

# Bioprotection in livestock buildings



**AXORB<sup>®</sup>**

# Group of Companies



Geohellas SA, is a member of the Constantakopoulos group of companies.

- Costamare Shipping CO. S.A.
- T.E.MES SA. (CostaNavarino)
- Faliro House Productions SA
- Geohellas SA



## A unique source of Attapulgite in Europe

- Geohellas SA, developed the unique Attapulgite deposits in Europe discovered in Northern-Greece.
- The factory has a yearly production capacity of 160.000 MT.
- 350 final products in 11 applications/ exports in 5 continents and > 50 countries.



# Clientele

Operations and sales commenced in late 2004 giving primary emphasis on technical products.

Today Geohellas products are successfully employed in major multi-national and independent companies, in :

Western and Eastern Europe,

greater Mediterranean area,

Middle East,

Far East & Asia,

Canada, USA,

Central & South America.

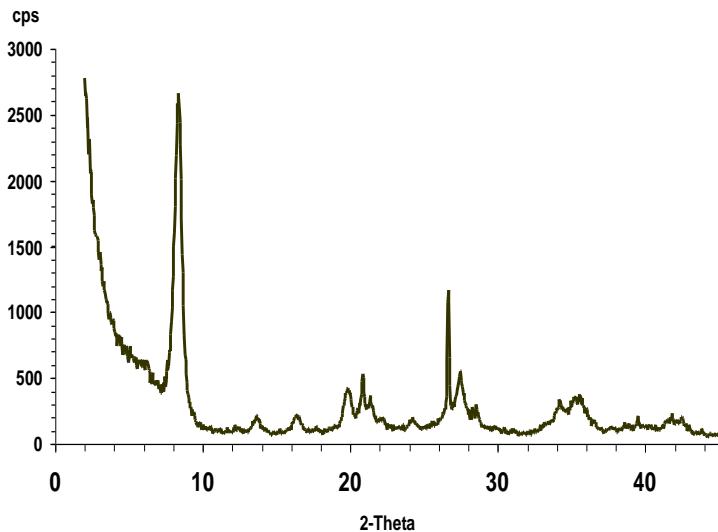
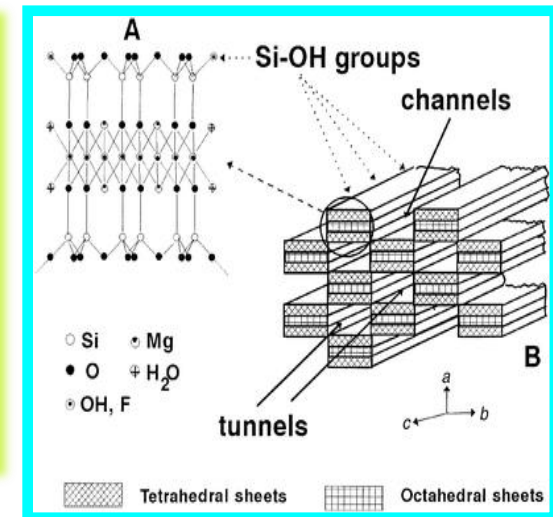


# Applications & Products

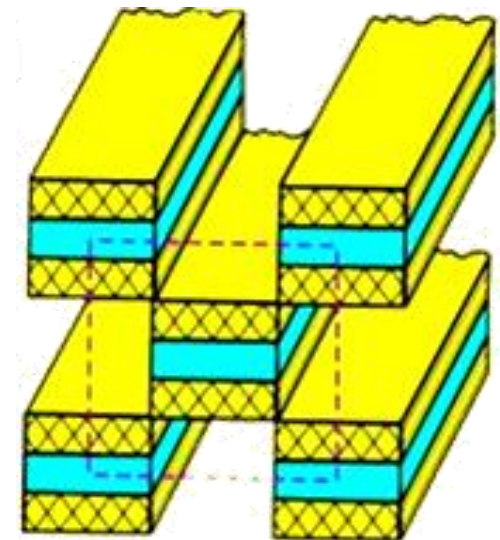
- Geohellas serves clients in several sectors with products that include:
  - ✓ soil improvers
  - ✓ agrochemical carriers,
  - ✓ bleaching earths used in the refining of edible oils and paraffins,
  - ✓ cat litter (high quality traditional lightweight as well as premium quality clumping),
  - ✓ complementary feeds & toxin binders for productive animals,
  - ✓ bedding conditioners for animal farming,
  - ✓ construction materials additives,
  - ✓ free flow and anti caking additives,
  - ✓ gelling/suspension aids,
  - ✓ industrial absorbents,
  - ✓ binders in molecular sieves/synthetic zeolites,
  - ✓ technical products for environmental applications and others.

