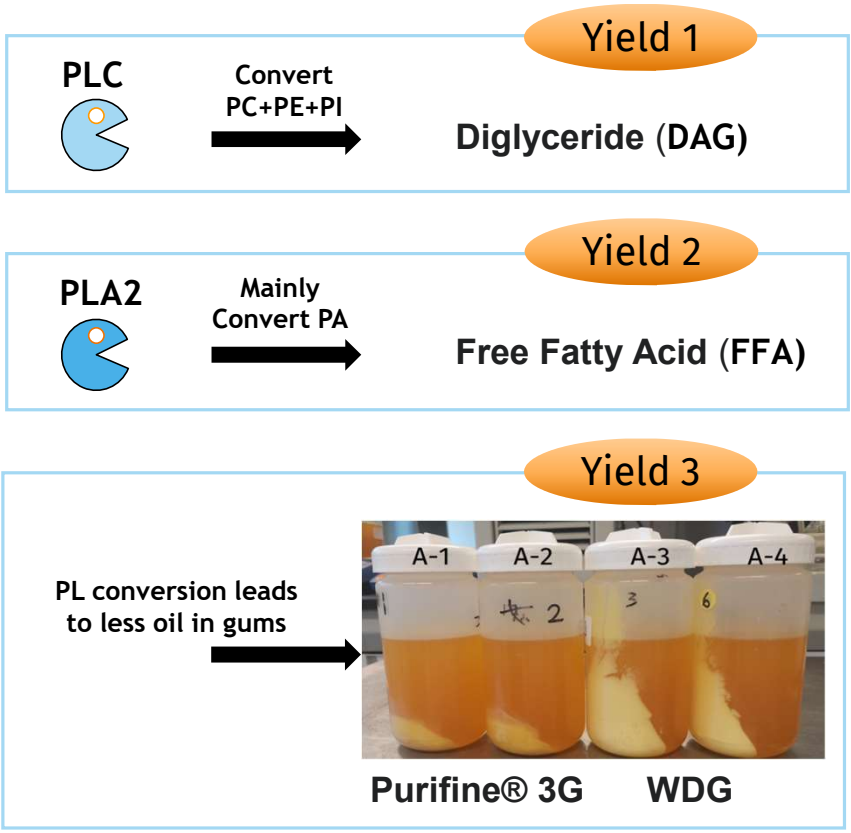
Industry-proven solution at full production scale confirms how Purifine® 3G increases oil yield

Source of Soybean Oil (SBO)	P content	Yield 1 Diglyceride (DAG)	Yield 2 Acid (FFA)	Yield 3 Oil from Gums
	ppm	%	%	%
USA	800-1000	1.2-1.5	0.05-0.2	0.5-0.8
Brazil	400-800	0.3-0.8	0.1-0.3	0.3-0.5
India	600-1000	We offer lab scale test to provide these values for your oil		



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Case study with Purifine® 3G:
Annual revenue gain of 290k Euro/year *

Crushing/Extraction plant operating 300 days/year
Capacity of 250 tonne SBO/day
The plant does not make lecithin (= gum goes to meal)
Crude oil contains 700 ppm "Total-P" from phospholipids

Purifine® 3G	Reaction Time	DAG Yield	Oil recovered	Annual revenue generated
150 ppm dosage	2h @ 60 °C	1 %	0.6 %	€ 290,000

Assumptions:

- Oil: 1000 €/tonne
- Meal: 450 €/tonne
- Extra energy consumption: 0,5 €/tonne

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Purifine® 3G, proven solution to increase oil yield in SBO Water-Degumming

