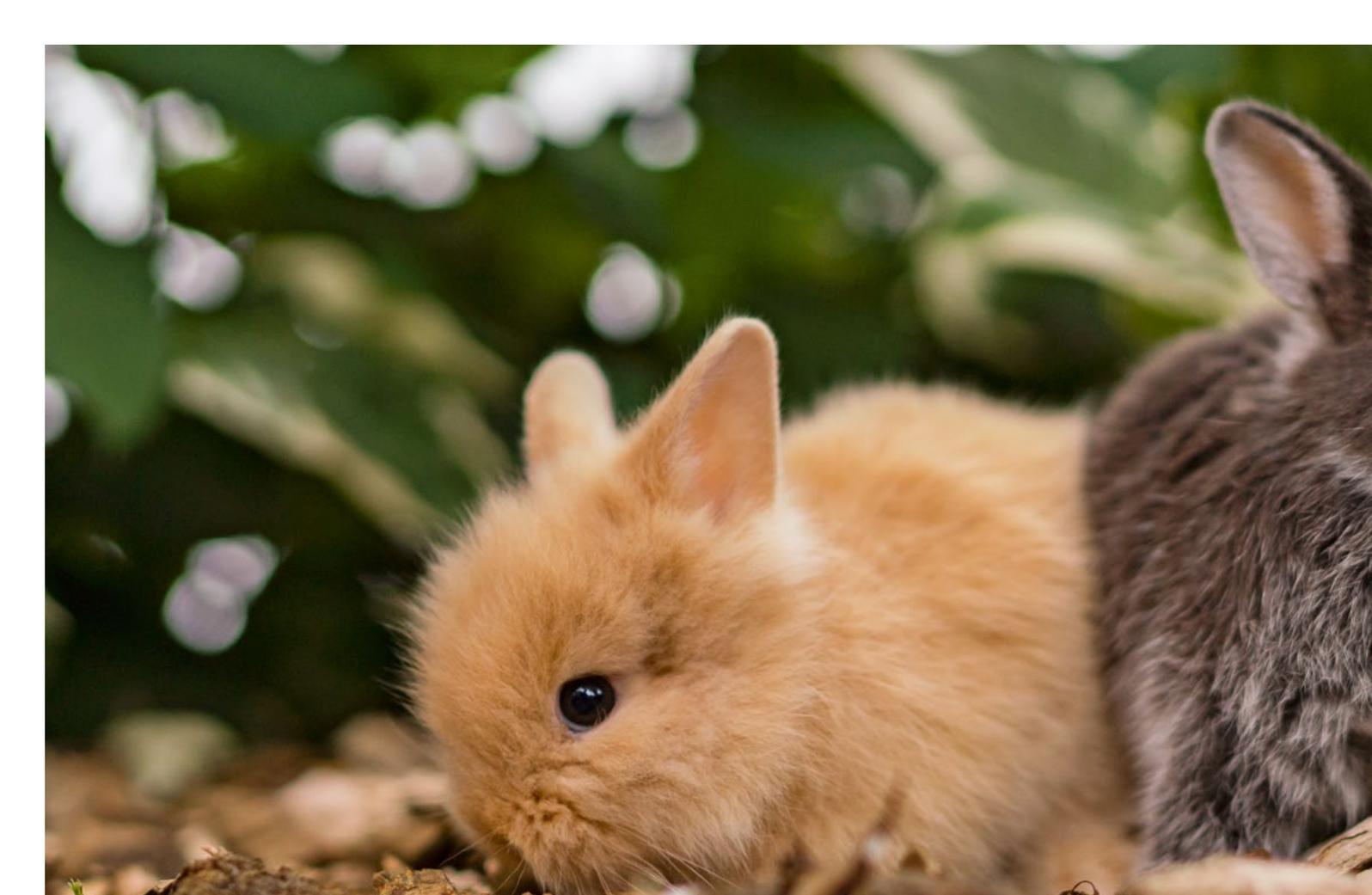


EMSLAND GROUP[®]
using nature to create

Animal Nutrition





Animal Nutrition with Potato and Pea Ingredients

The animal nutrition market is a fast growing market where the growth goes hand in hand with the expected global growth of the human population.