# Attapulgite - Palygorskite

- 2-D channel-type structure
- High specific surface area 350 m<sup>2</sup>/g
- High water absorption > 200 %
- Micro / Meso / Macroporosity
- Increased absorption of organic compounds (toxins) when mechanically / thermally activated



SiO <sub>2</sub>	56,00
MgO	15,05
Al <sub>2</sub> O <sub>3</sub>	4,97
Fe <sub>2</sub> O <sub>3</sub>	10,60
CaO	0,33
Na <sub>2</sub> O	0,06
K <sub>2</sub> O	0,30
(%) Loss on Ignition	10,95



# COMPARISON OF ATTAPULGITE WITH OTHER FEED ADDITIVES

Product	Type	Form	Water Binding	Pelleting Aid	Diarrhea Prevention	Intestine Retardant	Free Flowing Agent	Toxin Control	Odor Control
Bentonite	Absorben	P	++++	++	+++	++	+	++	+
Diatom. Earth	Diamol	P/G	++	++	++	++	+++	++	+
Kaolinite	KAS	P	+	++	++	++	-	-	-
Leonardite	HH40	P	+/-	++	++	++	-	++++	++
Sepiolite	60-100 mesh < 100 mesh	G	++	++	++	++	+++	-	+
		P	+++	+++	+++	+++	+	-	+
Attapulgite	60-100mesh > 100mesh	G	++	++	++	++	+++	++	+
		P	+++	+++	++++	+++	+	++++	+++
Silica	Amorphous	P	+++++	-	-	++	++++	-	-
Zeolite	Clinoptilolite	P/G	+	+	+	+	-	++	++

+++++ Excellent  
 ++++ Very good  
 +++ Good  
 ++ Sufficient  
 + Positive effect    - No positive effect  
 G Granular  
 P Powder

# Attapulgite Unique EU Deposits

## Grevena-Greece





Geohellas SA production site in Greece





Mechanical Activation of Attapulgite

## Mechanical Activation – Enhancing Hydrophilicity (anti-diarrhea effect)



# Thermal Activation of Attapulgite - enhancing toxin binding selectivity & efficiency



## Production of granular products



# AXORB®

## General characteristics:

- ✓ Non clumping function
- ✓ High water absorption
- ✓ Fast neutralizing of ammonia and volatile compounds
- ✓ Reduction of the microbial load of the litter
- ✓ Improvement of environmental conditions in the animal buildings
- ✓ Protection against bacterial infections (e.g. pododermatitis)
- ✓ Provides cleaner and healthier skin surface
- ✓ Removal of odors
- ✓ Faster healing of the navel area and protection from dermal infections for newborn piglets



# AXORB F<sup>®</sup> WILLOW - (EU patent EP11155396.2)

Unique odor trap

**NEW**  
**Advanced Freshness**



(11) **EP 2 489 269 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:  
**12.10.2016 Bulletin 2016/41**

(51) Int Cl.:  
**A01N 59/16** (2006.01) **A01N 25/08** (2006.01)  
**A01K 1/015** (2006.01) **A01P 1/00** (2006.01)

(21) Application number: **11155396.2**

(22) Date of filing: **22.02.2011**

(54) **Composition comprising a biocidal composite**

Zusammensetzung mit einem bioziden Verbundstoff

Composition comportant un composite biocide

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(30) Priority: **21.02.2011 GR 2011100101**

(43) Date of publication of application:  
**22.08.2012 Bulletin 2012/34**

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- **JUDIT MÉNESI ET AL:** "The Effect of Transition Metal Doping on the Photooxidation Process of Titania-Clay Composites", **INTERNATIONAL JOURNAL OF PHOTOENERGY**, vol. 2008, 1 January 2008 (2008-01-01), pages 1-9, XP55025376, ISSN: 1110-662X, DOI: 10.1155/2008/846304
- **K. D. BRUNT ET AL:** "A Group of More Friendly Biocides", **SURFACE COATINGS INTERNATIONAL PART B: COATINGS TRANSACTIONS**, 30 November 1997 (1997-11-30), pages 473-475, XP55025363, DOI: 10.1007/BF02692718
- **ANONYMOUS:** 'JMAC Silver Biocide', [Online] 24 July 2008, XP055071741 Retrieved from the Internet:  
<URL:<http://www.chemlink.co.uk/jmacbrochure1107.pdf>> [retrieved on 2013-07-17] & [Online] 17 July 2013, XP055071764 Retrieved from the Internet:  
<URL:<http://web.archive.org/web/http://www.chemlink.co.uk/jmacbrochure1107.pdf>>

# AXORB F<sup>®</sup> WILLOW - (EU patent EP11155396.2)

Unique odor trap

## Benefits

- Axorb F<sup>®</sup> – Willow combines the effectiveness of attapulgite in binding water & therefore inhibit the bacteria formation.
- Axorb F<sup>®</sup> – Willow eliminates common bacteria including *Escherichia coli*, *Klebsiella pneumoniae*, *Salmonella enteritidis*, and *Staphylococcus aureus* (99,9% elimination rates)

**Table:** Percent Reduction in Colony Forming Unit (CFU) from initial population for *E. Coli* and Methycillin Resistant *Staphylococcus aureus* (MRSA)

	MRSA		<i>E. Coli</i>	
Sample	24h	72h	24h	72h
AXORB – F <sup>®</sup> Willow	>99.88	>99.88	>99.87	>99.88

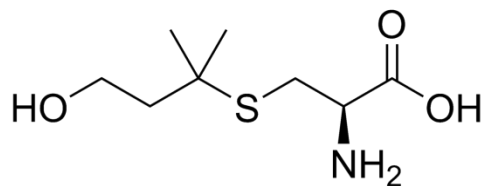
Tests conducted by IMSL, Industrial Microbiological Services Ltd UK .



