TECHNICAL ARTICLE

How to solve your top 5 anti-fogging packaging problems

BRINGING GOOD THINGS TOGETHER

Palsgaard®

In the fast-evolving world of food packaging, consumer demands continue to grow in complexity. Sustainability has emerged as a top priority, driving innovation in materials and designs. At the same time, the need for safe, effective packaging remains constant. Both aesthetics and functionality are essential to attract consumers and ensure product longevity.

In this article, Bjarne Nielsen, Business Development Manager for Polymer Additives at Palsgaard, examines the five most pressing issues in anti-fogging packaging. He highlights how Palsgaard's **Einar**® plant-based anti-fog additives can help solve these challenges while aligning with industry trends like sustainability, recyclability, and food preservation.

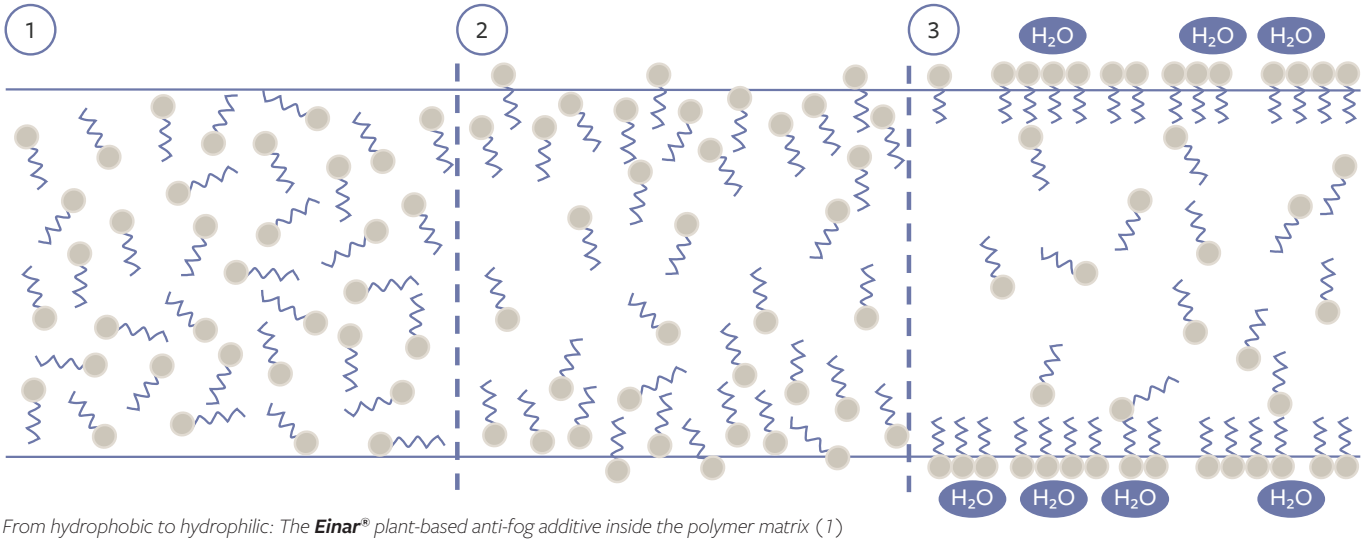
What causes fogging?

Fogging occurs when moisture, either from fresh or hot food, condenses on the inside of the packaging, forming water droplets that impair transparency. For refrigerated items, this is a common problem as the moisture content of the food reacts to the cooler temperatures in refrigerated storage. Clouded packaging will make food appear less fresh, discouraging purchases, while trapped moisture in the form of free water inside the packaging it self can negatively affect shelf life.

Hot prepared foods face similar issues, often referred to as "hot fog." Steam from the food condenses inside the packaging, reducing visibility. This is especially evident in items like rotisserie chicken packaged in clear polypropylene domes, where consumers expect a transparent, appetising view of the product. While the problem might seem primarily aesthetic, clear packaging plays a crucial role in consumer decision-making, especially at the point of purchase.

How do anti-fog additives work?

