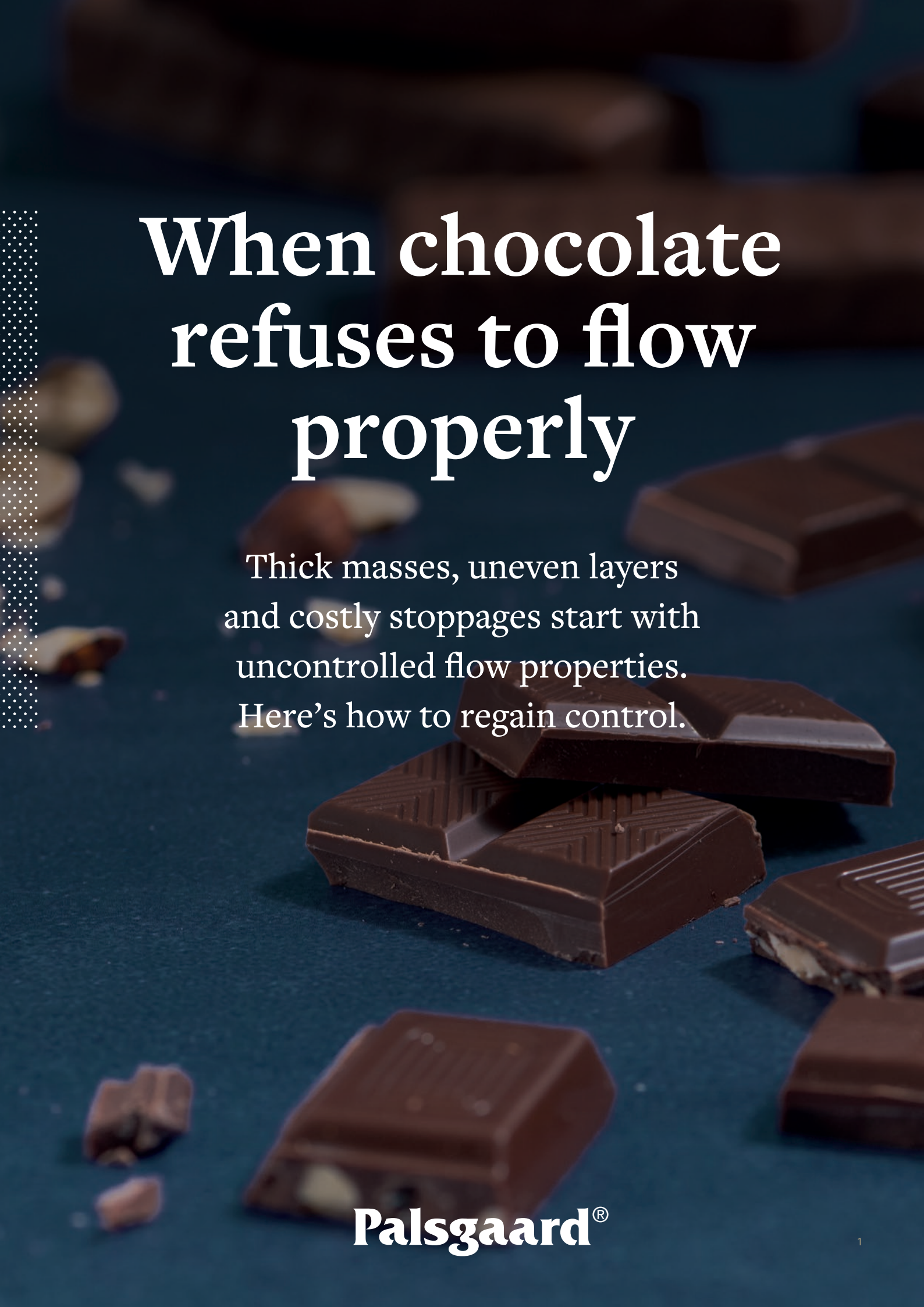


The background of the entire slide is a close-up photograph of several pieces of dark chocolate. The chocolate is broken into various sizes and shapes, some showing a textured surface with ridges. The pieces are scattered across a dark blue, slightly textured surface. The lighting is soft, highlighting the glossy sheen of the chocolate.

When chocolate refuses to flow properly

Thick masses, uneven layers
and costly stoppages start with
uncontrolled flow properties.
Here's how to regain control.



Problem

In chocolate production, small shifts in flow behaviour (plastic viscosity and yield value) quickly turn into thick chocolate masses, uneven layers, visually unappealing products, production stoppages and rework. Lecithin struggles to deliver the necessary functionality to avoid these issues.

Solution

Apply a measured approach to rheology by using emulsifiers that address both parameters of the Casson equation: Palsgaard® AMP 4455/4458 to reduce plastic viscosity without raising yield value, and Palsgaard® PGPR 4190 to lower yield value significantly. Together they offer precise, repeatable control across all chocolate applications – supported by pilot trials and batch verified performance in real chocolate.

What's inside

A clear explanation of chocolate rheology, a side by side emulsifier comparison, practical measurement steps and application examples. Plus, how our application specialists can help you optimise your production in application centres set up to fine tune your exact recipes under controlled manufacturing conditions.