# Elimination of odors

## Odour Attack - Willow aroma

- Axorb F Willow Odor Attack contains a *new Advanced Science™ formula* for *targeted odor elimination*
- The technologically advanced Willow fragrance in Axorb F Willow consists of *odor-fighting molecules* that target the very source of fecal and urine components, offering immediate and lasting deodorization
- Chemistry based approach to malodor control – targets N (nitrogen in amines-urine) and S (sulfur in feces) molecules



Felinine (cat pheromone) chemical structure  
(amino-acid found in cat urine)



# Quantity applied (g / m<sup>2</sup>) per animal specie

- **Dairy cows & Cattle:** 200 gr / m<sup>2</sup>, 2 times per week
- **Goat – Sheep:** 150 gr / m<sup>2</sup>, 2 times per week
- **Broilers:** 100 gr / m<sup>2</sup>, 1 time per week
- **Turkeys:** 100 gr / m<sup>2</sup>, 1 time per week
- **Pigs:**
  - Sows: 100 gr / m<sup>2</sup>, per day
  - Weaners: 100 gr / m<sup>2</sup>, per day
  - Growers: 100 gr / m<sup>2</sup>, per day
  - Fatteners: 100 gr / m<sup>2</sup>, per day
- **Horses:** 150 gr / m<sup>2</sup>, 2 times per week



# AXORB®

## Directions for use

1. Hand
2. Vink spreader
3. Fertilizer spreader
4. Garden blower
5. Bedding machine








Where to apply:

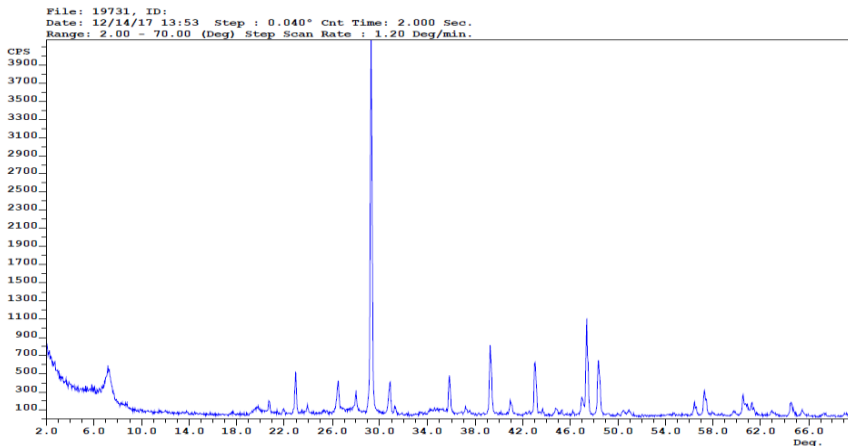


## 1. Composition

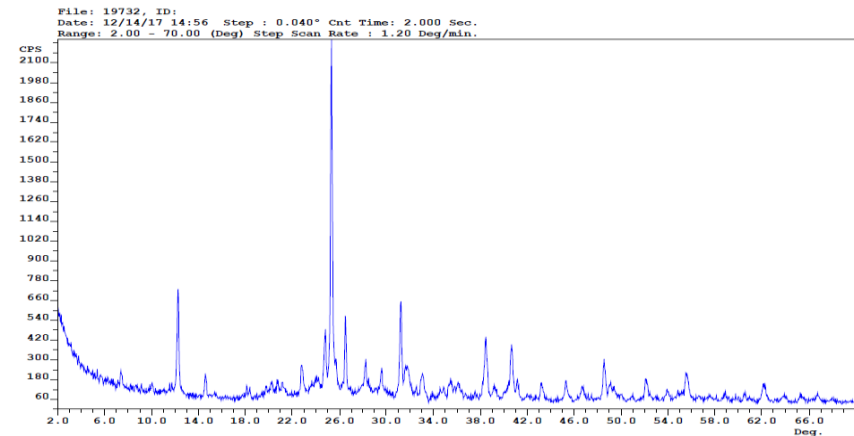
Axorb – F Willow Versus other commercial products

Product	Qualitative characterization
 GEOHELLAS - AXORB – F Willow / PVX	<b>100 % Greek Attapulгите</b>
 Product A	Calcite with traces of activated bentonite
 Product B	Mostly anhydride ( $\text{CaSO}_4$ )

