

natuphos[®] E
EFFICIENT BY EXPERIENCE

BASF
We create chemistry

Unfolding the benefits of our novel phytase

Natuphos[®] E

New
Natuphos[®] E
by BASF



NATUPHOS® E: UNPRECEDENTED PHYTASE FROM BASF.

As the first company to market a phytase for feed almost 25 years ago, BASF is once again proud to be setting a new standard in feed phytase technology. Our unprecedented new phytase Natuphos® E sets a new benchmark in the market, from which our partners in the feed industry can benefit.

NOVEL HYBRID TECHNOLOGY

Natuphos® E is a preparation of a bacterial-derived 6-phytase [EC 3.1.3.26] produced by our proven *Aspergillus niger* technology at BASF headquarters in Germany. This novel enzyme molecule is of bacterial origin and was created using a unique enzyme engineering method. A hybrid enzyme was created from three bacterial sources (Figure 1). The new technology results in unprecedented enzyme stability. It has been specifically designed to break down phytate and its complexes present in plant-based ingredients in pig and poultry diets at the required location in the gastrointestinal tract. Natuphos® E ensures a very fast and efficient release of phytate-bound phosphorous, which is of considerable value to the global feed industry.

STABILITY BOOSTS PERFORMANCE

Thanks to its hybrid enzyme-molecule, Natuphos® E provides exactly what users in the feed industry want. The new molecule demonstrates unprecedented overall stability in challenging environments – be it in the animal gut, in premixes, in feed or during pelleting processes. Natuphos® E is powerful at resisting pepsin, adverse pH-conditions and high temperatures. The excellent shelf life stability additionally contributes to the outstanding stability profile of Natuphos® E. This outstanding stability ensures an excellent performance.

**BASF – the phytase pioneer –
setting a new benchmark:**

- Novel hybrid 6-phytase of bacterial origin
- Unprecedented overall enzyme stability
- Outstanding economic and environmental benefits

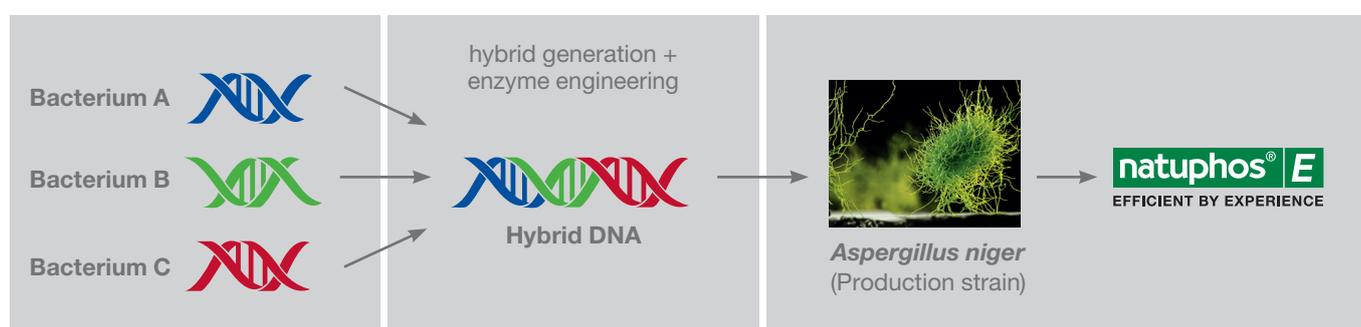
GOOD CHOICE FOR ECONOMY AND ENVIRONMENT

The efficient phosphorous release provides tangible benefits – for feed mixers, integrators as well as the environment. The unique feature of Natuphos® E – its exceptional stability based on the new molecule – is reflected in an optimal animal performance, considerable feed cost savings and an improved resource efficiency. The use of Natuphos® E also reduces the excretion of phosphorous with positive implications for the environment.

All these great attributes, which are built on our 25 years of phytase experience, are reflected in our Natuphos® E slogan: “Efficient by Experience”

natuphos® E
EFFICIENT BY EXPERIENCE

FIGURE 1: NOVEL HYBRID 6-PHYTASE



ADDITIONAL BENEFITS FOR OUR CUSTOMERS.