High Quality Feed

Next to growth, increased costs of raw materials and demands for a high-quality product are major challenges in the feed industry.

Humanization of Pet Food

The humanization of pets is the key trend driving the pet food market. Many pet owners are looking for pet food that reflects their own taste. As a result, there has been an increase in premium product offerings — giving lots of choice for owners. Premium, luxury, healthy and functional foods are moving into the mainstream as owners seem more focused on their pet's diet.

Emsland Group Ingredients

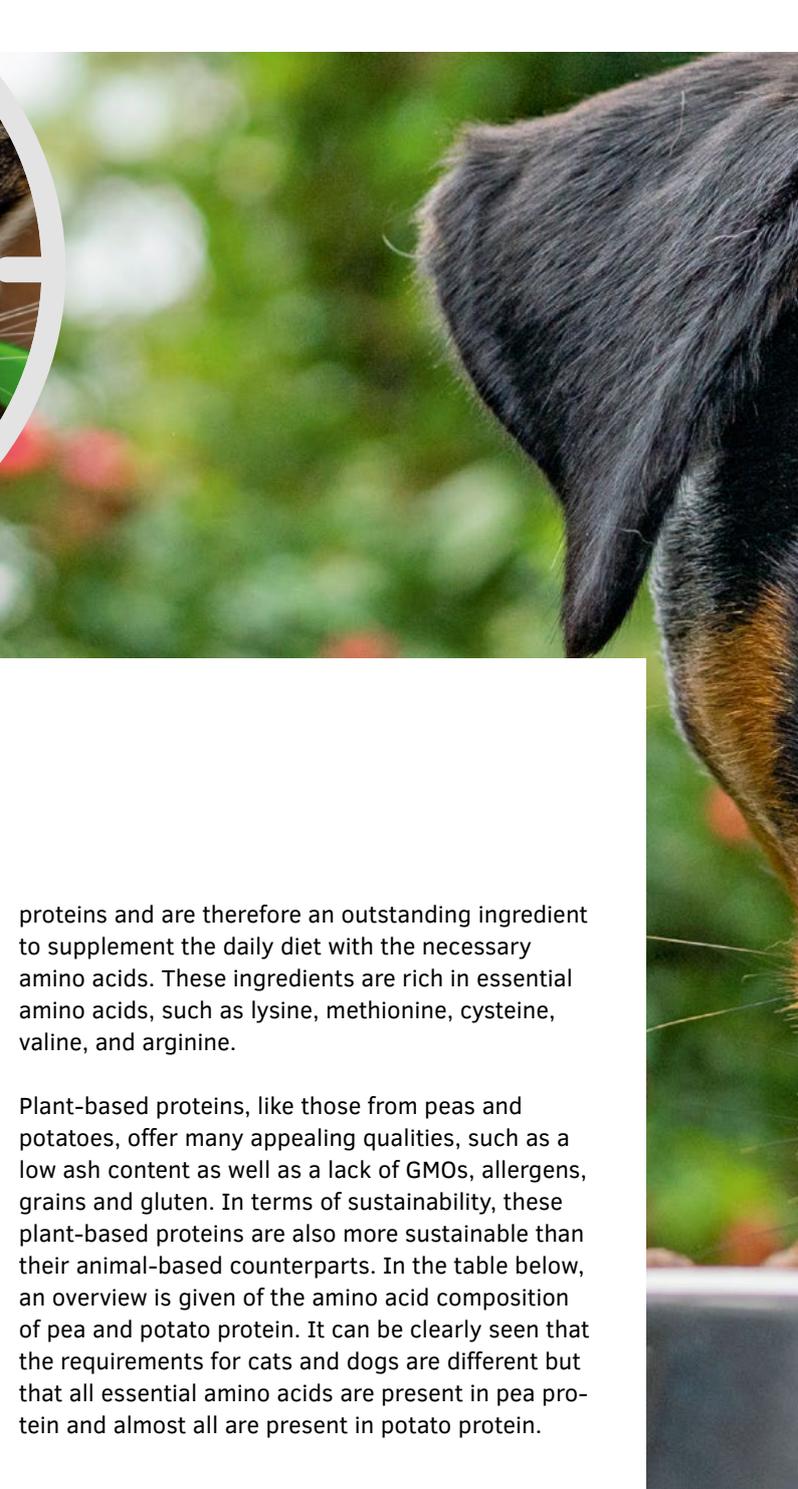
The plant-based and renewable ingredients of the Emsland Group are made from pea and potato as