XRD @ Product A

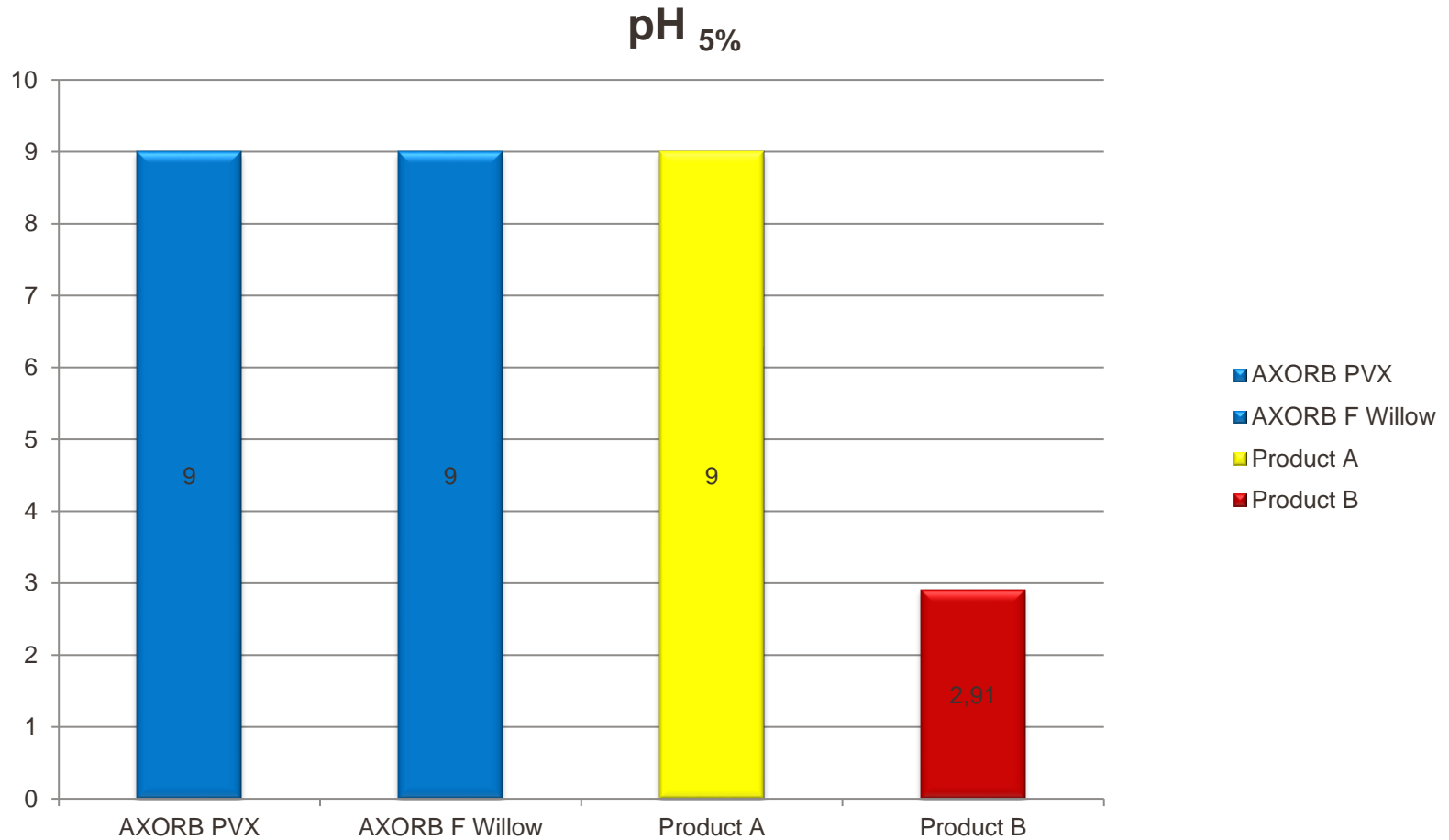


XRD @ Product B

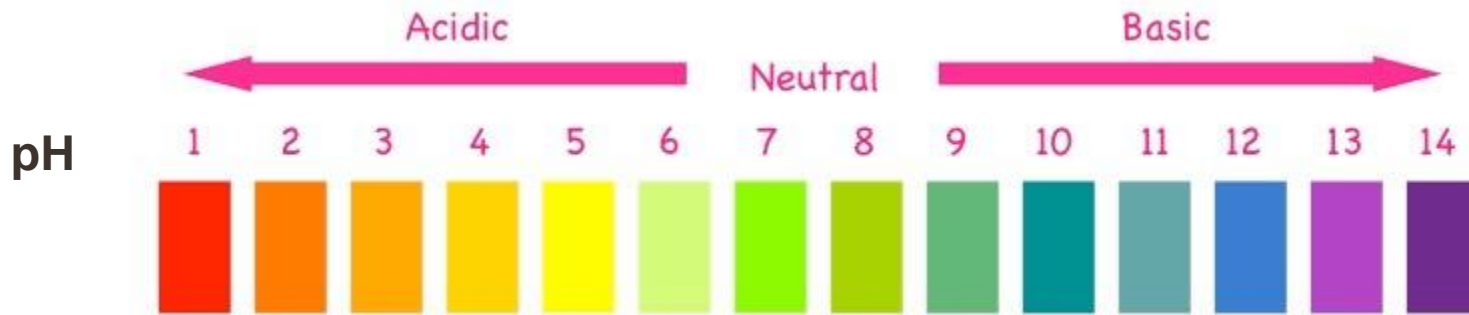


## 2. pH Value

Axorb – F Willow Versus other commercial products

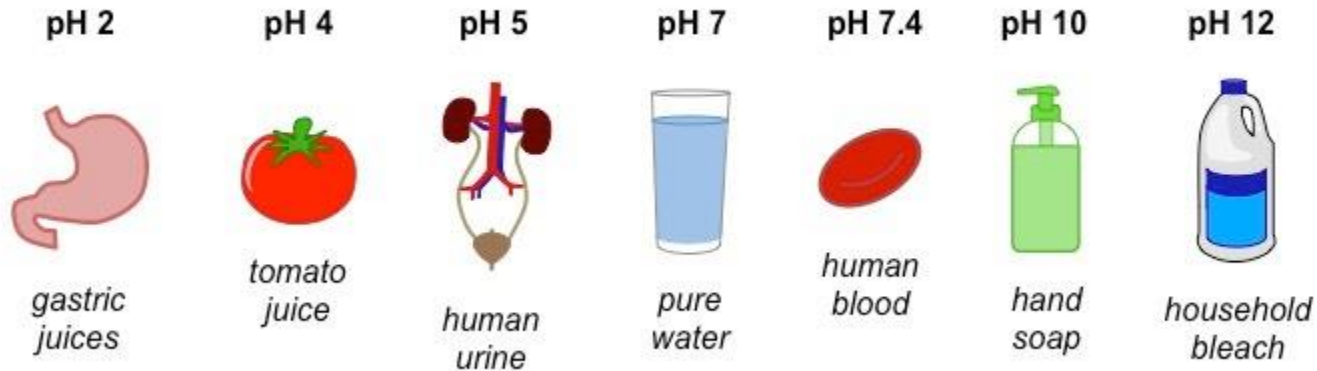


# AXORB®



## AXORB®

### Examples of pH Conditions:



sites.google.com



## pH : Would you use a product with a pH of 3 ?

pH 3 = gastric acid, hydrochloric acid, nitric acid, orthophosphoric acid, citric acid, hydrofluoric acid, nitrous acid, lactic acid, acetic acid ...

- ⊘ Chemical burns to the skin of the animals along with their feet.