RELIABILITY IS PART OF OUR BUSINESS

Products by BASF Animal Nutrition are precisely developed and renowned for high quality and consistency. Our technical support and recommendations for the use of Natuphos® E are based on sound scientific evidence, technical know-how and close interaction with our customers. This contributes to the recognized reliability of our matrix values. Our high-quality phytase product Natuphos® E is complemented with services and our application expertise.

READILY MIXABLE WITH OTHER ENZYMES LIKE NATUGRAIN®

All Natuphos® E formulations can be readily mixed with non-starch polysaccharide (NSP) enzymes. The unique 3-in-1 combination products Natuphos® E 5000 Combi L and Natuphos® E 5000 Combi G are mixtures of Natuphos® E (hybrid 6-phytase) and Natugrain® TS (endo-1,4-xylanase and endo-1,4-beta-glucanase) and facilitate stock management and application by enabling you to use one additive instead of two at the inclusion level of only one.

LAST BUT NOT LEAST: THE BASF SERVICE PORTFOLIO

We offer our customers application expertise through our global and regional technical as well as business support teams. We can provide analysis of feed enzymes containing premix, base mix and compound feed samples in BASF enzyme laboratories.

We can also support with a quantitative and reliable enzyme assay; approved by the International Organization for Standardization (ISO) and the Association of German Agricultural Analytic and Research Institutes (VDLUFA).

Finally, our stringent end product monitoring ensures a consistent high product quality. We are a certified FAMI-QS supplier and comply with a comprehensive set of standards, including ISO 9001, ISO 14001, and ISO 5001.

UNIQUE VALUES OF NATUPHOS® E BENEFITING OUR CUSTOMERS

The benefits of Natuphos® E for users in the feed industry are numerous. Most importantly, they can save on the addition of inorganic phosphorous. We offer a product with a reliable performance because of its exceptional product stability. Natuphos® E has a superb product shelf life of 18 months for all formulations and grades, which demonstrates its exceptional intrinsic stability.

A long product shelf life provides flexibility in logistics and trust in product performance. Natuphos® E combines three exceptional values within one product:

- HIGHLY EFFICIENT PHOSPHOROUS RELEASE
- SUPERIOR PELLETING AND PREMIX STABILITY
- LONG-TERM SHELF LIFE STABILITY

INTELLIGENT CHOICE SEEKING PERFORMANCE

1. SUPERB RESISTANCE AGAINST DIGESTIVE ENZYMES IN THE ANIMAL GUT, AN OPTIMAL FIT TO pH CONDITIONS

Phytase-mediated phosphorous release mainly takes place in the upper digestive tract of pigs and poultry. Here, the physiological pH ranges from 2.0 to 5.5. Figure 2 clearly shows that the optimum activity of Natuphos® E matches this targeted pH range perfectly.

Natuphos® E shows superior resistance to pepsin, the main protein-degrading enzyme in the monogastric's stomach (Figure 3). Both features allow the highly efficient decomposition of anti-nutritive phytate already in the very beginning of the digestive tract and maximize the time available for the animal to absorb the nutrients that would otherwise remain bound to and complexed with phytate.

2. SUBSTANTIAL FEED COST SAVINGS BY MAXIMIZING DIGESTIBILITY AND ANIMAL PERFORMANCE

Natuphos® E maximizes the efficient release of dietary phosphorous from phytate, thus making it readily digestible for pigs and poultry.

The ability of Natuphos® E to maximize the release of phytate-bound minerals, amino acids, and its large improvement of feed energy value has been verified and quantified in many feeding trials in all relevant species with widely varying diets. The high potential for energy and nutrient replacement offers unrivalled potential for feed cost savings, while ensuring at least equal performance parameters compared to the non-Natuphos® E supplemented standard diets.

