

PRODUCT HANDBOOK AND CATALOG

INGREDIENTS FOR PET NUTRITION







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DSM – BRIGHT SCIENCE. BRIGHTER LIVING.™

OUR COMPANY

Royal DSM N.V. is a global science-based company active in health, nutrition and materials. By connecting its unique competencies in Life Sciences and Materials Sciences DSM is driving economic prosperity, environmental progress and social advances to create sustainable value for all stakeholders simultaneously. DSM delivers innovative solutions that nourish, protect and improve performance in global markets such as food and dietary supplements, personal care, feed, pharmaceuticals, medical devices, automotive, paints, electrical and electronics, life protection, alternative energy and bio-based materials. DSM's 21,054 employees deliver annual sales of €8.6 billion. The company is listed on NYSE Euronext. More information can be found at www.dsm.com.

WHO WE ARE

Who we are as a company is the result of strategic choices that we have made. These in turn are based on our mission and our core value; they define what we believe in and how we go about our business.

OUR BRAND PROMISE

Bright Science. Brighter Living™. This sums up who we are, what we stand for and what we aim to achieve. These four words are the shorthand for our mission, our beliefs and our behaviors – a promise that we make to the world in which we operate. Bright Science refers to the unique way in which we combine Life Sciences and Materials Sciences disciplines, technologies and talents. We partner with customers and other stakeholders – then we share ideas, insights and inspiration to create innovative and sustainable solutions that address the key challenges facing society today. Brighter Living refers to our commitment to creating products and solutions that make a positive difference to people's lives. We are constantly seeking new ways to improve quality of life, and we seek to make a positive contribution to the lives of people today and generations to come.

OUR MISSION

Our purpose is to create brighter lives for people today and generations to come. We connect our unique competences in Life Science and Materials Sciences to create solutions that nourish, protect and improve performance.

OUR CORE VALUE

Our mission is supported by our core value: Sustainability. Everything we do should contribute to a more sustainable world. To us, achieving sustainability means simultaneously pursuing economic performance, environmental quality and social responsibility. In other words, we strive to create value on the three dimensions of People, Planet and Profit simultaneously.

SUSTAINABILITY AS A DSM STRATEGY

DSM is aiming to improve peoples' lives and environmental impact, through the way we take care of our people and own operations, and how we translate this into products and innovations.

The world has joined forces in 2015 by defining 17 common Sustainable Development Goals (SDGs), adopted by the United Nations. The SDGs cover a 15 year time frame to 2030 and include 169 targets. DSM contributes to all goals but particularly focusses on the following SDGs: SDG 2: No Hunger, SDG 3: Good Health, SDG 7: Renewable Energy, SDG 13: Climate Action and SDG 12: Responsible Consumption and Production.

SUSTAINABLE DEVELOPMENT GOALS

More about DSM's contribution to the Sustainable Development goals: <https://www.dsm.com/corporate/sustainability/vision-and-strategy/the-global-goals.html>

DSM'S COMMITMENT TO THE SDGS

Besides being our core value and a key responsibility, for many years we have made sustainability a real business driver for DSM, developing solutions, building partnerships and increasing our impact in key areas. Addressing the challenges of nutrition & health, climate & energy and resource scarcity drive our business and innovation strategies. We believe that our expertise in health, nutrition and materials position DSM well to actively contribute to the Sustainable Development Goals (SDGs). While all the Goals are important, our capacity to support their individual achievement varies. [The overview](#) to follow provides an initial indication of where we see intersections between the SDGs and our company and business strategy. [The five key SDGs](#) on which we believe our company and its businesses can be most influential are further expanded upon.

SDGS & DSM'S STRATEGY

While all the Sustainable Development Goals are important, our capacity to support their individual achievement varies. The following is an initial indication of where we see intersections between the SDGs and our company and business strategy.

The level of DSM's Engagement is gauged as
* Minor, ** Moderate or *** Major.



NO POVERTY**

Our HR policies on (minimum) wages and fair pay. We support smallholdings through [Africa Improved Foods \(AIF\)](#), help improve agricultural learning through our partnership with the UN World Food Programme (WFP) and participate in economic development programs in developing countries.



ZERO HUNGER***

We [improve nutrition](#) via initiatives such as the Nutrition Improvement Program and AIF, and through partnerships such as with the WFP and Scaling Up Nutrition (SUN). We continue to support Sight and Life, the nutrition think-tank.



QUALITY EDUCATION*

We support our employees' personal and professional development through our learning and development programs. We help improve agricultural learning through our [partnership with the WFP](#).



GENDER EQUALITY**

DSM's [Inclusion & Diversity](#) strategy and aspirations, and our sponsorship of Women's International Networking (WIN) to foster female leadership. Our CEO is signatory to the CEO Statement of Support for the Women's Empowerment Principles and a board member of [Catalyst](#).



AFFORDABLE & CLEAN ENERGY***

We enable energy solutions such as advanced biofuels and materials for solar panels, and support the quest for clean energy externally via our [Bright Minds Challenge](#). We are significantly increasing the use of renewable sources of energy and are members of RE100. See also SDG13 (Climate Action).



DECENT WORK & ECONOMIC GROWTH**

We make a positive contribution to economic growth in the countries and markets in which we operate and strive to decouple growth from resource consumption. We support small holdings through AIF and participate in economic development programs in developing countries.



REDUCED INEQUALITIES**

The DSM Inclusion & Diversity Strategy and aspirations promote the reduction of inequalities. Our [Brighter Living Solutions](#) program considers equal opportunities through People LCAs. Through AIF and economic development programs in developing countries we foster inclusive employment in local communities.



SUSTAINABLE CITIES & COMMUNITIES*

We support cross-sector partnerships and local philanthropic initiatives, such as our work with Global Health Corps.



CLIMATE ACTION***

We focus on [improving](#) our own carbon footprint, [enabling](#) the low-carbon economy through renewable energy solutions and bio-based chemicals, and [advocating](#) climate action through partnerships such as CPLC and WEF and other initiatives. See also SDG7 (Affordable and Clean Energy).



LIFE BELOW WATER**

Trevo™ nets support sustainable aquaculture. The Green Ocean partnership has the potential to transform aquaculture feed into more sustainable systems and DSM is a partner of [The Ocean Cleanup](#).



PEACE & JUSTICE, STRONG INSTITUTIONS*

Our Anti-Bribery and Corruption policy and training programs, Human Rights Policy as well as our grievance mechanism '[DSM Alert](#)', support [ethical business conduct](#) and [good corporate governance](#) within DSM.



PARTNERSHIPS FOR THE GOALS***

We partner with UN agencies, governments, academia, NGOs and industry peers such as World Economic Forum (WEF), World Business Council for Sustainable Development (WBCSD) and SUN as well as many other global and local partners to accelerate our contributions to the other 16 SDGs.



GOOD HEALTH & WELL-BEING***

Our [biomedical, health and nutrition portfolio](#) is geared to maintaining, protecting or regenerating health. DSM's Life Saving Rules and Vitality Program support employee's safety and health.



CLEAN WATER & SANITATION*

We identify and take action on areas of water scarcity with waste water efficiency and treatment programs such as at DSM in Pune (India).



INDUSTRY, INNOVATION & INFRASTRUCTURE**

[Bright Science](#) is the key driver behind our sustainable, sciencebased solutions.

Our innovation strategy supports the sustainable development agenda, with clear focus on several SDGs.



RESPONSIBLE CONSUMPTION & PRODUCTION***

Our HR policies on DSM-Niaga enables the manufacture of 100% recyclable carpets. [Food waste](#) can be reduced through solutions such as Pack-Age®. Advanced biofuels and [bio-succinic acid](#) replace fossil-fuel based alternatives. Our Brighter Living Solutions program considers the impact of our products throughout the value chain.



LIFE ON LAND*

Our Brighter Living Solutions program values the reduction of land use as part of the Life-cycle assessment technique.