Anti-fog additives are a simple yet powerful solution. They reduce the surface tension on the packaging film, encouraging water droplets to spread out into a continuous, transparent film. This not only improves visibility but also prevents free water inside the packaging, where it can compromise food quality and reduce shelf life. Anti-fogging additives help meet the dual demands of aesthetics and functionality, ensuring the product remains appealing and well-protected.



*From hydrophobic to hydrophilic: The **Einar**® plant-based anti-fog additive inside the polymer matrix (1) migrates to the surface (2) where its hydrophilic surfactant nature lowers the surface tension on the polymer surface(3), thus enabling water droplets to form a thin continuous film and establish the anti-fog effect.*

1. Achieving efficient sealing and anti-fog properties in very thin layers

In modern packaging design, a layer of linear low-density polyethylene (LLDPE) is often incorporated to enhance the sealability of packaging films. These sealing layers are typically extremely thin, ranging from 4 to 8 microns, and are predominantly made from metallocene-catalysed LLDPE. The use of metallocene is advantageous because it has a more narrow molecular weight distribution, enabling the material to achieve highly efficient heat sealing properties.

However, while these thin sealing layers improve the mechanical sealing efficiency of the packaging, they also present unique challenges for the migration of functional additives such as anti-fog additives. To ensure optimal packaging performance, the additives must migrate to the surface of the film, where they can deliver their intended effects.

Einar® 601 is an excellent solution to these challenges, as it is specifically formulated to demonstrate fast migration through polyethylene (PE), even in ultra-thin layers. This capability ensures that the inner sealing layer of co-extruded films not only seals effectively but also delivers a reliable anti-fog effect critical for maintaining product presentation and shelf life.

ANTI-FOG PERFORMANCE AND ADDITIVE MIGRATION IN THIN LAYERS

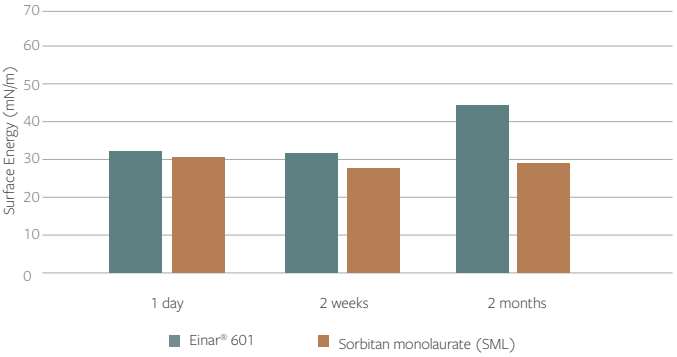
The anti-fog performance of packaging materials is highly dependent on the availability of additives on the film's surface. In thinner sealing layers, the reduced additive concentration can hinder migration, potentially compromising the uniform distribution required to achieve effective anti-fog properties.

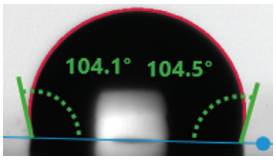
The performance of anti-fog additives is directly linked to two key factors:

1. **Concentration of the additive:** Sufficient quantities must be present the film to ensure coverage across the entire surface.
2. **Migration efficiency:** The ability of the additive to move to the surface plays a pivotal role in achieving consistent anti-fog effects.

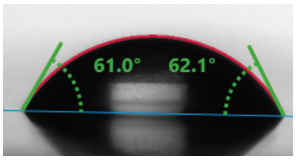
CONTACT ANGLE MEASUREMENTS - SURFACE ENERGY