FOR MATRIX VALUES, PLEASE CONTACT YOUR LOCAL BASF SALES REPRESENTATIVE

FIGURE 2: pH PROFILE OF NATUPHOS® E

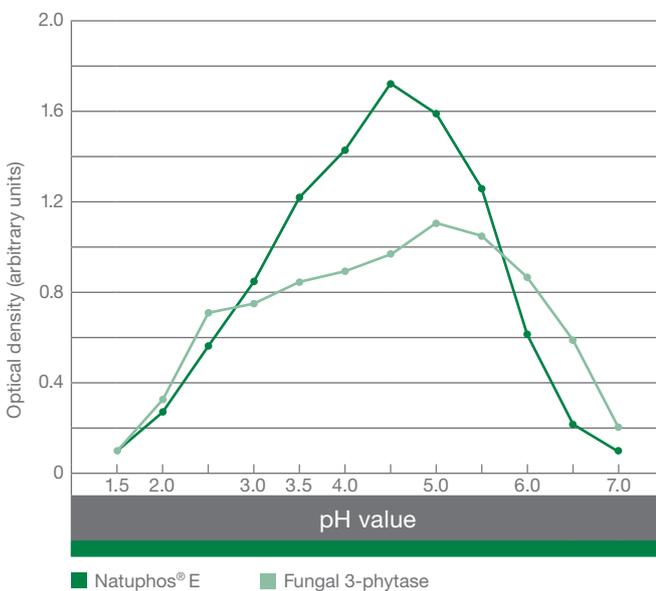
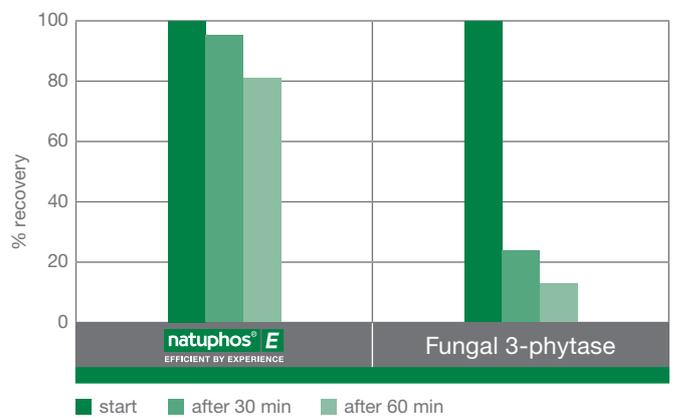


FIGURE 3: RESISTANCE OF NATUPHOS® E TO PEPSIN AT pH 2 IN VITRO



NATUPHOS® E ■ HIGHLY ACTIVE IN ACIDIC CONDITIONS ■ EXTRAORDINARY RESISTANCE TO PEPSIN



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3. SETTING NEW SUSTAINABILITY STANDARDS

Natuphos® E promotes the vital growth of animals and sets new standards for more sustainable livestock production. The use of our unrivalled phytase increases resource efficiency, minimizes environmental impacts, and reduces the required quantity of raw materials like minerals.

This is generated by an increase in the digestion efficiency of phosphorous. Lower or no supplementation of mineral phosphorous (depending on the diet) is needed to cover the requirement of the animals. The release of phosphorous, protein, amino acids, and energy, results in improved feed conversion and reduced phosphorous excretion. In this way Natuphos® E is a contribution to more sustainable production and proves the guiding principle of preserving and using resources efficiently.

RESOURCE EFFICIENCY



Less mineral phosphorous, protein, and amino acids needed as Natuphos® E improves digestion of phytate-bound phosphorous and other complexed nutrients in feed.



MINIMIZING ENVIRONMENTAL IMPACT

Reduced eutrophication by less excretion of phosphorous.



REDUCED DEPENDENCY ON MARKET PRICES

- Reduced dependency on inorganic phosphorous.
- Allows for the use of less costly by-products e.g. bran.



SUITABLE FORMULATIONS FOR ALL APPLICATIONS

Natuphos® E is available in powder, liquid, and granulate form. These formulations cover all usual areas of application. The actual product portfolio is shown in Table 1. Products with different activities may be available upon request. Especially to

be emphasized here, is the superb product shelf life of 18 months for all formulations and grades, reflecting the exceptional stability of Natuphos® E.