DSM NUTRITIONAL PRODUCTS



Representing the Life Sciences competency of Royal DSM N.V., DSM Nutritional Products contributes € 5.6 billion to annual sales in 2018 of € 8.6 billion and is organized around three market-facing entities: Animal Nutrition & Health, Human Nutrition & Health and Personal Care. More about DSM Nutritional Products: <https://www.dsm.com/corporate/about/business-entities/dsm-nutritional-products.html>

Animal Nutrition & Health addresses the nutrition additives segment of the feed and pet food markets. Human Nutrition & Health largely addresses nutrition and functional ingredients segment of the food markets. Personal Care is focusing on the actives and ingredients in the sun care, skin care and hair care industries.

DSM is the only producer who can supply the complete range of vitamins and carotenoids in the most suitable forms for all possible animal and human uses.

DSM has established leadership positions across all three areas of the ingredients business: feed, food and personal care. DSM is one of the world's leading producer of vitamins. DSM is working from its strong global presence in key value-added ingredients offered through an international infrastructure and reach.

DSM is uniquely involved in all three steps of the value chain: the production of pure active ingredients, their incorporation into sophisticated forms, and the provision of tailored premixes. Being the only fully integrated player allows DSM to differentiate itself all the way through the chain.

Managing the interdependencies between active ingredients, forms and premixes, which have important implications for innovation, logistics, and value delivery, is a core competence of DSM.

Striving to earn the title of "Trusted Partner"!

DSM NUTRITIONAL PRODUCTS, ANIMAL NUTRITIONAL & HEALTH, APPROACH TO QUALITY AND SAFETY

Petfood manufacturers and the suppliers that serve them are aware that pet food is a very highly regulated industry. Its standards for safety and quality are equal to, or in some cases, surpass those of the human food industry in some countries.

From a business perspective, managing safety and quality is about mitigating risk to your product's brand. The owners of a retail brand of pet food or snack that harms a companion animal will experience a cascade of events detrimental to their business. These events include immediate loss of sales, scrutiny by the regulatory authorities, possible lawsuits, and public rejection; events that may be severe enough to destroy the brand.

As a leading supplier to this industry, DSM has a global quality and safety standard for our products, including premix, with the goal of meeting or exceeding the expectations of the leading petfood brand owners in the market. Our global quality standard is based upon our 5 Q Values.

Our 5 Q Values take into consideration: Food Safety, Trusted Supply Chain, Closing the Loop, Traceability, and Sharing and Learning.



The DSM quality and safety program is designed around **Food Safety** standards and managed by a worldwide team of qualified quality and safety managers passionate about food safety. These experts are responsible for administering our quality and safety program, which includes as the central element the Hazard Analysis of Critical Control Points (HACCP), which follows World Health Organization standards and comprises sanitation standards, pest control systems, and minimizing cross-contamination. We also know that for this program to be successful it is important to create a high level of internal awareness around every aspect of safety and quality along the entire supply chain, creating a company culture that lives out safety and quality behaviors that embrace well-designed SOPs. DSM is dedicated to standardizing and ensures the integrity our program across the globe by conducting routine audits of all DSM facilities by a Corporate Operational Audit team (COA).

Our facility managers will tell you that they would rather have our customers audit them than the COA team due to the strict guidelines.

The integrity of our food safety program is the basis for a **Trusted Supply Chain**. This starts with vendor qualification and management processes in line with food safety standards. Success is achieved further through our supply chain by leveraging our excellence in analytics based on our long history in the chemical and biosciences industries, maintaining robust and integrated documentation, goods receipt, and warehouse management systems.

Mindful of the risks to both our customers and the sustainability of our business, perpetual improvement of this food safety program is part of our business strategy, we call **Closing the Loop**. This means, that we not only have the tools in place to do a thorough root cause analysis on deviations, we have the tools in place for change management, the process and techniques to manage the people side of change. This assures the adoption and the realization of a change are well in control and the risk minimized. To ensure we are Closing the Loop, our food safety mindset is integrated into our ideation and innovation workstreams.

The process of manufacturing bioactive micronutrients and microorganisms, and blends of these micro ingredients, is complex from a quality assurance perspective. We sell these micro ingredients to producers of retail products covering a broad array of dietary needs, ranging from concentrated dietary supplements to pet foods designed to deliver 100% of the animal's nutritional needs. Due to this complexity, and the safety concerns associated with these types of retail products, it makes sense that **Traceability** is included as one of our 5 Q values. At DSM, the integrity of our quality system is constantly checked and trained in mock recall and track & trace exercises to provide an assurance of safety and functionality. Rapid and accurate notification of a recall to our customers is the heartbeat of our emphasis on Traceability – only topped by the constant work to prevent these cases.

The DSM 5 Q values **Sharing and Learning** help us stay ahead of the curve. By DSM managing quality and safety on a global scale, using Compliance Quality Management (CQM) TrackWise® system and other companywide web-based training tools, every DSM employee becomes integrated into our global quality and safety program.

Having the right quality and safety processes in place are mandatory, but at DSM we believe you can only achieve the highest level of risk mitigation if you integrate a consciousness of quality and safety across all employees and it becomes part of your company's culture.

Our company recognizes that with business growth becoming more dependent on offering premium petfoods, and a heightened awareness of food safety among consumers, suppliers need to be trustworthy partners oriented towards mutual success. DSM strives to earn the title of "Trusted Partner"!

INNOVATION STARTS WITH AN IDEA!

IT IS NOT ONLY ABOUT THE IDEA, IT'S WHAT YOU DO WITH IT!

Idea Generation, often called "Ideation" is the creative process of generating, evaluating and communicating new ideas. Within DSM, this takes place in a variety of ways:

INNOVATION IDEA GENERATOR: A continuous exchange of ideas. Often the "seed" that gets people to think in new ways. Every DSM employee has access to a simple tool to enter their ideas for consideration.

IDEATION WORKSHOPS: A direct way to brainstorm, collect & evaluate ideas during highly participative workshops, or as we call them "play shops" events.

CAMPAIGNS, CHALLENGES & COMPETITIONS: Topic-specific focus to solve a specific question or problem. A fast way of gathering ideas.

COACHING & SHAPING IDEAS: A process of facilitation to shape the idea by identifying the potential value design prototypes, run pilots or proof-of-concepts.

BUSINESS SERVICE MODELING: We use the Enterprise Design Canvas to combine the powers of Innovation & Business Architecture!

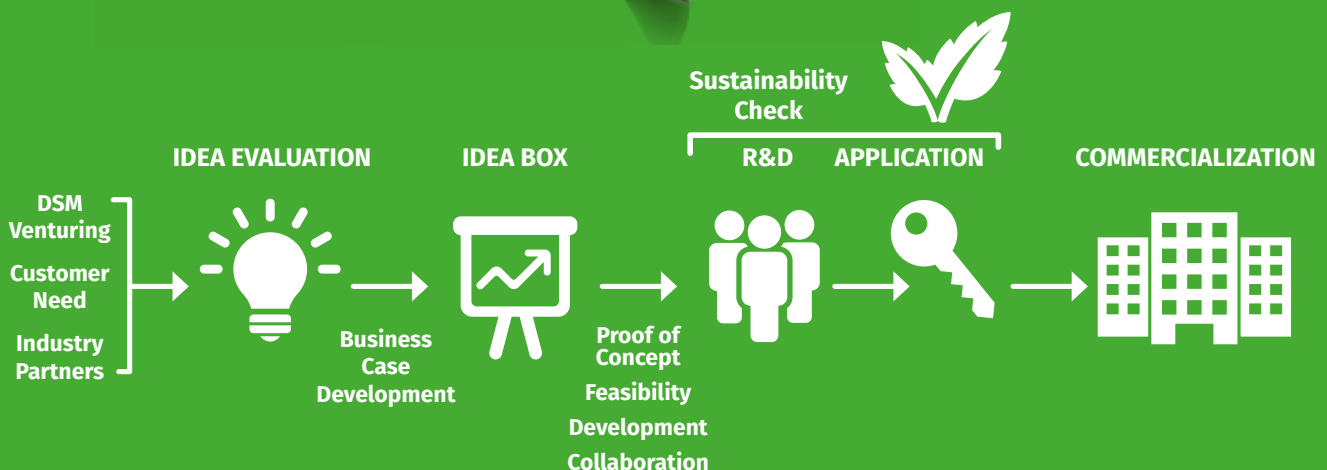
DSM Venturing is an active investor in start-up companies, which create innovative products and services in Life Sciences and Materials Sciences that contribute to the quality of life. DSM Venturing's mission is to explore emerging markets and technologies in order to support DSM's innovation and growth strategy.