Additive concentration = 0.1 % in LDPE blown film





Blank PE reference,
surface energy is 30 mN/m

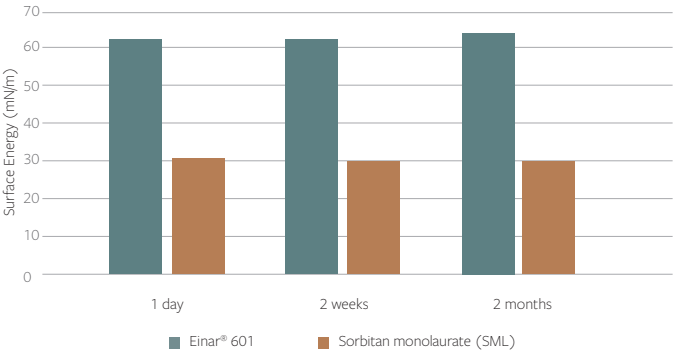


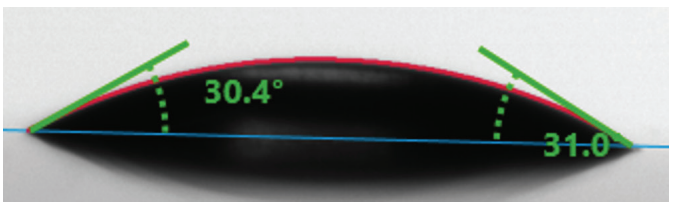
Einar® 601 at 0.1% at day 60,
surface energy is 45 mN/m

*Contact angle and surface energy measurements is a reliable tool to measure the efficiency of antifog chemistries. Results with 0.1% **Einar® 601** is a clear demonstration that this chemistry is efficient and can lower the contact angle, generate higher surface energy leading to good antifog properties. The comparison to sorbitan monolaurate (SML) shows a much higher anti-fog potential in the **Einar® 601** chemistry.*

CONTACT ANGLE MEASUREMENTS - SURFACE ENERGY

Additive concentration = 0.3 % in LDPE blown film





Einar® 601 at 0.3% at day 1, surface energy is 62 mN/m

*A higher concentration (0.3%) of **Einar® 601** proves the point with a very fast response from **Einar® 601** – a significantly lower contact angle and high surface energy on day 1. There is a very clear outperformance of conventional SML anti-fog chemistry.*

When the additive concentration is low or the migration process is slow, the packaging may fail to prevent the formation of water droplets, resulting in fogging. This reduces product visibility and impacts the consumer's perception of freshness and quality.

To overcome these limitations, manufacturers must carefully optimise the formulation of the anti-fog additive for thin layers. Several strategies can be employed:

- Selecting additives with higher inherent migration rates.
- Enhancing the surface concentration characteristics of the additive.
- Using advanced formulations like **Einar® 601**, which is specifically designed to perform well in thin PE layers.

EFFICIENT ADDITIVE MIGRATION WITH EINAR® 601

Einar® 601 is a highly efficient anti-fog additive that addresses the unique challenges of thin PE layers. Its formulation ensures rapid migration through the polymer matrix, even at low concentrations.

Key benefits of **Einar® 601** for Thin PE Films:

1. **Superior migration efficiency: Einar® 601** exhibits exceptional migration properties, allowing it to reach the film's surface quickly, even in layers as thin as 4 microns. This ensures effective anti-fog functionality without requiring excessive additive concentrations.
2. **Enhanced surface coverage:** The additive's ability to spread uniformly across the surface ensures consistent anti-fog effects, reducing the risk of uneven performance that can occur in thinner layers.
3. **Optimised performance in short timeframes:** By achieving the desired surface concentration more rapidly, **Einar® 601** helps manufacturers meet production timelines while maintaining high-quality results.

Einar® 601 product details

Physical/chemical properties:	polyglycerol ester	
	free fatty acids, max.	3%
	free glycerol and polyglycerol, max.	7%
	colour	off-white
	form at 25°C	paste
Storage conditions:	Should be stored in a cool and dry place in tightly closed packaging	
Packaging:	180 kg/396.8 lb net in steel drum	
Product form:	Einar® 601 comes in paste form	
Total shelf-life:	min. 24 months	

Guidelines for use

Einar® 601 should be incorporated into the polymer matrix via a masterbatch. The physical form of the additive requires that liquid dosing is used in order to meter the additive adequately.