TABLE 1: NATUPHOS® E PRODUCT PORTFOLIO^{1 2 3}

PRODUCT ¹	FORM	ADDITIONAL INFORMATION	STANDARD PACKAGING	ARTICLE NO.
PHYTASE				
Natuphos® E 5000	Powder	Hybrid 6-phytase (5,000 FTU/g), recommended for non-pelleted feed and pelleting up to 80°C	20 kg bag in box	50411374
			350 kg big bag	50411378
Natuphos® E 10000	Powder	Hybrid 6-phytase (10,000 FTU/g), recommended for non-pelleted feed and pelleting up to 80°C	20 kg bag in box	50461879
Natuphos® E 50000	Powder	Hybrid-6-phytase (50,000 FTU/g), recommended for non-pelleted feed and pelleting up to 80°C	20 kg bag in box	50471892
Natuphos® E 5000 L	Liquid	Hybrid 6-phytase (5,000 FTU/g), recommended for post-pelleting applications	125 kg plastic drum	50366325
			1,000 kg bulk container	50366324
Natuphos® E 10000 L	Liquid	Hybrid 6-phytase (10,000 FTU/g), recommended for post-pelleting applications	500 kg bulk container	50364770
Natuphos® E 5000 G	Granulate	Hybrid 6-phytase (5,000 FTU/g), can be used up to 95°C pelleting temperature	20 kg bag in box	50430020
			350 kg big plastic bag	50428732
Natuphos® E 10000 G	Granulate	Hybrid 6-phytase (10,000 FTU/g), can be used up to 95°C pelleting temperature	20 kg bag in box	50428731
			350 kg big plastic bag	50428732
PHYTASE, XYLANASE, GLUCANASE				
Natuphos® E 5000 Combi L	Liquid	Hybrid 6-phytase (5,000 FTU/g), endo-1,4-beta-xylanase (5,600 TXU/g) and endo-1,4-beta-glucanase (2,500 TGU/g); recommended for post-pelleting applications	125 kg plastic drum	50425767
			1,000 kg bulk container	50425769
Natuphos® E 5000 Combi G	Granulate	Hybrid 6-phytase (5,000 FTU/g), endo-1,4-beta-xylanase (5,600 TXU/g), and endo-1,4-beta-glucanase (2,500 TGU/g), can be used up to 85°C pelleting temperature	20 kg bag in box	50470843

1 At pelleting temperatures above 90°C, it is recommended to test for phytase retention as pelleting conditions vary greatly.

2 The contents indicated are minimum amounts of active substance.

GMO status: Our products are not subject to labelling and traceability acc. to the European regulation (EC) 1829/2003 and (EC) 1830/2003.

BSE/TSE status: The above-mentioned products do not fall under the scope of the Regulation (EC) No 999/2001 (current consolidated version), laying down the rules for the prevention, control, and eradication of certain transmissible spongiform encephalopathies.

3 Product availability is subject to country-specific product registration.

ATIONS ONS.

GRANULATES: EXTRAORDINARY PELLETING STABILITY

Our Natuphos® E granulates are off-white in color, virtually dust-free with a narrow particle size distribution (Figure 4). A homogeneous distribution in feeding stuffs can be obtained using standard mixing procedures.

The granulate formulations exhibit a superior stability and are recommended for pelleted feed, up to pelleting temperatures of 95 °C (Figure 5). The hybrid 6-phytase enzyme molecule is protected by formulation using a highly sophisticated and IP-protected process, while uncompromising its release from pelleted feed in the animal.

In addition, the premix stability of Natuphos® E granulates in a typical broiler premix is excellent (Figure 6).

POWDERS: HIGH PELLETING AND PREMIX STABILITY

The free-flowing powders are beige to light brown in color. The uncoated powder formulations can be used for pelleting temperatures up to 80 °C, and are predominantly recommended for all mash feeds. The economically interesting formulation furthermore exhibits a good stability in base mixes and premixes (Figure 6).