Besides financial support, we offer start-up companies access to DSM's knowledge base, resources and networks creating a business relationship based on mutual benefits and shared learning.

To DSM businesses we offer a window to the world of innovations that are taking place in the global start-up community; an inroad to collaborations / partnerships / licenses / supply & marketing relations with start-up companies; and an option to spin in 'outside' innovations.

DSM Venturing is an integral part of DSM's open innovation approach, focused on teaming up with innovative players all over the world.

CUSTOMER NEED plays an important role in the ideation process at DSM. We start by listening to the challenges our customers face and their novel ideas that lack commercial solution. Mutual success is often achieved when both parties view ideation within a framework of collaboration.





Seeking ideation from *Industry partners* combines the benefits of a mutual attraction to a particular market with often very different perspectives on the approach to solving a problem.

Couple this with differences in core competencies and experience, it is not hard to envision how this would yield a novel approach.

At DSM Nutritional Products, ideas from all sources are channeled into what we call the idea box. In this stage of the process, dedicated innovation project managers review the ideas for alignment with our core competencies, scope relative to the markets we serve, and economic feasibility.

The best candidates for further exploration are prioritized and formal projects are created. The project managers build a preliminary business case with minimum impact to those involved in daily business operation. This clears a rather significant resource management issue that often stalls the innovation process.

In the project phase, these new ideas will undergo a series of steps which *include proof of concept trials, sustainability check, and an application-specific evaluation*. During this phase we often collaborate with key accounts which can shorten the development cycle and provide our customer a first-to-market advantage.

Ultimately project success leads to *commercialization*, making the idea available to the world.

NUTRITIONAL INGREDIENT PRODUCTION

BACKWARD INTEGRATION UNDERPINS SUPERIOR QUALITY STANDARDS

DSM Nutritional Products operates thirteen bulk manufacturing and formulation sites across Europe, the United States, Latin America and China. These sites produce the majority of DSM's nutritional ingredients, which are sold either as straight products or as premixes and vitamin concentrates.



BELVIDERE, USA

Located adjacent to the Delaware River in New Jersey this is the production site for arachidonic acid and formulations of various vitamins including vitamin E for food applications.

FREEPORT, USA

Freeport, Texas is the location of a site specializing in the production of beta carotene and intermediates for other carotenoids.

KINGSTREE, USA

The Kingstree, South Carolina plant is dedicated to the production of nutritional lipids by algal and fungal fermentation.

NAPERVILLE, USA

Hydroxy-vitamin D destined for feed applications is produced at this site near Chicago.



NOVA SCOTIA, CANADA

The plant in Mulgrave, Nova Scotia is dedicated to fish oil processing and refinement while the plant in Dartmouth, Nova Scotia is dedicated to microencapsulation of these oils.



MAIRINQUE, BRAZIL

Formerly Tortuga, this DSM site produces a full range of organic mineral chelates for use in the animal nutrition and health industry.



DALRY, UK

Located in Ayrshire, Scotland the site is involved in the production of vitamin C and related derivatives and also the production of Panthenol and Ca-Pantothenate.



LEON, SPAIN

DSM's Leon site is dedicated to the production of natural carotenoids, such as beta-carotene and lycopene.

Our products are micro ingredients whose functionality is specific and whose impact can be enormous. It is therefore imperative to manufacture, package, store and ship them in accordance with the highest quality standards. Whether provided as straight products in bulk or as premixes tailored to individual customer needs, our products always meet the most stringent quality requirements.

We work to a unique global quality standard. This is rooted in the official regulations that give us our license to operate and is supplemented by our own internal quality systems. Full backward integration allows us to assure quality at every step of the supply chain. We deliver to our customers via a dedicated logistics network based on three main distribution centers. These are located in Venlo (NL), Belvidere (USA) and Singapore.



**VILLAGE NEUF,
FRANCE**

Formulations of several vitamins and carotenoids are produced at Village Neuf which is also the production site for STAY-C® stable vitamin C forms for feed applications. The site also includes a premix unit for food applications and the DSM Research Center for animal nutrition.



**GRENZACH,
GERMANY**

Located adjacent to the Rhine in Southern Germany, this site primarily focuses on the production water soluble B vitamins, vitamin D and vitamin C derivatives. In addition intermediates used in the production of carotenoids are produced.



**SISSELN,
SWITZERLAND**

Sisseln is the production site for several carotenoids and vitamins A & E. Other operations include the purification and formulation of Ω 3 fatty acids, the formulation of several vitamins for various applications and the custom synthesis of pharmaceutical intermediates. Sisseln is also home to our pilot plant and development center.



**NOVOZYMES,
DENMARK**

Novozymes is DSM's Feed Enzymes Alliance partner for more than 10 years, researching, producing and formulating a portfolio of enzymes for use in the animal nutrition and health industry across the globe.



**XINGHOU,
JINGJIANG,
CHINA**

The Xinghuo site is specialized in the formulation of vitamin E. The Jingjiang site produces vitamin C.



PREMIXES AND BLENDING

PRODUCT SERVICES WHERE CUSTOMERS NEED THEM

DELIVERING FLEXIBLE PRECISION NUTRITION

Pet owner and consumer awareness level surrounding the health benefits relating to vitamins and minerals, and other functional ingredients is high, often supporting the 'reason to believe' important label claims such as supporting immune function and bone and joint health. Consequently, this growing health benefit awareness, has led to the use of a more diverse list of micronutrients and functional ingredients in pet foods to support specific dietary label claims.

DSM has over 50 years of experience producing premixes for use in animal nutrition products. Premixes are blends of micronutrient and other functional ingredients as well as suitable carriers. Our experts work closely with customers to develop premixes that deliver the ingredient solutions needed to substantiate functionality claims made on labels, ensure accurate addition of these ingredients into pet foods, treats and supplements, all with the goal of achieving the highest possible food nutritional quality and safety. In addition to meeting functionality claims, we can often meet non-GMO, organic, country of origin and grain free requirements.

We have a global network of over 40 premix plants to ensure that we are close to where our customers are.

WHY DO YOU NEED A PREMIX?

Individually weighing and adding many of the very low inclusion micronutrient ingredients separately during the pet food production process carries a high risk. Weighment inaccuracies and poor distribution of very small amounts of the separate micro ingredients within the final pet food product could affect its nutritional quality or even safety at the point of consumption. Premixing micro ingredients together, for incorporation into the pet food, treat or supplement macro material mix ensures the active micronutrient particles are distributed more uniformly throughout the final product. DSM premixes are a critical link in the pet food supply chain and allow accurate, safe, and homogeneous micronutrient and functional ingredient inclusion into pet food products.

DSM PREMIX PRODUCTION

Premixes produced by DSM are backed through our global assurance of safety and quality. DSM continuously evaluates its responsibilities and the implication of our footprint in the feed and pet food supply chain. DSM's premix production and ingredient supply chain is designed around food standards and our 5 Q values: Food Safety, Trusted Supply Chain, Closing the Loop, Traceability, and Sharing and Learning, discussed at length on page 5.

10 THINGS YOU NEED TO KNOW ABOUT PREMIXES

Approximately 80% of the pet food industry uses premixes in the production of their complete and balanced pet food products. A premix is a blend of micronutrients that are individually added to pet food in "micro" amounts. Combining these ingredients in a premix simplifies the weighing process and improves accuracy in mixing and distribution of these micro-nutrients throughout the food. But, if you think a premix is "just a blend," think again.