ADDITIONAL CONSIDERATIONS FOR THIN-LAYER PACKAGING

When working with ultra-thin sealing layers, it is essential to balance the material's structural and functional requirements. For example, sealing efficiency, anti-fog performance, and additive compatibility must all align with the intended application of the packaging.

Thin sealing layers are often used in packaging for fresh produce, meats, or baked goods, where maintaining product freshness and visibility is paramount. In these cases, the combination of anti-fog and sealing properties ensures that the packaging meets both aesthetic and functional expectations.

Furthermore, the use of advanced additives like **Einar® 601** not only enhances packaging performance but also supports broader sustainability goals. By enabling the use of thinner layers without compromising functionality, these additives contribute to material reduction, lowering the overall environmental footprint of the packaging.

In conclusion, **Einar® 601** is a game-changing solution for packaging applications that require efficient sealing and anti-fog performance in ultra-thin layers. Its superior migration efficiency, rapid surface activation, and reliable performance make it a valuable tool for manufacturers looking to optimise both the quality and sustainability of their products.

2. Overcoming co-extrusion and lamination challenges

Modern food packaging often involves co-extruded multi-layer film and an additional lamination step to achieve the final design. Each layer plays a specific role, from providing barriers to moisture or gases to enhancing sealability. These processes add complexity to the packaging design, particularly when incorporating migratory additives such as anti-fogs.

EFFICIENT ANTI-FOG PERFORMANCE IN THIN LAYERS

In co-extruded films, the layer containing the anti-fog additive is often extremely thin. For optimal performance, additives must work effectively at low concentrations. **Einar® 611**, a high-purity plant-based additive, delivers excellent anti-fog performance even when used at concentrations as low as 0.2–0.4%.

ANTI-FOG SURFACE CONCENTRATIONS

A reduced thickness of the packaging material may result in lower concentrations of the migratory anti-fog additives on the surface. As the additive migrates over time it builds the necessary concentration on the surface that lowers the surface tension and establishes an effective anti-fog performance. Thinner structures is in it self a challenge for a migratory additive as it leads to lower migration and a more challenged environment. Choosing the most efficient anti-fog chemistry is therefore extremely important in order to get the best possible performance in these challenging highly complex film structures.

Einar® 611 product details

Physical/chemical properties:	polyglycerol ester	
	free fatty acids, max.	3%
	free glycerol and polyclycerol, max.	7%
	melting point, approx.	80°C
	colour	off-white
	form at 25°C	paste
Storage conditions:	Should be stored in a cool and dry place in tightly closed packaging	
Packaging:	180 kg/396.8 lb net in steel drum	
Product form:	Einar® 611 comes in paste form	
Total shelf-life:	min. 12 months	

Guidelines for use

Einar® 611 should be incorporated into the polymer matrix via a masterbatch.

LOWER DOSAGE

Einar® 611 demonstrates excellent performance at lower dosage levels. It provides efficient anti-fog properties at low concentrations and is therefore an ideal candidate when the packaging design puts high demands on the efficiency of a migratory additive. The lower dosage requirement helps minimise costs and potential negative effects on other material properties.

COMPATIBILITY

Einar® 611 is designed for optimal compatibility with PE films. It integrates well with polyethylene and its copolymers commonly used in co-extrusion and lamination processes without significant adjustments or adverse effects on the overall film performance.

By utilising **Einar® 611** as an anti-fog additive in thin PE films, manufactures can overcome the limitations associated with thinner co-extruded and laminated structures while maintaining effective anti-fog properties and anti-fog control. Its efficient migration, highly potent anti-fog chemistry, lower dosage requirements and compatibility with PE films contribute to reliable anti-fog performance in the new innovative and less resource intensive packaging solutions of the modern world.