- ⊘ Chemical burns to the skin of the workers and their eyes.
- ⊘ Respiratory problems for the animals and the workers. Using a protective mask when applying a product with pH=3 is of high importance for your health and your safety.
- ⊘ High corrosion of the metal parts of the building and the nearby machines that are having metal parts and accessories.
- ✓ Eliminates every possible microorganism.



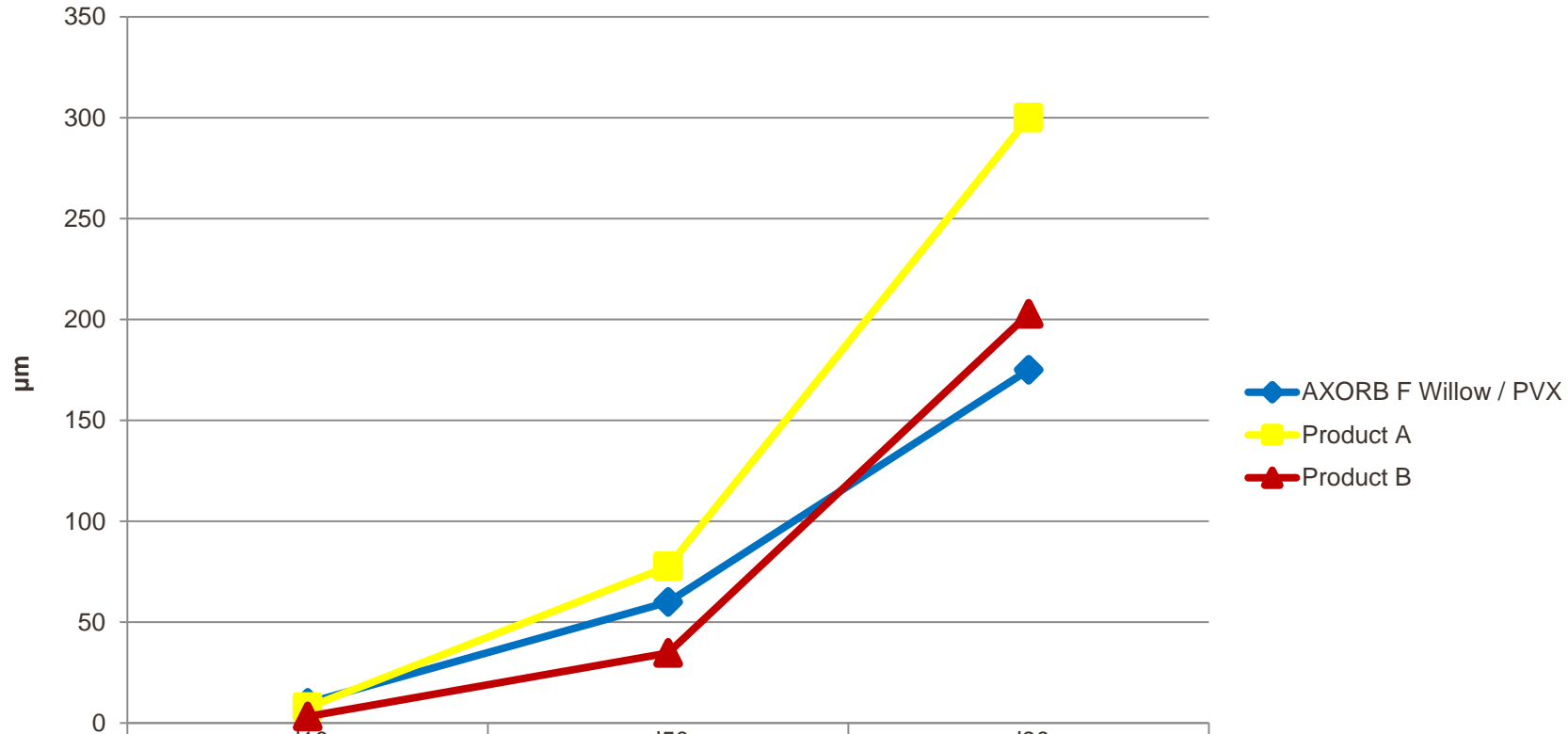
## **pH : Why would you choose to use an alkaline product ?**

pH 7 - 10 = blood, tap water, sea water, hand soap, eggs, toothpaste, mild detergent ...