Based on more than 50 years of experience producing micronutrients and premixes for the animal nutrition and health industries, ask your DSM representative to share the facts about **The 10 Most Important Things You Need to Know About Premixes:**

1. Nutrient form quality
2. Nutrient form potency
3. Nutrient form stability
4. Nutrient form physical characteristics
5. Carriers and other adjuncts
6. Mixing equipment and procedure
7. Premix formulation and use rate
8. Quality program
9. Handling of premixes
10. Pet food process and point of addition

INTEGRATED SUPPLY CHAIN

DSM manufactures their own range of vitamins along with many other key micronutrients. DSM therefore has a unique ability to control the origin of many ingredients used within a premix. DSM's integrated vitamin production and premix supply chain is unrivalled.

VENDOR CONTROL

Strict control of all ingredients used in premix is essential. Since we are not restricted to only supplying the ingredients that we produce, non-DSM raw materials are sourced from suppliers in compliance with our 5 Q Values. We understand the importance of selecting and sourcing ingredients that will protect brand equity for all in the supply chain.

TRACK AND TRACE

Traceability is a vital component of pet food safety. DSM's sophisticated global production, quality, purchasing and raw material intake systems are linked. DSM sites use a bar coding system which allows ingredients used to be tracked through from intake at the premix plant—the entire premixing process and finally to delivery to the customer. This means we can rapidly track and trace any ingredient used in any premix, meeting the prompt response times demanded by our customers should the need arise.

ANALYTICAL EXPERTISE

DSM premixes are formulated and manufactured to meet the highest standards for product quality, safety, efficacy, and traceability while meeting strict regulatory requirements. Routinely, premix quality, plus individual ingredients are checked in our own laboratories located at the premix sites and at our global analytical centers.

Nutritional sufficiency against specification, undesirable residues and routine micro-biological testing is carried out in accordance with DSM quality requirements, local and global regulation. Regular dispersion tests are also carried out to check the efficiency and quality of our premix mixing to ensure we deliver a homogenous premix to our customers.



EUROPE

Our network of thirteen (13) premix plants across Europe, the Middle East, and South Africa allow us the flexibility needed to supply and serve customers in the region.



NORTH AMERICA

Our four (4) North American premix plants assure customers service reliability in the supply of premixes across the United States and Canada.



LATIN AMERICA

DSM premix is produced in most Latin American countries with a total of thirteen (13) premix plants.



CHINA

DSM has the fastest expanding network of premix plants in China and serves most areas of the country from eight (8) sites.



ASIA PACIFIC, OCEANIA

DSM has premix production capabilities in all the major feed/pet food producing and exporting countries in the region with a total of nine (9) plants.

NUTRITIONAL INGREDIENTS

A BRIEF GUIDE TO VITAMINS

DSM produces an extensive portfolio of nutritional ingredients for use in pet food products and supplements including minerals, vitamins, carotenoids, and long chain polyunsaturated fatty acids. These products deliver a wide range of health benefits to all pet species.

Vital for the efficiency of a broad array of functions in the body, the DSM vitamin range contains all the vitamins crucial for healthy, thriving, long-living pets.

VITAMIN A Necessary for vision, growth, and tissue differentiation. Is important for keeping the skin, eyes, and inner linings of the body healthy and resistant to infection. Vitamin A is also needed for the maintenance and growth of teeth, nails, hair, bones and glands.

VITAMIN D Helps the body maintain and utilize the levels of calcium and phosphorus needed to build strong bones and teeth. Recent studies have shown additional benefits such as supporting immune health, weight management, and cancer prevention.

VITAMIN E Helps protect cell membranes, maintain the immune system, prolong the life of red blood cells, maintain a healthy circulatory system, and improve vitamin A use. Important for the health & proper functioning of body tissues. Is an antioxidant, neutralizing free radicals.

VITAMIN K Essential for the clotting of blood and may help maintain bone health.

VITAMIN B₁, THIAMINE Helps the body use its major source of energy, carbohydrates. Thiamine is also essential for proper muscle coordination, the maintenance of peripheral nerve tissue, and for normal growth.

VITAMIN B₅, PANTOTHENIC ACID Essential for the formation of certain nerve-regulating substances and hormones. It is also required for metabolism of proteins, fats, and carbohydrates.

VITAMIN B₆, PYRIDOXINE Necessary for energy metabolism, the formation of certain proteins, and the use of amino acids. It also helps the nervous system to function properly and is essential to a healthy immune system and heart health.



VITAMIN B₁₂, CYANOCOBALAMINE Necessary for the formation of DNA and the production of healthy red blood cells. Helps maintain the nervous system and is essential to maintaining mental function. Vitamin B₁₂, along with B₆ and folate, is essential to heart health.

VITAMIN B₉, FOLIC ACID Required for the formation of red blood cells, certain body proteins, and genetic materials for the cell nucleus. Emerging science suggests it may play an important role in reducing risk of cardiovascular disease, dementia, and certain cancers.

VITAMIN B₂, RIBOFLAVIN Helps the body transform proteins, fats, and carbohydrates into energy. Helps maintain healthy skin and eyes and is also necessary for building and maintaining body tissues.

VITAMIN B₃, NIACIN Niacin and niacinamide are essential for fat synthesis, protein metabolism, and the conversion of food to energy.

VITAMIN C, ASCORBIC ACID Aids in the production of collagen, which provides support to muscles, vascular tissues, bones, & cartilage. Aids the absorption of iron and improves teeth and gum health. Is an important water soluble antioxidant. Enhances the immune response and plays a protective role against cardiovascular disease, cataracts, and certain cancers.

VITAMIN H, BIOTIN Necessary for synthesizing fatty acids and breaking down protein and carbohydrate molecules. Helps in the maintenance of the thyroid and adrenal glands, nervous system, reproductive tracts, and skin.

NUTRITIONAL INGREDIENTS

DELIVERING HEALTHIER PETS

DSM's portfolio of nutritional ingredients includes: a range of carotenoids used for either antioxidant functionality or pigmentation, natural sources of omega-3 fatty acids, and trace minerals; all supporting the health and wellness of pets.

CAROTENOIDS

β-CAROTENE

(ROVIMIX®, CaroCare®)

β-carotene is an important source of vitamin A, converted into vitamin A as required. The additional health promoting effects of β-carotene include antioxidant functionality protecting cells, tissues, and organs from free radical damage and as a contributor to the robustness of the pet's immune system.

CANTHAXANTHIN

(CAROPHYLL® Red)

Canthaxanthin is a carotenoid that has dual functionality in birds and fish, skin / feather pigmentation and biological antioxidant. As an example of pigmentation, the feathers of a flamingo can range from pink to red depending on the amount of canthaxanthin in its diet. The biological functionality as an antioxidant, protecting cells from free radical damage and sparing vitamin E.