COLD FOG TEST OF 0.4% EINAR® 611

Measured in 50µm LDPE film

	1 day	7 days	1 month	2 months	6 months	18 months
1 min	E	E	E	E	E	E
5 min	E	E	E	E	E	E
15 min	D	E	E	E	E	E
60 min	D	E	E	E	D	E
180 min	D	E	E	E	D	E

Days after film manufacture

CONTROL TEST OF 0.4% COMPETITOR POLYGLYCEROL ESTER

Measured in 50µm LDPE film

	1 day	7 days	1 month	2 months	6 months
1 min	E	C	D	E	C
5 min	E	B	C	E	D
15 min	E	B	B	E	D
60 min	E	C	C	E	D
180 min	E	E	E	E	D

Days after film manufacture

*Cold fog performance of **Einar® 611**. Excellent performance of **Einar® 611** with very good immediate effect and long term performance. Superior to lower purity more conventional polyglycerol ester chemistry.*

HOT FOG TEST OF 0.4% EINAR® 611

Measured in 30µm LLDPE film

	1 day	1 week	2 weeks	1 month	2 months	3 months
1 min	E	E	E	E	E	E
5 min	E	E	E	E	E	E
15 min	E	E	E	E	E	E
60 min	E	B	E	E	E	B
180 min	B	B	B	B	E	B

Days after film manufacture

CONTROL TEST OF 0.4% POLYGLYCEROL ESTER OF ANIMAL ORIGIN

Measured in 30µm LLDPE film

	1 day	1 week	2 weeks	1 month	2 months	3 months
1 min	E	E	E	E	E	E
5 min	E	E	D	D	E	E
15 min	D	E	D	C	E	E
60 min	E	B	E	E	E	B
180 min	B	B	B	B	B	B

Days after film manufacture

*Very good hotfog performance of **Einar® 611** that will meet most requirements for excellent and reliable hotfog properties in a broad range of applications.*

3. Achieving efficient anti-fog performance in polypropylene (PP) film

Polypropylene (PP) is one of the most commonly used resins in food packaging due to its versatility, clarity, and resistance to moisture. However, achieving consistent anti-fog performance in PP films can be challenging. One of the main difficulties lies in the migratory behavior of the additives used in these films. The migration rate of anti-fog additives in PP can be slower compared to other resins, leading to inconsistent performance over time and a reduced ability to prevent condensation on the packaging surface.

To address these challenges, **Einar® 422** has become a rapidly growing solution in Palsgaard's portfolio, especially for applications involving hot foods or microwave-ready meals. In particular, one of the key uses of **Einar® 422** is for packaging hot, grilled, ready-to-eat chicken, where maintaining clarity and preventing fogging in the PP dome is essential. Small amounts of **Einar® 422** are highly effective in keeping the packaging transparent, even during the extended storage periods that are common for these types of products.

HOT FOG TEST OF 1.5% EINAR® 422

Measured in 30µm R-PP

	1 day	7 days	1 month	3 months	6 months	1 year	1.5 year
1 min	A	A	A	A	A	A	A
5 min	B	B	A	A	A	A	A
15 min	E	D	C	C	B	B	B
60 min	E	E	D	D	C	C	C
180 min	E	E	E	D	D	D	C

Days after film manufacture

HOT FOG TEST OF 1.5% NON-VEG. GLYCEROL ESTER

Measured in 30µm R-PP

	1 day	7 days	1 month	3 months	6 months	1 year	1.5 year
1 min	E	E	E	E	E	A	A
5 min	B	B	B	A	A	B	B
15 min	B	C	C	B	B	D	B
60 min	D	D	D	C	C	E	C
180 min	E	D	E	E	E	E	D

Days after film manufacture

*Hotfog performance in PP can be a challenging application resulting in inconsistent and not reliable performance. **Einar® 422** has proven it self in the market and is now the leading choice for the packaging of hot, grilled ready to eat chicken.*

KEY PERFORMANCE FEATURES OF EINAR® 422 IN PP PACKAGING

- **Instant anti-fog effect:** The performance of **Einar® 422** is immediate, providing clear packaging as soon as it is applied. This is particularly important for products like hot, freshly prepared foods that need to maintain their visual appeal throughout the entire storage and retail process.
- **Consistent performance at elevated temperatures: Einar® 422** continues to perform consistently, even when exposed to elevated storage temperatures. This makes it ideal for products that are stored under warm conditions, such as rotisserie chicken or microwave-ready meals, where fogging can occur due to the heat from the food.
- **Long-term effectiveness:** The additive remains effective throughout the product's shelf life, preventing fog formation and maintaining product visibility and freshness over time. This ensures that consumers can clearly see the product inside the package, an essential factor in food choice at the point of sale.