- ✓ Safe for the skin of the animals and their feet
- ✓ Safe for the skin of the workers
- ✓ No respiratory problems as many everyday products that we use have an alkaline pH
- ✓ No corrosion of the metal parts of the building and the nearby machines that are having metal parts and accessories.

## 3. Particle Size Distribution

Axorb – F Willow Versus other commercial products



	d10	d50	d90
AXORB F Willow / PVX	10	60	175
Product A	7,8	77,6	299,9
Product B	3,3	34,7	202,8

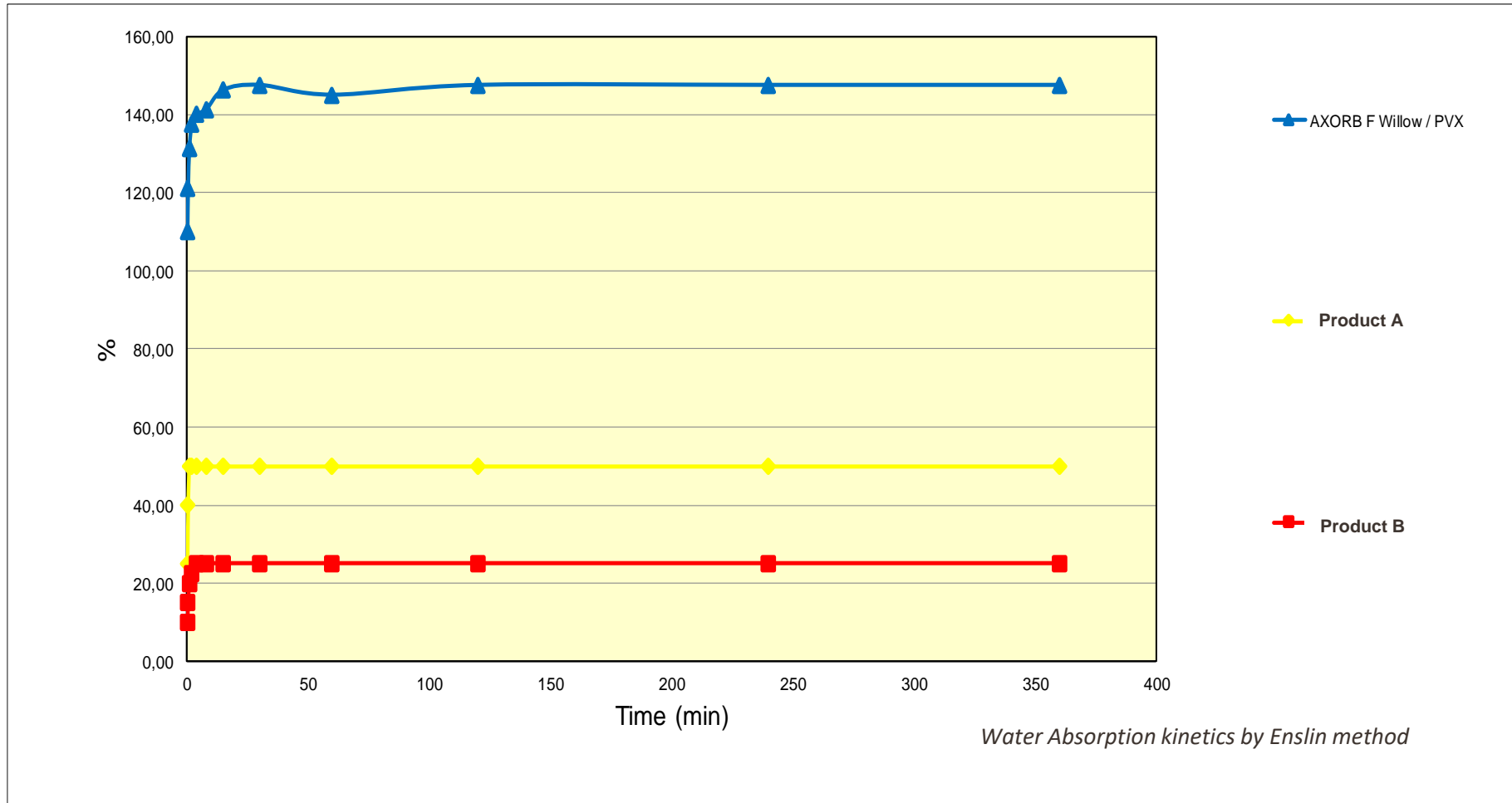


Particle Size Distribution : What does this mean in real time conditions ?

- **Higher water absorption, ammonia and volatile compounds – Minimal usage of product per use.**
- **Even distribution in the buildings and lower consumption if used with garden blower.**
- **Easier application for the product.**
- **Fast creation of a thin layer of the product over the needed surfaces with no limitation of the spreader machine of choice**

## 4. Water Absorption

Axorb – F Willow Versus other commercial products





Water Absorption : What does this mean in real time conditions ?