ASTAXANTHIN

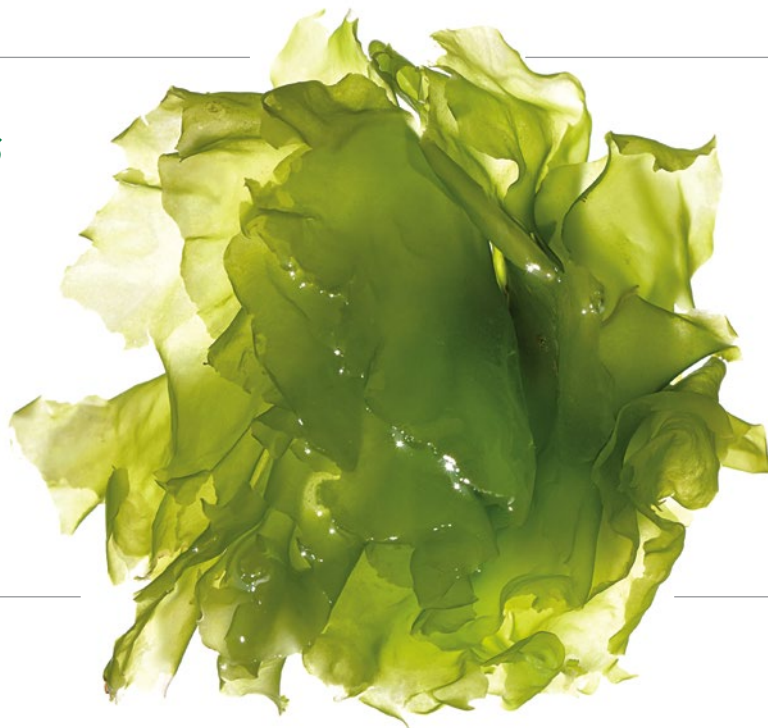
(CAROPHYLL® Pink)

Besides pigmentation, astaxanthin is a carotenoid that is recognized as being one of the most powerful antioxidants found in nature. Other health benefits associated with astaxanthin include eye health and immune function support.

NUTRITIONAL LIPIDS

OMEGA-3 FROM ALGAE

DHA omega-3 derived by algal fermentation containing docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), fatty acids that support cardiovascular, eye, and brain health (e.g. memory), and directly reduce cellular inflammation supporting joint, skin, and coat health.



OMEGA-3 FROM FISH

Highly refined and deodorized fish oils containing both eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).



MINERALS AND TRACE ELEMENTS

Examples of important minerals and trace elements

SELENIUM (Se)

Selenium is an antioxidant that protects cell membranes.

IODINE (I)

Iodine is essential for proper thyroid gland function.

COPPER (Cu)

Copper is involved in energy production, connective tissue formation, iron metabolism, normal red blood cell formation, normal nervous

system function, neurotransmitter synthesis and metabolism, melanin formation for pigmentation of hair and also has an antioxidant function as part of super oxide dismutase.

MANGANESE (Mn)

Manganese contributes to the formation and quality of the bones and joint cartilage while also playing an active role in the functioning of the mitochondria.

ZINC (Zn)

Zinc is involved as a co-enzyme in many cellular enzyme systems and impacts carbohydrate, lipid, protein and nucleic acid metabolism. It is crucial for collagen and keratin synthesis contributing to skin integrity and coat quality. It is also needed by the immune system and plays an important role in reproduction.

IRON (Fe)

Iron is an essential component of the oxygen carrying hemoglobin in the red blood cells and intramuscular myoglobin, helps support immune function, and is an integral part of many important enzymes systems including those supporting energy production, DHA synthesis, and functionality as a cellular antioxidant.

KNOWING PET PRODUCT TECHNOLOGIES

UNDERSTANDING HOW DIFFERENT PET PRODUCT TECHNOLOGIES INFLUENCE THE APPLICATION OF NUTRITIONAL INGREDIENTS

A white plate containing several pieces of wet pet food, including a loaf of pate and chunk-in-gravy foods, some of which are coated in a yellowish sauce.

WET PRODUCTS

Wet food styles include loaf (pate) and chunk-in-gravy foods and treats. Initially, meat and other ingredients are mixed with or without heat for various periods of time.

This mixture is either placed in a container, sealed and cooked at a high temperature or cooked using a steam tunnel, formed into chunks, sealed in a container with gravy, and cooked again at a high temperature.

For this application, nutritive ingredients need to be resistant to moisture, oxidation, enzymes, and extreme changes in temperature throughout manufacturing. Finally the finished product color must not be adversely affected plus remain shelf stable for 24 months.

The pet food market is characterized by a wide variety of different product forms. This occurred because ingredient forms were developed to support changes in formulation, process conditions, and packaging.

Specially formulated nutritive and functional ingredients are often the key to the successful development of foods, treats, and supplement products. As a leader in nutritional ingredient form development, DSM offers a comprehensive range of ingredients suitable for the full range of manufacturing processes and formulation options our customers use to create products with distinct points of differentiation.

A collection of various baked pet food products, including bone-shaped biscuits, round biscuits, and flaked products, scattered on a white surface.

BAKED PRODUCTS

Food, treat, and flaked products are manufactured using baking. Initially, dough is formed exposing the ingredients to moisture and sometimes enzymes. The formed dough is heated to the desired degree of cook and dryness. For this application, nutritive ingredients need to be resistant to heat, moisture, enzymes, and oxidation throughout manufacturing plus remain shelf stable for 18–24 months.

A large pile of dark brown, round extruded pet food products, possibly kibble or small biscuits, scattered on a white surface.

EXTRUDED PRODUCTS

Extrusion, one of the harshest processing technologies, is used to produce food and treat products. This process typically requires ingredients to be exposed to high temperatures, pressure, moisture, shear, rapid expansion, and a drying step.

For this application, nutritive ingredients need to be resistant to rapid changes in temperature, pressure and moisture heat, shear, and oxidation throughout manufacturing plus remain shelf stable for 18–24 months.



MILK AND FATTY LIQUIDS

High fat (oil) paste and liquid products range from infant food to lubricants for the gastro-intestinal tract to aid mobility and control hairballs. During manufacturing these types of fatty liquids often experience high shear during mixing and homogenization, high temperatures during sterilization, and unwanted enzyme activity. For this application, nutritive ingredients may need to be resistant to UV light, oxidation, shear, high and rapidly changing temperatures, enzyme activity, display high miscibility and emulsification properties during manufacturing plus remain shelf stable for 3 to 24 months without causing sedimentation or other negative product attributes.



COMPRESSED TABLETS

Tablets are swallowed, chewed or dissolved to deliver their functional ingredients. During manufacturing the ingredients may be ground and screened to obtain a uniform particle size. The final blend experiences pressure and shear while forming the tablets. Depending on the packaging, the tablets may be exposed to moisture and oxygen. Some tablets are formulated to effervesce when added to water subsequently exposing the ingredients to moisture, changes in pH, and further oxidation for an undefined period of time. For this application, nutritive ingredients need to be resistant to pressure, shear, oxidation, and possibly reduction in particle size, changes in pH and moisture.



INJECTION MOLDING

This process is used to manufacture treats and chews where appearance, structure and actual product design are major challenges. This process usually involves high temperatures with a low shear and moisture. For this application, nutritive ingredients need to be resistant to high and changing temperatures, and oxidation. The finished product color and hardness must not be adversely affected and remain shelf stable for 24 months.



CLEAR SOLUTIONS

Bottled waters are sometimes used to deliver functional ingredients. Unlike other liquid products, formulating while maintaining clarity is the challenge. In addition to the attributes associated with manufactured liquid products, nutritive ingredients for this application must not react to other ingredients, UV light or oxidation causing a loss of nutritive value, coloration or sedimentation.



DRY MIXES AND POWDERS

Dry mixture products range from supplements to milk replacers. Dry blends require ingredients that can be dispersed readily throughout the mixture, not prone to particle segregation/separation and are chemically stable. Some are designed to be added to liquids and must be readily soluble or miscible. For this application, nutritive ingredients usually need to be uniform in particle size and density, chemically and heat stable, have a low propensity to create an electrostatic charge, not attract moisture plus resist oxidation through manufacturing and storage. The finished product color must also not be adversely affected.

KNOWING NUTRIENT FORM TECHNOLOGIES

LEVERAGING NUTRIENT FORM TECHNOLOGY TO ACHIEVE YOUR PET PRODUCT NUTRITION GOALS

FORM REQUIREMENTS

BIOAVAILABILITY:

The nutrient should have a chemical structure which is fully metabolized and the product formulation should provide protection but release the nutrient upon ingestion.

STABILITY:

The ingredient must remain stable “as is” or in blends and premixes. Therefore the ingredient must be adequately stabilized in a chemical and / or product form which when stored, transported, milled, or mixed, maintains its activity. The product form must be resistant to activity loss due to environmental factors such as temperature, moisture, and oxygen.