Up to 2% extra Oil yield

- Saving oil loss from gums
- Generate neutral oil in form of DAG

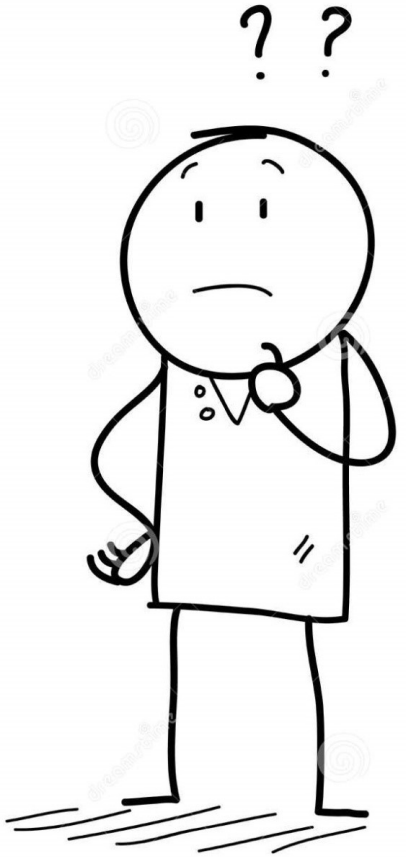
Industrially proven, at global scale

- Tested and proven on different soybean sources
- Used in plants in North America, Europe & LATAM regions

Meal with higher protein content, Typical oil:

- P-level 100-150 ppm
- DAG formation: ~1%
- FFA formation: ~0.1%
- Gums to meal
- No lecithin

I want to **increase yield**, but am not ready (yet) to invest in Capex



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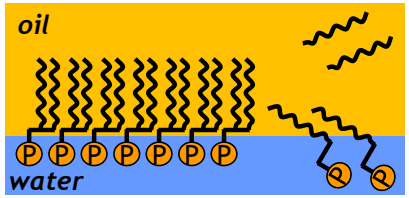
Purifine® LM helps minimize oil loss to gums, at no Capex (Plug-n-Play)

Purifine® LM enzymatic-assisted Degumming

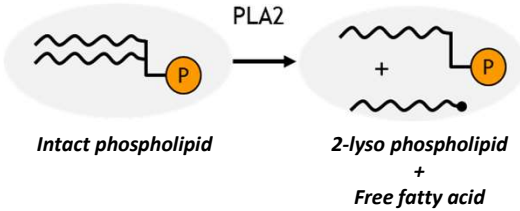
Temperature stable 75-85 °C
Reaction time 30-60 min.

No preconditioning or high-shear mixing



Breakdown of PLs into lyso-phospholipid (LPL) & free fatty acid (FFA)

Phospholipase A2



Enzyme functions at current WDG conditions
No change in plant set up required

Enzyme is added with simple dosing pump

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Purifine® LM, no Capex solution for Water Degumming SBO that increases oil recovery and produces lyso-lecithin

Up to 1% extra Oil yield

- Up to 200k Euro revenue gain
- Saving oil loss from gums
- 20-35% reduction in gum volume

Successful Industrial implementation

- No Capex required, minimal process changes
- Successful proof of principle on multiple crude oils
- Trialed in plants in USA, Europe & LATAM

Lyso-lecithin valuable niche

- Wide range of applications in food, feed & cosmetics
- Retains nutritional characteristics of lecithin

We are ready to discuss how Purifine® can benefit your plant!

We offer:

On-site trial support

Technical support during and after field trials, including troubleshooting

Team of scientists and application working to innovate in oils and fats

Come visit our booth

We bring progress to life™

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PURIFINE® PLA1

ENABLE PHYSICAL REFINING OF SBO TO INCREASE OIL YIELD & MEET PHOSPHORUS SPECIFICATION IN REFINED OIL

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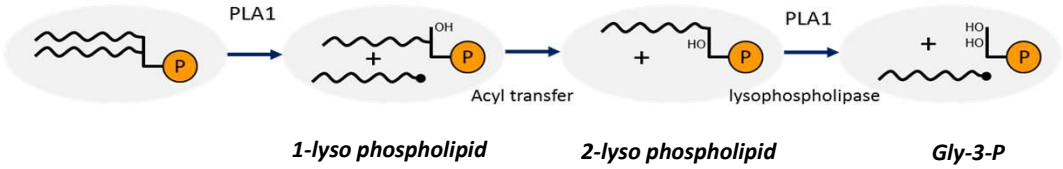
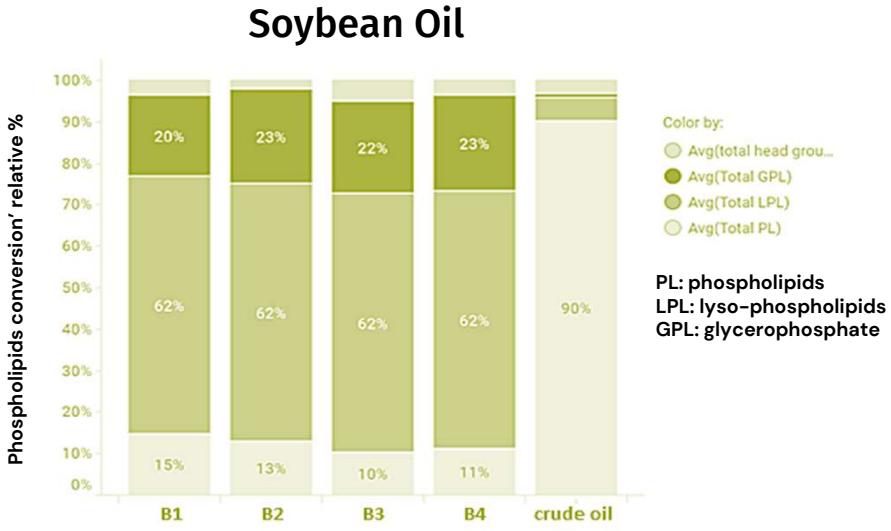
What is the function of Purifine® PLA1?

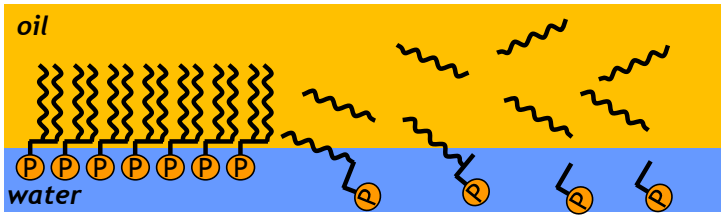
Phospholipase A1





PL: phospholipids
LPL: lyso-phospholipids
GPL: glycerophosphate

Reach 85-90% hydrolysis of all phospholipids on SBO



Break the emulsion without caustic addition, reaching P-spec

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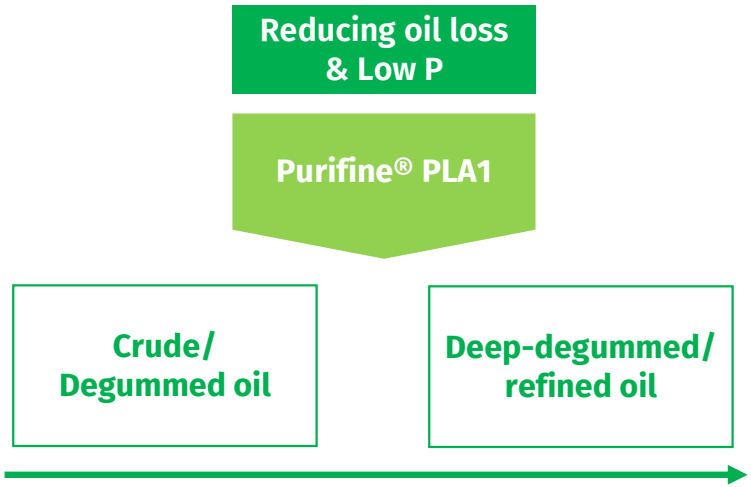
Purifine® PLA1: the enzymatic physical refining solution

- Enable physical refining of SBO
- Saving oil loss up to 2%
- No caustic usage - avoid soapstock formation
- Robust performance on reaching P-spec
- Successful Industrial applications globally



Applied on	Applied in	Outlet oil goes into	Outlet oil P level	Outlet oil FFA
Crude oil or degummed oil	Deep-degumming step	Bleaching / deodorization	< 20 ppm	Increase of 0.1-1.2%

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