raw material. In line with our guiding principle — “using nature to create” — we have developed an innovative line of products for domestic and commercial animal nutrition. The components of potatoes and peas are ideal to start this process, as these materials offer the possibility to produce non-GMO, natural and gluten- and grain-free products. Additionally, they contain a low percentage of fat, which is essential for animal health. The portfolio of the Emsland Group for animal nutrition consists of proteins, fibers, potato flakes and starches.

Customer Support

The Emsland Group has many years of experience in the area of animal nutrition. Emsland Group's Innovation Center has all the tools and expertise to support customers with their projects. Depending on the specific application, our application team can advise which protein, fiber, potato flake or starch our customers can use.





Pet Food

Natural and Allergen-free

Thanks to years of international experience, the Emsland Group is able to manufacture a range of high-quality pea- and potato-based products for further processing by the pet-food industry. Our product solutions, made of natural ingredients, provide high quality pet food.

Especially for pet food, allergies are one of the most decisive reasons to move to grain-free food. The Emsland Group offers various gluten- and grain-free solutions.

Proteins

Pets need various amino acids. Although they are capable of producing the majority of these themselves, there are 10 (essential) amino acids which they cannot generate. Peas and potatoes are excellent sources of easily digestible vegetable

proteins and are therefore an outstanding ingredient to supplement the daily diet with the necessary amino acids. These ingredients are rich in essential amino acids, such as lysine, methionine, cysteine, valine, and arginine.

Plant-based proteins, like those from peas and potatoes, offer many appealing qualities, such as a low ash content as well as a lack of GMOs, allergens, grains and gluten. In terms of sustainability, these plant-based proteins are also more sustainable than their animal-based counterparts. In the table below, an overview is given of the amino acid composition of pea and potato protein. It can be clearly seen that the requirements for cats and dogs are different but that all essential amino acids are present in pea protein and almost all are present in potato protein.

Essential Amino Acids

Amino acid	Threonine	Valine	Methionine	Isoleucine	Leucine	Phenylalanine	Histidine
Pea Protein	2.8%	4.0%	0.7%	3.6%	6.4%	4.1%	1.9%
Potato Protein	4.7%	5.0%	1.8%	4.2%	8.1%	5.0%	1.8%
Recommendation for an Adult Dog*	0.43%	0.49%	0.33%	0.38%	0.68%	0.45%	0.19%
Recommendation for an Adult Cat*	0.52%	0.51%	0.17%	0.43%	1.02%	0.40%	0.26%



<i>Lysine</i>	<i>Arginine</i>	<i>Tryptophan</i>
5.7%	8.5%	1.1%
6.4%	4.0%	-
0.35%	0.35%	0.14%
0.34%	0.77%	0.13%

* Amino acid nutrition of dogs and cats from Alison N. Beloshapka, Ph.D. University of Illinois

** Next to the essential amino acids in the table, pea and potato protein also contain other amino acids, such as Aspartic acid, Serine, Glutamic acid, Proline, Glycine, Alanine, Cysteine and Tyrosine.





Fibers

Fibers can play a very important role in a pet's diet. Insoluble fibers are responsible for creating a feeling of fullness without adding extra calories to the daily diet. By increasing the fiber content in everyday animal feed, the animal feels fuller with the same volume of food. Especially for overweight animals or animals that are constantly hungry, increasing the fiber in their diet can help make it easier to implement a weight loss diet and prevent obesity.