UNIFORMITY:

The particle size and size distribution determines how well the nutrient is dispersed throughout the finished product, impacting the nutrient activity per serving. A uniform product minimizes the tendency for nutrients to segregate when mixed and transported with other micro-ingredients, allows adequate flow through equipment during production and reduces dust formation when handled.

CONSISTENCY IN POTENCY:

For reliable dosing of a nutrient in production, potency must be consistent both particle-to-particle and lot-to-lot. The availability of appropriate dilutions supports the accuracy of dosing during production.

DISSOLUTION BEHAVIOR:

The form of the nutrient dictates its aqueous (water) or non-aqueous (fats or oils) solubility or miscibility. These physical characteristics influence the distribution of the functional ingredient in the final pet product, its color, texture and / or shelf life.

The pet food sector is becoming increasingly sophisticated with the demand for a wide range of ingredients with different matrices, textures, colors, shapes and nutritional functionality as suppliers look to differentiate their products on the retailers' shelves.

EXTERNAL FACTORS INFLUENCING VITAMIN STABILITY

VITAMIN	Temperature	Oxygen	Humidity	Light	pH Acid	pH Alkaline
Vitamin A	✓✓	✓✓	✓	✓✓	✓	●
Vitamin D3	✓	✓✓	✓	✓	●	✓
Vitamin E-Acetate	●	✓	●	●	●	✓
Vitamin K3	✓	✓	✓✓	✓	✓✓	✓✓
Vitamin B1	✓	✓	✓	●	●	✓✓
Vitamin B2	●	●	✓	✓	●	✓
Vitamin B6	✓✓	●	✓	●	●	●
Vitamin B12	✓✓	✓	✓	✓	●	●
Pantothenic Acid	✓	●	✓	●	✓	✓
Nicotinic Acid	●	●	●	●	●	●
Biotin	✓	●	●	●	●	●
Folic Acid	✓✓	●	✓	✓✓	✓✓	●
Vitamin C	✓✓	✓✓	✓✓	✓	●	✓

● = Stable ✓ = Slightly Sensitive to Sensitive ✓✓ = Very Sensitive

PRODUCT FORM REQUIREMENTS

	Heat Stable	Moisture Stable	Shear Tolerant	Resistant to Oxidation	Not Adversely Affected by Enzyme Activity	Low Coloration and/or Small Particle Size	Compression Tolerant	Resistant to UV Light	Proper Solubility or Miscibility
Extrusion	●	●	●	●	●	●	●	●	●
Baking	●	●	●	●	●	●	●	●	●
Restoring/Steaming	●	●	●	●	●	●	●	●	●
Fresh/Frozen	●	●	●	●	●	●	●	●	●
Injection Molding	●	●	●	●	●	●	●	●	●
Dry Mixing/Powder	●	●	●	●	●	●	●	●	●
Tableting/Compression	●	●	●	●	●	●	●	●	●
High Fat Liquid	●	●	●	●	●	●	●	●	●
Low Fat Liquid/Milk	●	●	●	●	●	●	●	●	●
Clear Water	●	●	●	●	●	●	●	●	●



PRODUCTION OF INGREDIENT FORMS

PRODUCTION: Functional ingredients such as vitamins or carotenoids are produced either by chemical synthesis, by fermentation, by extraction (often from a natural source) or by a combination of these technologies.

MODIFICATION: Once the basic functional compound is produced it may be further processed to develop a more stable chemical form, using processes such as crystallization of an organic salt, esterification and phosphorylation.

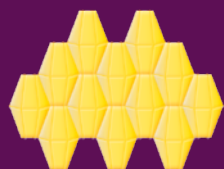
FORMULATION: To achieve specific product characteristics the ingredients then undergo a formulation process. Such formulation creates highly specified nutrient forms optimally equipped to meet the specifications within a pet food, food or feed product.



FORMULATION TECHNOLOGIES

CRYSTALLINE GRADES

Nutrient compounds are chemically modified to form organic salt which after drying are not further formulated but used "as is". Optionally crystalline material can be coated with ethyl cellulose which slows any possible detrimental influence of other ingredients present in the formula.



Nutrient in crystalline form

ADSORBATES

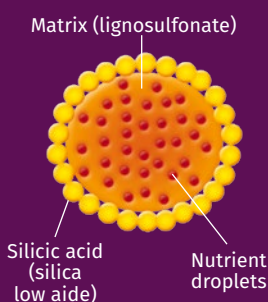
Suitable carriers such as silica particles are prepared for adsorbing mainly fat soluble nutrients. Adsorption has the advantage of delivering an economically attractive dry form of an intrinsically stable nutrient, and results in a free-flowing powder with good mixability, flowability and dust characteristics.



Nutrient adsorbed on silica particle

SPRAY-DRIED POWDERS

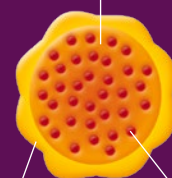
Spray-drying is applied for many of the water soluble nutrients to enhance stability, handling and distribution. The nutrient compound is added into a dextrin solution. The solution is spray dried into a powder, which offers a variety of advantages including stabilizing the nutrients and delivering it in a digestible matrix.



BEADLETS

In beadlet technology nutrient compounds are emulsified in a gelatin, starch and glycerin matrix, with an antioxidant sometimes added to increase stability. The emulsion is then sprayed to form beadlets which are coated with corn starch to absorb excess moisture. Moist beadlets are dried to produce the finished beadlet. Micronization of the often oily functional ingredient allows the production of stable, yet dispersible beadlets for clear liquids.

Matrix (gelatin/carbohydrates or vegetable)

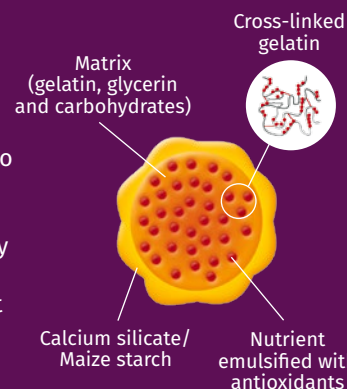


Maize starch

Nutrient emulsified with antioxidants

CROSS-LINKED BEADLET

Additional chemical bonds are introduced to create a hardened beadlet most commonly referred to as a cross-linked beadlet. A chemical reaction occurs which creates cross-linked bonds thereby creating a more rigid structure. This technology provides excellent stability and is used to protect nutrients in high temperature applications.



Matrix (gelatin, glycerin and carbohydrates)

Cross-linked gelatin

Calcium silicate/ Maize starch

Nutrient emulsified with antioxidants



PET NUTRITIONAL SOLUTIONS

BY DSM

The humanization of pets has been the driver behind significant growth of premium and superpremium pet food and snack products across the globe. It is increasingly more difficult for those responsible for brand development to create points of differentiation based on nutritional claims considering regulatory and economic constraints. Although there are many functional ingredients being marketed to pet food manufacturers, those registered for use in pet foods which allow substantive health claims are rare.

DSM is uniquely positioned to provide nutritional solutions designed to help you make your products attractive to the health-conscious pet product consumers purchasing premium and superpremium products for their furry children. Here are a few reasons why:

- **GLOBAL LEADER IN NUTRIENT MANUFACTURING AND PREMIX**

Beginning with the first synthesis of vitamins 100 years ago, we have unparalleled experience in the manufacture of a broad array of micronutrients, functional ingredients, and premix to create solutions in the best form for the application.

- **INGREDIENTS AS TOOLS**

We leverage our broad portfolio of innovative, high-quality health nutrients and work with other leading ingredient manufacturers to create quality solutions.

- **KNOWLEDGE AND EXPERIENCE**

We combine over 30 years of active engagement in the science of measuring animal and human nutrition and health efficacy with collaborative projects with academic and industry specialists to create robust solutions.

- **PET INDUSTRY DEDICATED TALENT**

We have a dedicated team of pet industry specialists experienced in pet food manufacturing and marketing to create solutions that are relevant.