- **High water absorption thus lower moisture over the litter**
- **Less product is needed for better results**
- **Less changes of the bedding materials**
- **Ammonia naturally is a gas but when it occurs through urine, is hydrated with water. Higher the water absorption equals lower ammonia emissions in the farm.**
- **Lower the moisture of the litter equals lower CFU of the microorganisms on the litter.**



## 5.1 In Vivo Testing

### Broiler Buildings

**Location:** France and in Greece (Ross breed)

**Product:** AXORB (granular form with diameter of particles 0.25 – 1.18 mm), placed on top of the straw or sawdust.

### Results:

- ✓ Reduced the humidity of the litter by 3 – 5% (according to the case),
- ✓ 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

**Table 1: Application of attapulгите (AXORB®) with fertilizer spreader on the straw, in broilers building in France.**

Breeding of Broiler on various substrates	Trial 1		Trial 2		Trial 3		Trial 4		Trial 5	
	Control	AXORB®	Control	AXORB®	Control	AXORB®	Control	AXORB®	Control	AXORB®
Days of breeding	37.3	38.47	34	33	41	40	33	34	40	41
Final Body Weight (kg)	1.88	2.04	1.394	1.364	2.088	2.057	1.375	1.355	2.060	2.131
DWG (g)	50.32	53.13	41.1	41.3	50.9	51.4	41.6	39.8	51.5	52.3
FCR	1.83	1.80	1.888	1.802	1.870	1.880	1.761	1.682	1.971	1.970

- The Table 1 (Trials 1 - 5 ) Brittany-France :

Building surface of 2,000-3,000 m<sup>2</sup> , broiler number from 30.000 to 45.000.

Attapulгите added with a fertilizer spreader, before placing the birds, at a dosage of 1 kg/m<sup>2</sup>.

Day 20 of the breeding cycle: attapulгите (AXORB®) added manually (with scoop) at additional 0.35 kg/m<sup>2</sup>.

- Greek trials at Kolchiko - Northern (Table 2, trial 6) and Pisonas – Evia (Table 2 - trial 7) :

Attapulгите added in presence of birds on the 14th day and later on the 30th day with 1.5 kg/m<sup>2</sup>/breed on sawdust, having a thickness of 5-7 cm.

This amount of attapulгите 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.



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

Breeding of Broiler on various substrates	Trial 6		Trial 7	
	Control	AXORB®	Control	AXORB®
Days of breeding	44	39.85	43	42
Final Body Weight (kg)	2.681	2.549	2.300	2.285
DWG (g)	60.9	63.9	52.1	54.4
FCR	2.00	1.81	2.00	1.79

## Discussion

(5 farms out of 7) 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.

## 5.2 In Vivo Testing

### Ammonia Reduction

**Location:** Greece (Technological Educational Institute of Epirus in cooperation with the Veterinary School of Aristotle University and the Agricultural University of Athens).

**Product:** Attapulгите in feed

### Results

- ✓ Decreases the concentrations of ammonia in the buildings from 18.1 ppm to 12.6 ppm, corresponding to a **decrease of 30.3%**



## Ammonia Reduction

**Location:** Greece (Technological Educational Institute of Epirus in cooperation with the Veterinary School of Aristotle University and the Agricultural University of Athens).

**Product:** Attapulgite in feed

A total of 576 fattening pigs divided into six groups (in a commercial farm of Philippiada) showed that administering 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%.

*(Skoufos et al., "A comparative study of the reduction of gas emissions from fattening pigs with the dietary use of attapulgite and benzoic acid", 5<sup>th</sup> Pan-Hellenic Congress in Technology of Animal Production, 30 January 2015, Thessaloniki, Greece, S93-S94).*

# Article about AXORB F WILLOW application in pigs' farm in France

50 TERRAIN

TESTÉ POUR VOUS

L'Axorb®-F Willow ne serait abrasif, ni pour les animaux ni pour les utilisateurs.



#### CARACTÉRISTIQUES

##### AXORB®-F WILLOW

> Asséchant composé d'attapulгите, d'ions d'argent et d'huile essentielle de saule

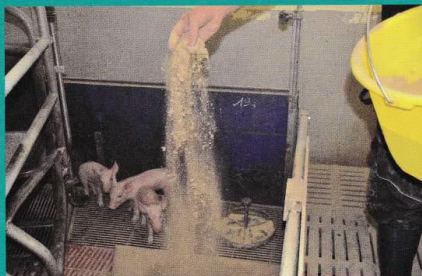
> Prix éleveur: 9-9,5 € HT/sac selon la quantité

> Conditionnement: sac de 25 kg sur palette (40 sacs/palette)

> Durée de conservation: trois ans

> Fabricant et distributeur: Geohellas.

A noter: un distributeur français serait en cours de nomination



Cet asséchant posséderait des propriétés assainissantes grâce aux ions d'argent qu'il contient.

## POUR UNE AMBIANCE ASSÉCHÉE ET ASSAINIE

**Hygiène /** En plus de sa forte capacité d'absorption d'eau permise par de l'argile attapulгите, l'Axorb®-F Willow, un asséchant développé par Geohellas, permettrait d'assainir l'environnement des animaux en combinant celle-ci à des ions argent et de l'huile essentielle de saule.