The **Empet® E 5** ingredients play what could be called a “mechanical” role in the digestive tract. Fibers have been proven effective in relieving the symptoms of various diarrheal diseases due to their strong ability to absorb water. They also help lower the pH value in the digestive tract, reducing the ammonia content being released, which provides relief. Additionally, fibers have been proven to help alleviate diseases of the liver and kidneys as well.

Overview Pet Food Ingredients

	Empet® E 4	Empet® E 4 80	Empet® K 4 72	Empet® E5 B10
Product Type	Pea Protein	Pea Protein	Potato Protein	Pea Outer Fiber
Description	Rich in lysine and other essential amino acids	High protein level	High amount of lysine, methionine, cysteine and valine, low content of glycoalkaloids < 2000 ppm	Max. particle size: 2.0 mm Water binding capacity: 450%
Feed Catalogue Number	03.03.05	03.03.05	04.03.07	03.03.08
Nutritional Value	Protein content: approx. 75% (as is)	Protein content: approx. 80% (as is)	Protein content: min. 72% (as is)	Crude fiber: approx. 48% TDF: approx. 80% Cellulose: approx. 60% Hemicellulose: approx. 7% Lignin: < 0.5%
Grain/Gluten Free (< 20 ppm)	✗	✗	✗	✗
Natural (AAFCO)			✗	✗



Emflake® B	Potato Starch Superior	Pea Starch Premium
Potato Flake	Native Potato Starch	Native Pea Starch
Dehydrated potato powder		
	04.03.03	13.03.01
Carbohydrate content: approx. 74%. Fiber content: approx. 6,6% Protein content: approx. 8,3% (as is)	Starch content: min. 80%	Starch content: approx. 90%
	✗	✗
	✗	✗



Livestock Feed

The Best Feed for Livestock

The Emsland Group produces and sells a range of dry and wet products as ingredients for feed. Our single ingredients can be used in various feed applications.

Mixed Feeds

Mixed feeds are composed in a fully industrial process and tuned to the requirements of a specific animal species. Mixed feed consists mainly of energy components (various cereals), protein components (potato, pea or other protein sources), as well as smaller amounts of vitamins and minerals. Other components, such as natural health-promoting ingredients, organic acids, flavoring and pigment, can be added to suit the customer's requests.

Specialties

"Specialties" denotes feed for specific groups of animals, or cattle feed supplements for specific purposes. These might include milk replacers for calves, feed for weaning piglets, products to promote health, or alternatives to antimicrobial growth stimulants.

animal-feed segment. The desired protein content can be achieved through adding plant-based proteins. The Emsland Group offers two options for this: potato protein and pea protein. Both proteins have an outstanding amino acid profile.

Potato Pulp

The nutritional value of pea and potato pulp is determined by the amount of starch and raw fiber. Pea and potato pulp are a good source of carbohydrates, fibers and proteins and offer many advantages, such as the improved development of milk proteins in cow milk, and the balance of nitrogen in the milk.

Potato Pieces (Liquid)

Potato skins removed by steam are a byproduct of the production of dehydrated potatoes. In the course of processing, the potatoes are washed and steamed, which removes the skins and some of the starch. The resulting steam-removed potato pieces are finely ground and used as a high-quality energy-rich liquid feed in pig farming. The high temperature during the peeling process opens up the structure of the potato starch, making it very easy to digest. Steam-removed potato skins enhance the performance of animal feed and are appropriate for sows and fattening pigs.

Pea Protein Liquid (PPL)

Pea Protein Liquid (PPL), is a byproduct of the starch-extraction process. The process involves heating and grinding peas and separating the starch from the fibrous components. PPL is a cost-effective, high-quality protein source

Our Single Ingredients

Plant-Based Proteins

Products with increased protein content are attracting more and more attention in the