- **INVESTED IN STUDYING PET CONSUMER INSIGHTS AROUND THE GLOBE**

Ultimately consumer perceptions drive the success of any nutritional solution, which is why we invest in studies to help us create solutions that help you be successful.



Talk to your DSM representative to learn how we can deliver the right solution for your brand.



OPTIMUM VITAMIN NUTRITION

DSM VITAMIN SUPPLEMENT GUIDELINES

Leveraging the full potential of vitamins, nutrition that supports a long and healthy life.

WHY ARE VITAMINS IMPORTANT TO PETS?

Vitamins are involved in most metabolic functions, as essential for companion animals as they are for humans. Although vitamins play a significant role in the health and well-being of companion animals, the animal feed industry only sets vitamin fortification levels for complete feeds at a minimum amount required to prevent overt clinical deficiency, without guidance on application specific considerations (e.g. process and storage loss).

The pet industry is beginning to consider vitamin requirements in the wider context of optimum levels, but the trend remains to only follow evidence based upon limited studies of low complexity. Such an approach generally negates experience or intelligent interpretation or extrapolation of aspects of physiological processes associated with diseases and comparative nutrition as the evidence based approach tends to only consider “hard” end points of trials.

In the context of determining Optimum Vitamin Nutrition for companion animals there should be perhaps a subtler set of considerations as to what constitutes a positive response to vitamin supplementation. OVN™ is a move to maintaining overall animal well-being rather than preventing a clear-cut deficiency, which includes functional improvements, like coat condition, outward signs of cognitive function, antioxidant status or stamina during exercise. This is an important point to recognize in your development of quality pet food.



IS OVN™ MORE THAN CHOOSING THE RIGHT VITAMIN LEVELS IN MY PRODUCT FORMULATION?

OVN™ is a DSM solution designed to provide you with practical help formulating the correct vitamin supplement pack in alignment with your brand and business goals. How is this done?

- It starts with DSM's OVN™ guidelines used to identify the amount of vitamin activity you need to target in your product at the time of consumption to meet NRC, AAFCO, and FEDIAF guidelines on minimum vitamin requirements plus any additional vitamin activity needed to support desired health claims.
- Our experts then select the most technologically advanced vitamin ingredient forms designed for the application, in compliance with key global regulations and DSM's quality and safety program, and with the appropriate overages to account for losses through the product's manufacturing process and storage ensuring the correct level of vitamins are consumed by the pet.
- These experts further formulate and produce a pre-blend or premix of these vitamin ingredients leveraging our knowledge and experience producing pet food premixes, considering many factors including proper dilution for accurate dosing and handling characteristics.
- No solution would be complete without a consumer friendly OVN™ logo as a symbol of the optimum vitamin nutrition inside your product.

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MICROGRAN[®], Mineral Preparations
VEVOMIN[®], Mineral Chelates

Ingredient forms:

- Feed grade ○ Food grade

Not all products are available in every country but registration is possible.

Application:

Dry: Dry pet food and treats

Wet: Wet pet food and treats


Injection: Injection molded chews

Tablet: Tablet supplements

Powder: Powder supplements

Milk: Milk and low fat liquid products

Water: Water based liquid products

Icons like this  provide a general indication the ingredient category is commonly registered for use in diets or supplements for that species.

CAROTENOIDS

β-Carotene

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● ROVIMIX® β-Carotene 10%	Stabilized Beadlet	France	•	•	•	•	•	•		
● ROVIMIX® β-Carotene 10% P	Cross-Linked Beadlet	France	•		•					
○ β-Carotene 10% CWS	Beadlet, Cold Water Dispersible	Switzerland		•	•			•	•	•
○ β-Carotene 10% B	Cross-Linked Beadlet	Switzerland	•							

Canthaxanthin

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● CAROPHYLL® Red 10%	Beadlet	France	•	•	•	•	•	•		

Astaxanthin

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● CAROPHYLL® Pink 10% CWS	Beadlet, Cold Water Dispersible	France	•	•	•	•	•	•		

FAT SOLUBLE VITAMINS

Vitamin A

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● ROVIMIX® A 1000 (100 kIU/g)	Cross-Linked Beadlet	Switzerland	•	•	•					
● ROVIMIX® AD3 1000/200 (1000 kIU A/g) (200 kIU D3/g)	Cross-Linked Beadlet, Stabilized Beadlet	Switzerland	•	•	•					
● ROVIMIX® A 500 WS (500 kIU/g)	Spray Dried, Water Dispersible Beadlet	France			•	•	•	•	•	•
● ROVIMIX® A 500 N (500 kIU/g)	Cross-Linked Beadlet, No Porcine Gelatin	China								
○ Vitamin A Palmitate 1.0 mIU/g	Oily Solution (Peanut Oil), Stabilized with Tocopherol	Switzerland							•	•
○ Vitamin A Palmitate 1.7 mIU/g	Oily Liquid, Stabilized with Tocopherol	Switzerland			•					•
○ Dry Vitamin A Acetate 500 B (500 kIU/g)	Beadlet, Tablet Grade	USA	•	•		•	•			
○ Dry Vitamin A Palmitate, Type 250 S/N (250 kIU/g)	Spray-Dried, Starch Based	France			•		•	•		

Vitamin D₃

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● ROVIMIX® D ₃ 500 (500 kIU/g)	Spray-Dried, Water Dispersible, Stabilized Powder	France			•	•	•	•	•	•
● ROVIMIX® AD3 1000/200 (1000 kIU A/g), 200 kIU D3/g)	Cross-Linked Beadlet, Stabilized Beadlet	Switzerland	•	•	•					
○ Vitamin D ₃ 1.0 mIU/g	Oily Solution, Stabilized with Tocopherol	Switzerland			•	•	•	•	•	•
○ Dry Vitamin D ₃ 100 SD/S (100 kIU D3/g)	Spray-Dried, Cold Water Dispersible, Stabilized with Tocopherol	Switzerland	•	•	•	•	•	•	•	•

FAT SOLUBLE VITAMINS (CONT.)

Vitamin E

Product Name	Product Description	Country of Origin	Dry	Wet	Injection	Tablet	Powder	Milk	Water
● Tocopheryl Acetate Technical Grade (100% Basis)	Clear Viscous Oil	Switzerland	•	•	•				
● ROVIMIX® E 50% Adsorbate (500 IU/gm)	Vitamin E Oil Adsorbed on Silicon Dioxide	Switzerland USA China	• • •	• • •			• • •		
● ROVIMIX® E 50% SD (500 IU/gm)	Spray Dried, Water Dispersible Powder	France Switzerland USA		• • •	• • •	• • •		• • •	• • •
○ Dry Vitamin E 50% CWS/S (500 IU/g)	Spray-Dried, Cold Water Dispersible	France Switzerland			• •			• •	• •
○ Dry Vitamin E 50%, Type SD (500 IU/g)	Spray-Dried, Powder	Switzerland USA	• •	• •		• •	• •		
○ Dry Vitamin E 75 HP (750 IU/g)	Beadlet, High Potency	USA				•			
○ dl-α-Tocopherols 70 IP	Liquid Antioxidant	Switzerland		•				•	
○ Mixed Tocopherols 70 IP	Liquid Antioxidant, Natural Source, Non-GMO	Argentina		•	•			•	
○ Mixed Tocopherols 95	Liquid Antioxidant, Natural Source	USA		•	•			•	
○ Dry Mixed Tocopherol 30%	Dry Antioxidant, Natural Source	USA	•	•	•	•	•	•	•

Vitamin K, Menadione

Product Name	Product Description	Country of Origin	Dry	Wet	Injection	Tablet	Powder	Milk	Water
● MSBC (Sodium Bisulfite Complex, 33%) Available in USA Only	Fine Crystalline Powder	Turkey Uruguay China	• • •	• • •	• • •	• • •	• • •	• • •	• • •
● ROVIMIX® K ₃ MNB (Menadione Nicotinamide Bisulfite)	Fine Crystalline Powder	Turkey Uruguay China	• • •	• • •	• • •	• • •	• • •	• • •	• • •