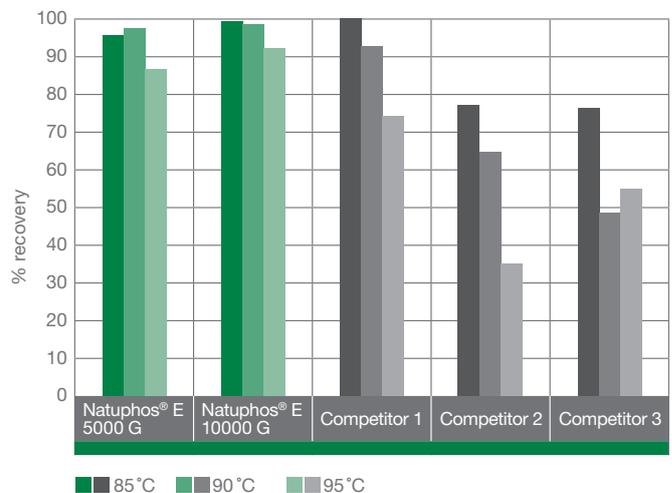
FIGURE 4: NATUPHOS® E GRANULATES ARE VIRTUALLY DUST-FREE AND HAVE A NARROW PARTICLE SIZE DISTRIBUTION



LIQUIDS: IDEAL FOR POST-PELLETING APPLICATION

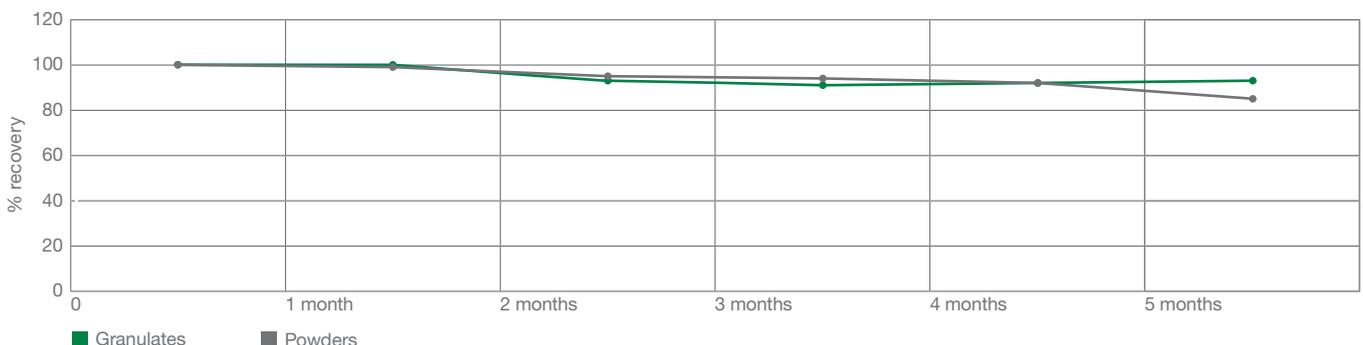
The liquid Natuphos® E formulations are light to medium brown, clear fluids without any turbidities or suspending particles. This ensures an optimal application by post-pelleting systems onto the cooled pellets since the outstanding product quality prevents nozzle blocking at the highest level possible. Over the last two decades, BASF has gained a vast experience in installing post-pellet liquid application (PPLA) systems. With appropriate equipment the liquid formulation of Natuphos® E is sprayed onto the cooled pellets. BASF can assist in sourcing these PPLA systems.

FIGURE 5: NATUPHOS® E GRANULATES EXHIBIT AN EXCELLENT PELLETING STABILITY



Conditions: corn/SBM-based broiler diet, 20s conditioning time, die holes: 40 mm x 3 mm, capacity: 600-650 kg/h

FIGURE 6: NATUPHOS® E GRANULATES AND POWDERS EXHIBIT AN EXCELLENT STABILITY IN BROILER PREMIX (STORAGE TEMPERATURE: 20 °C, N = 3)



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