



Animal bedding

Use of attapulgite for bio-protection in livestock buildings

Attapulgite, a rare magnesium aluminosilicate mineral with a great surface area (250 m²/g) and adsorption capacity (200% water by weight), has some remarkable applications in livestock farming, such as: (a) a feed material with antidiarrheal action and effective protection of intestinal microflora of productive animals from pathogens leading to an enhancement of digestive function and as (b) a bio-protection conditioner in livestock buildings for its ability to reduce bacterial count, moisture of litter and emissions of ammonia.

This article summarizes the bio-protection function of attapulgite for productive livestock buildings.

The company

Attapulgite has been discovered some centuries ago, in Attapulgis - Georgia of the United States of America and used to solve intestinal disorders and diarrheas in humans. The unique attapulgite deposit of Europe was discovered by Geohellas in 1998 in the region of Grevena (Northern Greece) and production started in 2004. Since then, Geohellas has developed more than 120 different products based on attapulgite, which are exported to more than 50 countries in the world, for applications such as: toxin binders and animal feed supplements, soil improvers, agrochemical carriers, pet litters, bleaching earths, industrial absorbents, molecular sieve binders and flow aids.

Actions of Attapulgite

Large surface area and hydration behavior

The large porosity and water absorption capacity of attapulgite can be exploited in agriculture (soil improvement), in animal feeding (antidiarrheal action and toxin binding), as well as in livestock farming (absorption of ammonia & humidity in buildings). The surface area of attapulgite is 250m²/g (if we open the surface of all pores, with only one gram of attapulgite, we can cover a surface of 250m²), that makes attapulgite the larger molecular "sponge" in comparison to other minerals such as zeolite, having a surface area of only 40 m²/g. This property is directly connected to the water absorption capability of the two minerals, e.g. for attapulgite 130% for the coarser and 200% for the finer particle sizes, while for the zeolite only 35 – 40% absorption. In the same way, through the porous structure of attapulgite, the absorption of ammonia takes place (figure 1).

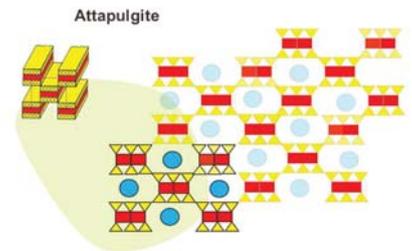


Figure 1: Microscopic structure of attapulgite forming a honeycomb pattern that receives the molecules (blue spheres) of water or ammonia (light blue spheres) in its pores.





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Use in broilers' buildings

In trials conducted in France and in Greece (Ross breed), attapulgite (brand AXORB®) used in granular form (diameter of particles 0.25 – 1.18 mm) was placed on top of the straw (figure 2) or sawdust and due to its large surface area and porous structure, it reduced the humidity of the litter by 3 – 5% (according to the case), with a consequent reduction of microbial load and ammonia in the buildings by 30 – 50% versus control, thus improving the hygiene and leading to enhanced production characteristics of broilers such as the F.C.R. (see Tables 1 and 2). The tests 1-5 (Table 1 & 2) refer to farms in Brittany-France with building surface of 2,000-3,000 m² each and corresponding number of broilers placed from 30.000 to 45.000. Attapulgite (AXORB®), having a water absorption capacity of about 150%, was added with a fertilizer spreader, before placing the birds, at a dosage of 1 Kg/m² as shown in figure 2. Later on, on day 20 of the breeding cycle, attapulgite (AXORB®) was added manually (with scoop) at additional 0.35 Kg/m².

In similar buildings - Greek trials at Kolchiko - Northern Greece (Table 2 - trial 6) and Pisonas – Evia (Table 2 – trial 7), attapulgite was added in presence of birds on the 14th day and later on the 30th day, with a total addition of 1.5 kg/m²/breed on sawdust, having a thickness of 5-7 cm. This amount of attapulgite dries the litter and consequently minimizes the breast blisters because of the reduced microbial load and the hock burns due to reduced release of ammonia.



Figure 2: Application of attapulgite (AXORB®) with fertilizer spreader on the straw, in broilers' buildings in France.

Breeding of Broiler on various substrates	Trial 1		Trial 2		Trial 3		Trial 4	
	Control	AXORB®	Control	AXORB®	Control	AXORB®	Control	AXORB®
Days of breeding	37.3	38.47	34	33	41	40	33	34
Final Body Weight (Kg)	1.88	2.04	1.394	1.364	2.088	2.057	1.375	1.355
DWG [g]	50.32	53.13	41.1	41.3	50.9	51.4	41.6	39.8
FCR	1.83	1.80	1.888	1.802	1.870	1.880	1.761	1.682

Table 1: Application of attapulgite (AXORB®) with fertilizer spreader on the straw, in broilers' buildings in France.





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Breeding of Broiler on various substrates	Trial 5		Trial 6		Trial 7	
	Control	AXORB®	Control	AXORB®	Control	AXORB®
Days of breeding	40	41	44	39.85	43	42
Final Body Weight (Kg)	2.060	2.131	2.681	2.549	2.300	2.285
DWG (g)	51.5	52.3	60.9	63.9	52.1	54.4
FCR	1.971	1.970	2.00	1.81	2.00	1.79

Table 2: Productive characteristics of broilers on various substrates in France and in Greece by using attapulgite (AXORB®) on the floors, in comparison with control.

It has been observed almost in most farms (5 farms out of 7) that with the use of AXORB® we have a better F.C.R., that seems to be directly related to hygiene and health in the buildings (reduced humidity and ammonia). Respectively, in 2 out of the 7 farms no significant differences in the F.C.R were observed.