WATER SOLUBLE VITAMINS

Vitamin B₁, Thiamine

Product Name	Product Description	Country of Origin	Dry	Wet	Injection	Tablet	Powder	Milk	Water
● ROVIMIX® B ₁ (Thiamine Mononitrate)	Fine Crystalline Powder	Germany	•	•	•	•	•	•	•
○ Thiamine HCl (Thiamine Hydrochloride)	Fine Crystalline Powder	Germany	•	•	•			•	•
○ Thiamine Mononitrate	Powder	Germany	•	•					
○ Rocoat® Thiamine 33 1/3%	Coated Powder	USA	•	•		•			

Vitamin B₂, Riboflavin

Product Name	Product Description	Country of Origin	Dry	Wet	Injection	Tablet	Powder	Milk	Water
● ROVIMIX® B ₂ 80-SD	Spray-Dried, Water Dispersible Powder	Germany	•	•	•	•	•	•	•
○ Riboflavin Tablet Grade	Tablet Grade	Germany				•			
○ Riboflavin Universal	Powder	Germany	•	•	•			•	•
○ Rocoat® Riboflavin 33 1/3%	Coated Powder	USA	•	•		•			

WATER SOLUBLE VITAMINS (CONT.)

Vitamin B₃, Niacin

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● ROVIMIX® Niacin	Fine Crystalline Powder	Switzerland	•	•		•	•			
● ROVIMIX® Niacinamide	Fine Crystalline Powder	China	•	•	•	•	•	•	•	
○ Rocoat® Niacinamide 33 1/3%	Coated Powder	USA	•	•		•				

Vitamin B₅, Pantothenate

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● ROVIMIX® CalPan (Calcium Pantothenate)	Spray-Dried, Water Dispersible Powder	Great Britain	•	•	•	•	•	•	•	
○ Calcium D-Pantothenate	Spray-Dried Powder	Great Britain	•	•	•	•	•	•	•	

Vitamin B₆, Pyridoxine

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● ROVIMIX® B ₆	Fine Crystalline Powder	Germany China	•	•		•	•	•	•	
○ Pyridoxine Hydrochloride	Crystalline Powder	Germany China	•	•	•	•		•	•	
○ Rocoat® Pyridoxine Hydrochloride 33 1/3%	Coated Powder	USA	•	•		•				

Vitamin B₉, Folic Acid

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● ROVIMIX® Folic 80 SD	Spray-Dried, Water Dispersible Powder	France China	•	•	•	•	•	•	•	
○ Folic Acid	Powder	Switzerland	•	•	•	•	•	•	•	

Vitamin B₁₂, Cobalamin

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● Vitamin B ₁₂ 1% Feed Grade	Crystalline Powder Dilution	France	•	•	•	•	•			
○ Vitamin B ₁₂ Crystalline	Crystalline Powder	France	•	•	•			•	•	
○ Vitamin B ₁₂ 0.1% WS	Crystalline Powder Dilution	Switzerland				•	•	•	•	

Vitamin H, Biotin

Product Name	Product Description	Country of Origin								
			Dry	Wet	Injection	Tablet	Powder	Milk	Water	
● ROVIMIX® Biotin (2% Biotin)	Spray-Dried, Water Dispersible Powder	France	•	•	•	•	•	•	•	
● ROVIMIX® Biotin HP (10% Biotin)	Spray-Dried, Water Dispersible Powder	France USA	•	•	•	•	•	•	•	
○ D-Biotin	White Crystalline Powder	France				•	•			
○ Bitrit-1 Type A (1% Biotin)	Triturate, Powder	USA	•	•	•			•	•	

WATER SOLUBLE VITAMINS (CONT.)

Vitamin C, Ascorbic Acid

Product Name	Product Description	Country of Origin	Dry	Wet	Injection	Tablet	Powder	Milk	Water
● ROVIMIX® Stay-C® 35 (Sodium Calcium Ascorbyl Phosphate)	Spray-Dried Powder, Heat Stable	France	•	•	•		•		
● ROVIMIX® C-EC	Ethcellulose-Coated Powder	Great Britain		•		•	•		
○ Stay-C® 50 (Sodium Ascorbyl Phosphate)	Spray-Dried Fine Powder, Heat Stable	France	•		•	•		•	•
○ Ascorbic Acid	Crystalline Powder	Great Britain						•	•
○ Ascorbic Acid Fine Powder	Fine Powder	Great Britain			•		•		
○ Ascorbic Acid Fine Granular	Fine Granular Powder	Great Britain				•	•		
○ Ascorbic Acid 95% Granulation	Granular Powder	Great Britain				•	•		
○ Calcium Ascorbate	Powder	USA		•	•			•	•
○ Calcium Palmitate	Powder, Antioxidant	Germany	•	•	•			•	•

NUTRITIONAL LIPIDS

Omega-3 Fatty Acids From Algae

Product Name	Product Description	Country of Origin	Dry	Wet	Injection	Tablet	Powder	Milk	Water
● DHAGold® Min. 17% DHA	Fine Dry Flakes of Microalgae	USA	•	•	•				
○ DHASCO® Min. 40% DHA	Microalgae Derived Oil	USA	•	•	•			•	
○ life's™ OMEGA 60 Min. 30% DHA, 15% EPA Min. 60% Total Omega-3	Microalgae Derived Oil	USA	•	•	•				
○ life'sDHA® S17-P100 Min. 17% DHA	Free-Flowing Powder of Microalgae Derived Oil	USA	•	•	•	•	•	•	

Omega-3 Fatty Acids From Fish

Product Name	Product Description	Country of Origin	Dry	Wet	Injection	Tablet	Powder	Milk	Water
○ MEG-3® 30% TG Oil Min. EPA + DHA area %, min. 30% Min. EPA + DHA content as T.G. 260 mg/g Min. EPA + DHA content as F.F.A. 250 mg/g	Marine Fish Oil	Peru	•	•	•			•	
○ MEG-3® 30% Powder Min. 150mg - Max 220 mg EPA + DHA and 180 mg Total Omega-3 per g	Microencapsulated Marine Fish Oil Powder	USA		•	•	•		•	•

MINERALS

Mineral Preparations

Product Name	Product Description	Country of Origin	Dry	Wet	Injection	Tablet	Powder	Milk	Water
● MICROGRAN® Co 5% BMP (Preparation of Cobalt Carbonate)	Free-Flowing, Micro Granules	Italy	•	•	•	•	•	•	•
● MICROGRAN® Se 1% BMP (Preparation of Sodium Selenite)	Free-Flowing, Micro Granules	Italy	•	•	•	•	•	•	•
● MICROGRAN® Se 4.5% BMP (Preparation of Sodium Selenite)	Free-Flowing, Micro Granules	Italy	•	•	•	•	•	•	•
● MICROGRAN® I 10% BMP (Preparation of Calcium Iodate)	Free-Flowing, Micro Granules	Italy	•	•	•	•	•	•	•

Mineral Chelates

Product Name	Product Description	Country of Origin	Dry	Wet	Injection	Tablet	Powder	Milk	Water
● VEVOMIN® Cu 13% (Cupric Chelate of Amino Acids, Hydrate)	Free-Flowing Powder	Canada	•	•	•	•	•	•	•
● VEVOMIN® Fe 12% (Ferrous Chelate of Amino Acids, Hydrate)	Free-Flowing Powder	Canada	•	•	•	•	•	•	•
● VEVOMIN® Mn 11% (Manganese Chelate of Amino Acids, Hydrate)	Free-Flowing Powder	Canada	•	•	•	•	•	•	•
● VEVOMIN® Zn 13% (Zinc Chelate of Amino Acids, Hydrate)	Free-Flowing Powder	Canada	•	•	•	•	•	•	•



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To find out more about our ingredients for pet nutrition, please contact your nearest DSM Nutritional Products office.

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