Einar® 422 product details

Physical/chemical properties:	blend of glycerol- and propylene glycol esters	
	monoglycerides, min.	45%
	acid value, max.	3.0 mg KOH/g
	melting point, approx.	56°C
	colour	off-white pellets
	form at 25°C	
Storage conditions:	Should be stored in a cool and dry place in tightly closed packaging	
Packaging:	25 kg multiply paperbag with an inner PE bag	
Product form:	Einar® 422 comes in pellet form	
Total shelf-life:	min. 24 months	

Guidelines for use

Einar® 422 should be incorporated into the polymer matrix via a masterbatch.

USAGE AND INCORPORATION

Einar® 422 is available in pellet form, which makes it easy to incorporate into the polymer matrix during the manufacturing process. The recommended loading level for random copolymer PP films is between 0.5% and 1.5%. For homopolymer PP films, the recommended loading range is slightly higher, between 1.5% and 2.0%.

To achieve the best results, the additive should be incorporated into the polymer matrix via a masterbatch or added directly at the resin manufacturer. This method ensures even dispersion of the additive throughout the PP film, which is critical for uniform anti-fog performance across the entire surface of the packaging.

VERSATILITY WITH EINAR® 618 FOR COLD AND HOT FOG APPLICATIONS

In addition to **Einar® 422**, Palsgaard also offers **Einar® 618**, a versatile additive that provides excellent anti-fog performance in PP films. While **Einar® 618** is primarily used for cold fog applications (such as for refrigerated products), it also offers performance in hot fog conditions. This makes **Einar® 618** suitable for a wide range of packaging applications, from chilled foods to hot food displays.

The development of anti-fogging solutions like **Einar® 422** and **Einar® 618** addresses critical challenges in polypropylene (PP) packaging, making it possible to maintain packaging clarity, improve shelf life, and ensure the freshness of hot and cold food products. Their fast migration and consistent anti-fog performance make them indispensable for packaging applications that require long-term, reliable results in both high and low temperature environments. With these advanced additives, manufacturers can meet consumer expectations for both aesthetic and functional packaging, improving the overall food experience and reducing waste in the process.

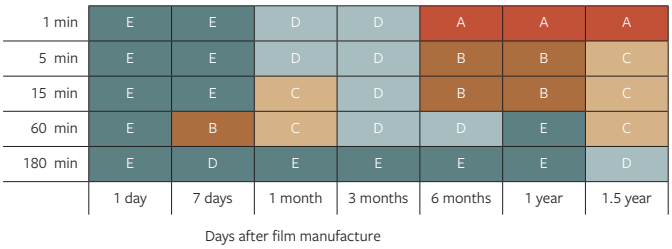
Einar® 618 product details

Physical/chemical properties:	polyglycerol ester	
	free fatty acids, max.	4%
	(as oleic acid), max.	7%
	total fatty acid ester content, min.	90%
	melting point, approx.	30°C
	colour	off-white
	form at 25°C	paste
Storage conditions:	Should be stored in a cool and dry place in tightly closed packaging	
Packaging:	180 kg/396.8 lb net in steel drum	
Product form:	Einar® 618 comes in paste form	
Total shelf-life:	min. 12 months	

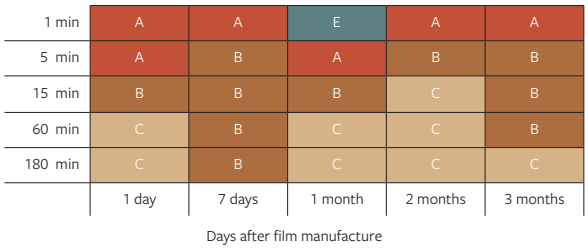
Guidelines for use

Einar® 618 should be incorporated into the polymer matrix via a masterbatch.