Mixed attapulgite /saponite minerals of Geohellas, such as AXORB® A/S with particle size of 0.25 – 0.85 mm, exhibited a water absorption of up to 400%, while saponite, belonging to the family of bentonites, has a different crystal structure than attapulgite and absorbs water through clumping. Attapulgite, because of its special structure, binds water through its internal porosity, without becoming muddy and without creating clumping aggregates as other bentonite minerals do, while the big difference in its water absorption (150%) in comparison to zeolite (40%) makes it very useful in such applications.

Respectively, the levels of ammonia in livestock buildings in Megara (Attica-Greece) were reduced from 60 – 80 ppm (controls) to 10 –15 ppm, when the addition of attapulgite (AXORB® A/S) 1.5 kg/m² was directly on the concrete floor and before introducing a rice cortex substrate. This means that attapulgite/saponite, when wetted, forms a solid crust under the rice cortex and traps the released ammonia.



Figure 3: Recording of ammonia in livestock that uses attapulgite in the feed.



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Furthermore, in trials conducted by the Technological Educational Institute of Epirus in commercial broiler farms in Arta using attapulgitite in feed (at a percentage of 0.3% or 3 kg per ton of feed), continuous recordings on environmental conditions in the buildings were made, including the recording of ammonia as shown in figure 3, which demonstrated that attapulgitite, when present in feed, binds ammonium resulting from the degradation of proteins in the digestive system, contributing significantly at the reduction of ammonia in the buildings with values corresponding to those mentioned above.

Special applications in horses

In special applications for racing horses, AXORB® was applied on the stables' concrete floors (Figure 4 / Olympic Hippodrome of Spata-Greece) before the addition of sawdust to 1/3 of the surface, with the objective of reducing ammonia release and lowering microbial levels on the floor due to reduced moisture. The quantity of AXORB® used was 2 Kg/m².

Special AXORB® Eucalyptus enriched with Eucalyptus essential oils, provides freshness in the air inside the box.

Use of attapulgite in pigs

Attapulgitite can be spread on the surface of the body of piglets (brand AXORB®-F, micronized attapulgitite containing silver ions with antimicrobial function) at first day after birth in a similar way to talcum, in order to absorb the birth liquids and to stop bleeding and sterilize the navel of the piglet.

The thin layer of attapulgitite pasted on the body of the piglet helps with body heat retention on the first day of birth.

AXORB®-F is also used on the floor of the piglets for reducing humidity and microbial load (up to day 28 after birth/figure 5).

AXORB®-F is also used in fattening pigs, prolonging the cleaning time of the floors, as it keeps the concrete floor drier.



Figure 4: Using attapulgitite (AXORB®) as substrate in horses boxes before placing the sawdust.





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A comparative study on the reduction of polluting gases and ammonia using attapulgite in feed of fattening pigs, was held by the Technological Educational Institute of Epirus in cooperation with the Veterinary School of Aristotle University (AUTH) and the Agricultural University of Athens (AUA) (Skoufos et al., "A comparative study of the reduction of gas emissions from fattening pigs with the dietary use of attapulgite and benzoic acid", 5th Pan-Hellenic Congress in Technology of Animal Production, 30 January 2015, Thessaloniki, Greece, S93-S94). A total of 576 fattening pigs divided into six groups (in a commercial farm of Philippiada) showed that administrating attapulgite in dosage of 4 Kg/MT of feed, decreases the concentrations of ammonia in the buildings from 18.1 ppm to 12.6 ppm, corresponding to a decrease of 30.3%, while in relevant experiments with zeolite from Slovakia in the literature (Milic et al., in "The performance of natural zeolite as a feed additive in reducing aerial ammonia and slurry ammonium ion concentration in the pig farm nursery" Folia Veterinaria, 49,3, S23-S25, 2005), adding zeolite at the pig's feed in a ratio of 2% e.g. 20Kg/MT of feed (i.e. five times larger amount of zeolite used per ton of feed compared to attapulgite), reduces the emissions of ammonia by 33%. This value confirms the five times higher absorption of attapulgite which is directly linked to the structural characteristics of the two materials (almost five times higher specific surface area of attapulgite versus zeolite).

In ruminants

AXORB® is used on the floors of dairy animal buildings for the same reasons which were mentioned above in dosages and renewal times, depending on the type of ruminant and usual practices. Here, an important reason of using AXORB® is the bacterial contamination of sheep's nails, as well as the reduction of the bacterial count in milk producing animals. The dactylic dermatitis (hobble of sheep) is an infection that appears between the hooves of the sheep and is owed to *Fusiformis nodosus* bacterium. The dactylic dermatitis is caused by increased humidity of the floor and the bedding conditions, with elevated occurrences in autumn and winter.

The pododermatitis is due to *Fusobakterium necrophorum* bacterium that very often is present in cow manure. Particular attention should be paid to farm buildings in relation to the microbial status in drinkers and areas where moisture is generated and where there should be an enhanced presence of attapulgite (Figure 6 on goats).



Figure 5: Suckling piglets on attapulgite substrate.



Figure 6: Using attapulgite as substrate floors in dairy cows and goats.



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The environmental nuisance which arises from the residential problem of expanding settlements in rural areas that include multiple farms, as the case of establishments of fur animals (mink) in the region of Kozani and Siatista-Northern Greece, is leading to the usage of attapulgite to condition the accumulated manure under the cages and at the special locations of permanent disposal. The percentage of AXORB® that was added per unit volume to treat the produced slurry effluent was 1.5% (15 Kg/m³).

News

New products of Geohellas for drying and disinfection: AXORB® P, AXORB® PVX and new product application methods, that are minimizing the quantities used while maximizing the efficacy, will be soon presented.

For more information about Geohellas and our product range, please contact sales@geohellas.com or call +30 210 94 90 100.