Nicolas Theophilou, directeur commercial et développement chez Geohellas

Un environnement sec et propre. N'est-ce pas la finalité d'un asséchant ? Pour Nicolas Theophilou, directeur commercial et développement de l'entreprise grecque Geohellas, cela ne fait aucun doute. Celui-ci précise même qu'il doit permettre « une amélioration globale de l'ambiance et du confort des animaux dans les bâtiments d'élevage, réduction des odeurs comprise ». Prenant en compte

ces objectifs, l'entreprise a développé l'Axorb®-F Willow, un asséchant composé de trois éléments clés, à savoir de l'argile attapulгите, des ions d'argent et de l'huile essentielle de saule (willow signifie saule en anglais). Le produit a été présenté en France à l'occasion du Space 2019. « L'Axorb®-F Willow associe la forte capacité d'absorption d'eau de l'attapulгите (150 %) avec une technologie brevetée

par Geohellas utilisant des ions d'argent aux effets antibactériens combinée à de l'huile essentielle de saule, véritable capteur d'odeurs », explique Nicolas Theophilou. L'attapulгите incorporée dans cet asséchant provient de carrières naturelles, propriétés de l'entreprise en Grèce. Avant d'être incorporé au produit, cet aluminosilicate de magnésium reçoit un traitement tribomécanique et de délamination dans le but d'améliorer ses propriétés

d'absorption. Pour compléter l'intérêt de l'utilisation de cette argile, Nicolas Theophilou ne manque pas de rappeler qu'elle est également employée comme additif en alimentation animale pour favoriser le bien-être intestinal des porcelets.

#### CHARGE MICROBIENNE RÉDUITE

Par ailleurs, la charge bactérienne de l'environnement étant, de fait, diminuée par

la réduction de l'humidité ambiante, les ions d'argent viendraient ainsi appuyer l'effet assainissant mis en avant par l'entreprise. « Dans la littérature, il est admis que les ions argent agissent comme agents antibactériens contre les bactéries à Gram + et Gram -. Des tests ont validé l'efficacité de l'Axorb®-F Willow contre les bactéries E. coli et Staphylococcus aureus résistant à la méthycilline [NDLR : % de réduction de l'Unité Formant Colonie (UFC) par rapport à la population initiale] > à 99,8, par rapport à la population bactérienne initiale », détaille le directeur commercial.

Ce produit peut aussi bien être utilisé sur caillebotis comme

sur litière, pour assécher les porcelets à la naissance ou encore pour assurer des sols secs et ce, à chaque stade physiologique. Applicable à la main ou pulvérisé mécaniquement, il se présente, sans surprise, en poudre dont la taille des particules se situe entre 8,7 et 367 µm (50 % d'entre elles se situent autour de 132 µm). Pour terminer, Nicolas Theophilou précise que le pH du produit est situé entre 8 et 9, donc légèrement neutre à basique. « Il n'est donc pas ou peu abrasif pour les utilisateurs ». ■ C.W.

Février 2020 / n° 549 / Porcma

Mr. Luc Girard has been using AXORB products since 2019.

- Axorb®-F Willow creates dry and clean environment for the animals
- Use in all stages:
  - Before farrowing and in the newborn piglets to reduce moisture and to treat diarrheas
  - Also in gilts and sows to decrease foot problems
  - Weaning 1 and 2, growing and fattening
- Arthritis problems tend to decrease in breeding

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**AVIS D'ÉLEVEUR** →

**Luc Girard,**  
responsable d'élevage  
de la Scea du Rivault,  
NE 1 100 truies installé  
à Bouresse (86)



« UNE MAÎTRISE DE L'HYGIÈNE CONFORTÉE »

Étant donné que nous produisons des porcs sans antibiotiques dès la naissance, une bonne maîtrise des conditions d'élevage et notamment de l'hygiène est primordiale. L'asséchant Axorb®-F Willow contribue à maintenir un environnement sec et propre pour nos animaux. Nous l'utilisons depuis septembre 2019. En plus de répandre deux poignées de cet asséchant sur les plaques chauffantes avant les mises bas, nous séchons individuellement les porcelets tout juste nés avec. Nous le distribuons aussi en cas de diarrhées pour assécher les plaques et les porcelets. De plus, j'ai l'impression que les problèmes d'arthrites ont tendance à diminuer dans l'élevage. Mais, je n'ai pas de chiffres à avancer pour le démontrer. Par ailleurs, afin de prévenir des problèmes d'aplombs chez nos cochettes de renouvellement, nous raclons deux fois par semaine les caillebotis après quoi nous recouvrons les sols d'asséchant, et ce, lorsqu'elles sont en quarantaine et en gestante. Cette stratégie semble bien fonctionner.

**LES PLUS**

- + Fort pouvoir asséchant
- + Effet bactériostatique

**LES MOINS**

- Difficulté d'approvisionnement en France jusqu'à présent



## Other Options

A series of natural litter conditioners based on Attapulgite, used for a fast drying and disinfecting action of the litter of various productive animals (dairy cows, goat / sheep, calves, broilers, layers, pigs, horses, rabbits etc.

### Granular Products

**AXORB®**

**AXORB® - A/S**

**AXORB® - G**

**AXORB® - G EUCALYPTUS**

### Powder Products

**AXORB® - P**

**AXORB® - F**

**AXORB® - PVX**

**AXORB® - F WILLOW**

# AXORB®

Thank you for your attention