COLD FOG TEST OF 1.5% EINAR® 618
Measured in 30µm R-PP



COLD FOG TEST OF 1.5% NON-VEG. GLYCEROL ESTER
Measured in 30µm R-PP



***Einar® 618** is a good performing cold fog solution in many PP packaging applications. It stands out with more consistent and reliable performance compared to competing products in the market*

4. Reducing food waste through improved packaging

Food waste represents a significant global challenge, exacerbated by ineffective packaging that compromises the freshness and visual appeal of food products. It's estimated that nearly one-third of all food produced globally is wasted. Much of this waste occurs at the retail and consumer levels, highlighting the critical need for improved packaging solutions. This amounts to 1.6 billion MT of food worth about $1.2 trillion of waste. By 2030 annual food waste will hit 2.1 billion MT. According to NGO WRAP, as much as 40% of the bagged salads bought in Great Britain every year are thrown out totalling 178m bags of wasted food.

ROLE OF ANTI-FOG ADDITIVES

Palsgaard's plant-based and food-grade **Einar®** additives are pivotal in enhancing food packaging by preventing fog formation and maintaining product visibility. These properties are essential for extending the shelf life of perishable products and keeping them appealing to consumers, thus reducing waste.

SPECIFICS OF EINAR® ADDITIVES

Einar® additives are particularly designed for both polyethylene (**Einar® 601 and Einar® 611**) and polypropylene films (**Einar® 422 and Einar® 618**), targeting the prevention of condensation—a common issue in refrigerated and freshly prepared foods. These additives spread moisture into a uniform, transparent layer rather than allowing it to bead up, ensuring clarity and visibility under various environmental conditions.

FUNCTIONAL BENEFITS AND SUPPLY CHAIN EFFICIENCY

The functionality of **Einar®** additives extends beyond aesthetic improvements. By preventing moisture accumulation, they reduce the risk of spoilage and are particularly beneficial for perishable goods like fresh produce and baked items. This not only enhances product longevity but also improves inventory management, facilitating more efficient logistics and decision-making processes within the supply chain.

INTEGRATING ADVANCED TECHNOLOGIES

Combining **Einar®** additives with smart packaging technologies, such as temperature-sensitive labels, creates a robust system for preserving food quality. This integration forms a comprehensive approach to mitigating food waste, leveraging technology to enhance the effectiveness of food packaging.

SUSTAINABILITY AND CONSUMER TRUST

The shift towards sustainable solutions is becoming increasingly important, and Palsgaard's **Einar®** anti-fogging technologies are at the forefront of this transition. By improving the sustainability of packaging, these technologies foster greater consumer trust and promote environmental responsibility, thereby shaping the future of packaging in a more sustainable direction.

Through these expanded functionalities and benefits, Palsgaard's **Einar®** additives play a crucial role in the broader context of global sustainability efforts, reducing food waste through innovative packaging solutions.

COLD FOG TEST OF 0.25% EINAR® 601
Measured in 20µm LLDPE film

1 min	E	E	E	E	E	E
5 min	E	E	E	E	E	E
15 min	E	E	E	E	E	E
60 min	E	E	E	E	E	E
180 min	E	E	E	E	E	E
	3 days	1 week	2 weeks	4 weeks	6 weeks	16 weeks

Days after film manufacture

***Einar® 601** has excellent cold fog performance in LLDPE film and can thus help film producers establish the best possible anti-fog properties and secure that packaged foods will stay fresh and maintains consumer appeal for the longest possible time.*

5. Enhancing packaging recyclability

Recyclability has become a critical priority for the packaging industry, but many existing designs actually hinder the process. Current packaging often uses multi-material constructions to meet performance demands, which complicates recycling streams. For instance, polyethylene (PE) is widely recyclable, but when combined with other materials like ethylene vinyl alcohol (EVOH), it becomes nearly impossible to recycle effectively.