When chocolate refuses to flow properly

Getting your flow properties right is the fastest way to unlock quality and efficiency gains in your chocolate production. Palsgaard is recognised as the world's n° 1 in non GMO chocolate and confectionery emulsifiers, with deep rheology expertise and facilities designed to transfer that know how directly to your production lines. This paper outlines how our products enable cocoa butter/fat reduction, reduce waste, rework and call-backs, minimise production stops and increase overall efficiency.

Chocolate flow behaviour can be described through two key parameters. The first is plastic viscosity, which represents the linear slope of the flow curve at low, medium and high shear. This parameter directly describes how chocolate behaves under flow during high-shear unit operations such as blowing, shaking and spraying. The second is yield value, defined as the force required to initiate flow. Yield value plays a decisive role in low-shear processes, such as maintaining a stable pick-up when dipping ice creams in chocolate, ensuring precise piping and moulding of chocolate and allowing air bubbles to escape effectively.

These parameters matter differently depending on the application. In ice cream coatings, they determine layer thickness, bubble release and the prevention of drip noses. During enrobing, plastic viscosity and yield value in combination govern layer thickness, while yield value alone has a major impact on feet formation at the base of the product. For moulded chocolates, achieving the right flow ensures cavities fill completely, avoiding holes and preserving sharp detail in the finished texture. And in filled products, balanced flow properties are critical to achieving uniform shell thickness, preventing weak points and reducing the risk of breakage.

Research and evidence

Choosing the right emulsifier isn't guesswork – it's science. At Palsgaard, we back every recommendation with solid data and real-world testing, ensuring that our customers can make confident, cost-effective choices. In-house trials demonstrate how AMP and PGPR outperform conventional solutions, delivering measurable improvements in flow properties – helping you get flow properties just right.

Palsgaard® AMP 4455/4458

- Palsgaard® AMP 4455/4458 reduce both plastic viscosity and yield value more effectively than lecithin at the same dosage. Unlike lecithin, they maintain stable yield values even at higher concentrations, and can be applied at levels up to 1.0% to achieve the desired viscosity reduction (or up to max 0.7% in the US).
- Palsgaard® AMP 4455 is sunflower-based, while Palsgaard® AMP 4458 is derived from rapeseed. Both are non-GMO, completely neutral in taste and odour and designed for easy handling – pumpable at room temperature without special preparation.
- Lecithin at ~0.4% typically delivers ~4% fat saving, while Palsgaard® AMP 4455/4458 at the same dosage can add an extra ~2–3% of fat savings, for a total potential saving of 6–7% (recipe dependent).

Palsgaard® PGPR 4190

- Built for demanding applications – where full control of the yield value is needed.
- Demonstrates notable batch to batch stability under testing in real chocolate. It's manufactured to be flavour neutral, non-GMO and based on non palm ingredients.
- Works with lecithin, but offers incomparable cost reduction possibilities when teamed with Palsgaard® AMP 4455/4458.



Proposed solution/ approach

At Palsgaard, we believe the most effective way to overcome flow challenges lies in the recipe itself – not in costly equipment upgrades or disruptive process changes. By focusing on the right emulsifier strategy and applying proven measurement methods, chocolate producers can unlock smoother processing and tighter quality control.

The starting point is to understand how different emulsifiers influence flow behaviour. Lecithin, while widely used, has a clear drawback: at higher dosages it tends to increase yield value which limit flexibility. In contrast, Palsgaard® AMP 4455/4458 drastically lower plastic viscosity without raising yield value, while Palsgaard® PGPR 4190 provides a marked reduction in yield value without impacting viscosity. Used individually or in combination, they give manufacturers precise tools to stabilise flow properties.

Emulsifier	Yield value	Plastic viscosity
Lecithin	Increases at high dosage	Lowers moderately
Palsgaard® AMP 4455/4458	No impact (doesn't rise with dosage)	Lowers drastically
Palsgaard® PGPR 4190	Lowers drastically	No impact

The most effective approach begins with AMP to bring plastic viscosity into the right range without risking a rise in yield value. Where low yield value is critical – PGPR is then introduced to fine-tune flow behaviour and ensure predictable performance.

To make these adjustments data-driven, measurement is essential. Running flow curves with a rotational viscometer or rheometer across relevant shear rates replicates the real conditions of pumping, depositing and enrobing. From these curves, plastic viscosity (slope) and yield value (intersection) can be calculated using the Casson model. Alternatively, a three-step shear test offers comparable insight into the flow behavior of a given chocolate.

By mapping these results to your process windows, you obtain clear guidance: low-shear applications, such as moulding and ice cream dipping, are primarily governed by yield value, whereas medium- to high-shear processes, including pumping and enrobing, are determined by plastic viscosity. Finally, practical considerations are also important. AMP is a liquid that can be pumped more easily than lecithin at ambient temperature. This eliminates the need for pre-heating or special stirring and helps avoid the risk of burned off-flavours during extended holds – offering peace of mind throughout the whole production.