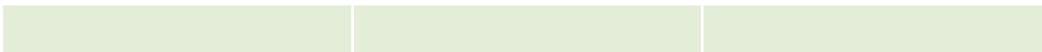
Overview Livestock Feed Ingredients

	Potato Protein	Pea Protein	Potato Pulp
Description	Moisture: approx. 10%, Crude protein: approx. 76%, Ash content: max. 0.5%	Moisture: approx. 10%, Crude protein: approx. 75%	Moisture: approx. 85%, Starch content: approx. 4%, Crude fiber: approx. 3%
Feed Catalogue Number	04.03.07	03.03.05	04.03.09
Grain/Gluten Free (< 20 ppm)	✗		✗
Natural (AAFCO)	✗		



Potato Pieces/Skin Liquid	Pea Pulp	Pea Protein Liquid (PPL)
Moisture: approx. 88%, Starch content: approx. 6%, Crude fiber: approx. 1%	Moisture: approx. 80%, Starch content: approx. 6%, Crude fiber: approx. 4%	Moisture: approx. 75%, Crude protein: approx. 8%, Crude ash: approx. 4%
04.03.11	03.03.06	03.03.07

x





Aqua Feed

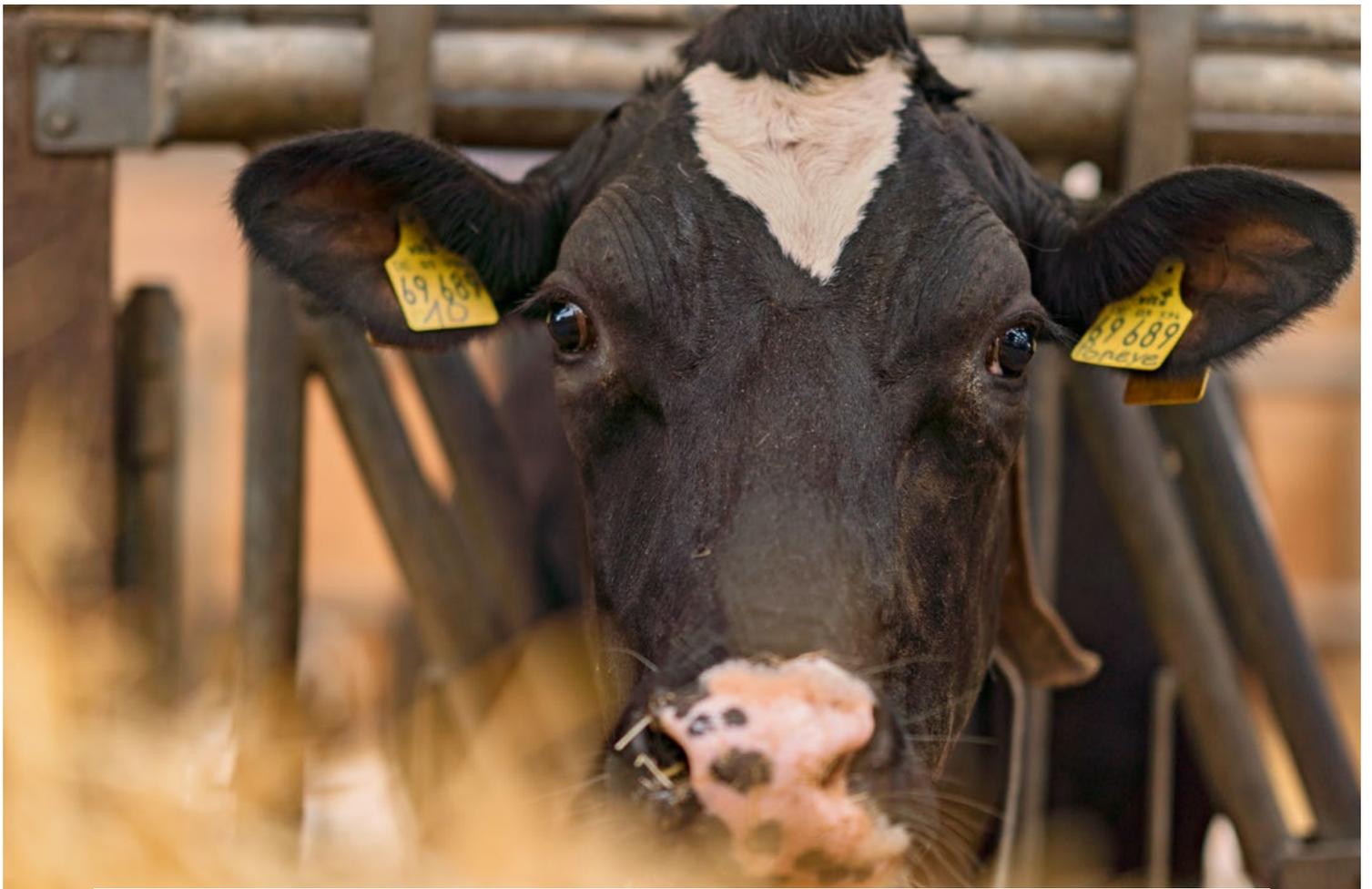
In modern aquaculture practices, extrusion is the predominant method of producing feed for aquaculture. Extruded pellets efficiently absorb oils and fats, which enables distinct floating characteristics and a slow sinking ability. Originally tailored to salmonids, such as trout and salmon, this technology is now ubiquitous and shapes the production of feed for many fish species as well as certain crustaceans, such as shrimp.