STREAMLINING MATERIAL USE

Modern packaging designs often require multilayer films to achieve essential properties such as moisture barriers, structural rigidity, and heat sealing capabilities. These complex constructions pose a significant challenge for recycling efforts. But, by reducing the number of layers and utilising more compatible materials, manufacturers can significantly enhance the recyclability of their products, promoting a more sustainable approach in packaging technology.

THE ROLE OF ADVANCED ANTI-FOG ADDITIVES

Brand owners and consumers a like are very passionate about the need to move toward more recycling-friendly technologies. It is a trend that needs to happen, but which is still in the innovation stage. Going forward, anti-fog solutions must evolve to align with recyclability goals. Traditional additives, though inexpensive and straightforward, often fall short in modern, thinner films and new polymer formulations.

Innovations like Palsgaard's **Einar®** additives are designed to maintain effectiveness while supporting streamlined material use and therefore an ideal choice when new innovative and recyclable packaging solutions are developed. Palsgaard's **Einar® 601** and **Einar® 611** anti-fog additives for PE films exemplifie this shift. These plant-based additive are engineered to maintain high performance in recyclable PE films, preserving both the clarity and anti-fog properties essential for maintaining product attractiveness and longevity. **Einar® 611** is particularly valuable in single-material packaging designs where recyclability is prioritised.

Einar® polymer additives are made from carefully selected plant oils, including RSPO-certified sustainable palm oil, rapeseed, sunflower and castor oil. The same raw materials used in Palsgaard's food emulsifiers and personal care ingredients.

THE IMPACT OF PLANT-BASED ADDITIVES ON SUSTAINABLE PACKAGING

Einar® 601 and **Einar® 611** will not only aid in maintaining the functional integrity of the packaging but also support the global movement towards more sustainable packaging practices. By integrating such advanced solutions, manufacturers can create packaging that is both effective in preserving product quality and aligned with green initiatives. This additive makes it feasible for brands to meet stringent sustainability criteria while ensuring that packaging remains practical and appealing to consumers.

This strategic inclusion of **Einar® 601** and **Einar® 611** in packaging designs marks a critical step towards reducing the environmental impact of packaging waste, aligning with broader sustainability goals and enhancing consumer trust in eco-friendly products.

Anti-fog application support

Palsgaard has acquired extensive expertise in plant-based anti-fog polymer additives. Continuous research, development and sampling at our Polymer Application Centre make sure that our customers stay in the lead of the most effective and cost-efficient anti-fog technology for their particular needs, resulting in end products with enhanced sustainability and safety at no compromises in quality or performance.

The Centre is fully equipped for flexible and precise testing to support new application developments or assist customers in evaluating and comparing the performance of **Einar®** anti-fog or anti-stat solutions vs. their current additives. Capacities include injection moulding, blown and cast film production equipment as well as comprehensive testing facilities for material characterisation and additive performance, such as static decay time and surface resistivity at both ambient and low humidity. For colour masterbatches, specialised filter pressure, particle count and colour strength measuring solutions have been developed to help optimise pigment dispersion.

This allows customers to convince themselves of the benefits derived from **Einar®** plant-based additives for the quality and sustainability of their products by means of conclusive sampling and optimisation trials at the source.

ABOUT BJARNE NIELSEN

Bjarne Nielsen is Business Development Manager for Polymer Additives at Palsgaard. In this role since 2016, he is responsible for the business development of glycerol esters and food-grade additives for use in applications outside the food industry in polymers and personal care products.

Bjarne brings close to 30 years of experience in the development of new products and applications in this field. He has a successful track record of working closely with many different customers to understand and develop new opportunities, resulting in several patented products, successful innovations and commercial applications.

Prior to joining Palsgaard, Bjarne has been working in product development as well as delivering development and technology services to customers around the globe for approximately 23 years at Danisco/ DuPont.

Bjarne has a background in Chemical Engineering and holds a Master's degree from Danish Technical University (DTU) in Lyngby, Denmark.

To learn more about Palsgaard's plant-based, food-grade polymer additives, please visit **www.palsgaard.com** or contact us directly here:

CONTACT US