Benefits and advantages

By applying the proposed approach, chocolate manufacturers can achieve far more than stable flow behaviour. The combination of AMP and PGPR unlocks a series of advantages that address both operational and commercial pain points.

Cost savings

Customer trials show that lecithin alone typically enables around 4% fat reduction at a dosage of ~0.4%. With Palsgaard® AMP 4455/4458 at the same level, this saving rises to 6–7% – a difference that translates directly into lower recipe costs across high production volumes. When Palsgaard® PGPR 4190 is added, even greater reductions are possible.

Efficiency in production.

By achieving consistent plastic viscosity and yield value, the combination of AMP and PGPR minimise the risk of thick chocolate masses, uneven coatings and costly production stoppages.

6–7%

fat reduction at a dosage of ~0.4%



Implementation details

Step 1 Define targets

Plastic viscosity window, yield value window, visual/ texture standards (snap, gloss) , layer thickness and line speed.

Step 2 Start with a functional combination

0.5% Palsgaard® AMP 4455/4458 + 0.01-0.05% Palsgaard® PGPR 4190. This combination addresses both plastic viscosity (AMP) and yield value (PGPR) . Adjust within the up-to-1.0% AMP dosing headroom as needed.

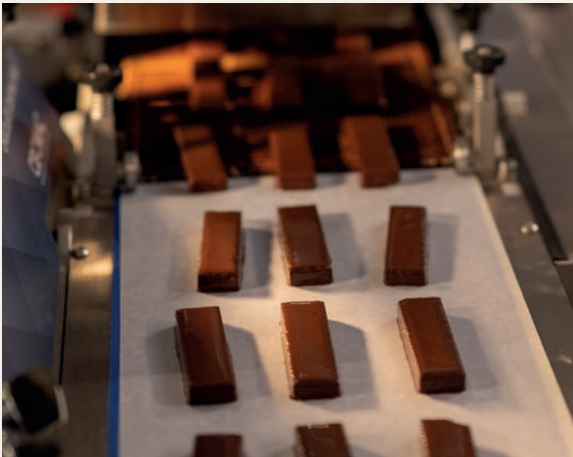
Step 3 Optimise total fat

Trim fat in 0.5–1.0 percentage point steps while measuring plastic viscosity and yield value. Verify quality on your equipment and cooling profiles.

Step 4 Validate and scale

Validate your recipe in our application centres, where we replicate real production conditions to secure a confident scale-up and provide documented savings alongside quality results – from flow behaviour to cost per unit.

Short examples



Enrobing (bars/biscuits, low fat target)

Use ~0.5% AMP + ~0.01-0.05% PGPR, then gradually reduce the total fat content until the desired apperance and layer thickness are achieved. If feet formation occurs, consider lowering the PGPR dosage and increasing the AMP dosage.



Ice cream coating

Moisture migration from the water-based ice cream into the chocolate during dipping can increase viscosity. A combination of AMP with PGPR helps maintain flow and avoid thick coats, pinholes and waste.



Moulded and filled chocolates

Use a combination of AMP and PGPR to enhance lettering and intricate moulding shapes, and to create a perfectly even layered shell for filled chocolates.

Conclusion and next steps

Getting your flow properties right is the foundation for consistent quality, efficient production and confident scale-up of new innovations in chocolate manufacturing. By managing both plastic viscosity and yield value with the right emulsifier strategy, producers can avoid common pitfalls such as thick chocolate masses, uneven layers or unstable coatings. The AMP/PGPR approach ensures stable, predictable flow behaviour across applications – so every product meets its target in both appearance and performance.

Let's collaborate to solve your production pains. As niche experts in high-functionality, speciality emulsifiers with deep knowledge and expertise within chocolate rheology, we bring decades of know-how directly to your recipes and production lines. In our global application centres, we work side by side with your team to run pilot trials, refine formulations and validate performance under real-world conditions. Together, we translate complex flow challenges into practical solutions – building peace of mind into every batch.

Product portfolio snapshot

(label-ready choices):

- Palsgaard® AMP 4455
- Palsgaard® AMP 4458
- Palsgaard® PGPR 4190

About Palsgaard

Emulsifiers. It's our world. Since inventing the first plant based emulsifier in 1917, this has been our area of niche expertise. We collaborate closely with customers across categories and industries to add value and solve development, production and quality challenges.

Owned by the Schou Foundation, and with operations in many countries, we do everything we can to bring reliability, security and peace of mind to our customers globally.

Notes on claims and compliance
Product performance should always be confirmed in your own recipes and market conditions through pilot trials in our application centres, with the dosage ranges in this paper serving as indicative starting points based on Palsgaard's application expertise.

Label claims depend on local regulations and full ingredient disclosure.



A century of emulsifier expertise

The founder of Palsgaard, Einar Viggo Schou, invented the plant-based food emulsifier in 1917. We have been exploring and innovating ever since.

Because even though we are only a small part of the foods we go into, the impact can be extraordinary. A recipe reformulated.

A new product created. Production efficiencies increased.

Scarce resources protected.

We make business personal and collaborate closely with our customers to understand their challenges and find unique solutions to them. And do everything we can to provide peace of mind through business stability and supply chain security.

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