The products of the Emsland Group for extruded aqua feed formulations have the ability to withstand the elevated temperatures and pressures of the extrusion process and gives the desired properties to the extruded products.

Overview Aqua Feed Ingredients

	Emes® EA 05	Emden® KVH 1840
Description	Modified cook-up pea starch	Modified cook-up potato starch
Feed Catalogue Number	-	04.03.03
Grain/Gluten Free (< 20 ppm)	✗	✗





EMSLAND GROUP

Using nature to create is the guiding principle of the Emsland Group. As a global leader in refined products made from potatoes and peas, we offer a wide range of innovative products with the high quality and reliability that the Emsland Group name is known for.

Our plant-based ingredients include native, clean label and modified potato and pea starches, proteins and fibers, as well as potato flakes and granules, which can be used as thickeners, binding agents, emulsifiers and stabilizing additives for various applications. We serve a variety of industries and offer solutions for trends, such as clean label, kosher, halal, gluten-free, vegan, fiber enriched, sustainability, as well as non-GMO raw materials.

Innovation is a core driving force at the Emsland Group. Experts at our Innovation Center in Germany are constantly developing and optimizing products and concepts to meet the evolving demands of both the industry as well as the end user. We work closely with customers to further develop our product portfolio and overcome challenges in a sustainable way.

Sustainability is a responsibility that, for us, does not begin in the factory, but in the field. Since 1928, we have been relying on the innovative power of nature and working in harmony with our natural resources in all our endeavours. Our team is dedicated to continuously working to develop products that are in line with newer sustainability benchmarks, helping to drive the global trend towards more environmentally friendly and sustainable options through the production of plant-based solutions.

The Emsland Group is committed to producing consistently high-quality ingredients. Customer health and safety, as well as transparency regarding our manufacturing methods, are top priorities. To view a complete list of our certifications and qualifications, scan the QR code or visit

www.Emsland-Group.com





EMS LAND GROUP[®]

using nature to create

Contact Us

www.Emsland-Group.com

+49 5943810

info@emsland-group.de

Emslandstrasse 58

49824 Emlichheim Germany

Disclaimer: All information and data in this brochure are in accordance with the best practise experiences and laboratory examinations of Emsland-Stärke GmbH and Emsland Food GmbH hereafter called Emsland Group. The indications are based on the current state of development, technology and research and should be taken as information on the products of Emsland Group, but must not be understood as promise of characteristics.

Emsland Group cannot assume liability for the product information and products, as the conditions under which the stocking, treatment and processing occur are out of the control of Emsland Group.

Liability claims against Emsland Group which refer to material or immaterial damages caused by the use or disuse of the offered products and product information of Emsland Group are basically exempted, unless demonstrably intended or grossly negligent fault exists which directly caused the damage. In particular Emsland Group assumes no liability that the offered products or product information are economically utilizable, technically executable or useful or that the offered products and product information do not infringe the rights of third persons.