Mycotoxin Binder

Protects Liver

Ammonia Remover

Klinofeed®

Deodorizes the Air

Improves Immunity

A Versatile Useful Multi-Purpose Product

Anticaking Agent

Swiss quality

Pellet Binding Enhancer

Unipoint AG, Switzerland

Improves Blood Quality

Klinofeed®

A Very Safe Mycotoxin Binder

Unipoint AG, Switzerland

What is a Good Feed Additive Mycotoxin Binder ?

- Broad spectrum
- Large adsorbing capacity
- Strong adsorbing power
- Selective adsorption
- Nutritionally inert (not digestible)
- Stable shelf life
- Not harmful itself
- Contains no harmful substances
- Additional benefits

Klinofeed®

A Broad Spectrum Mycotoxin Binder

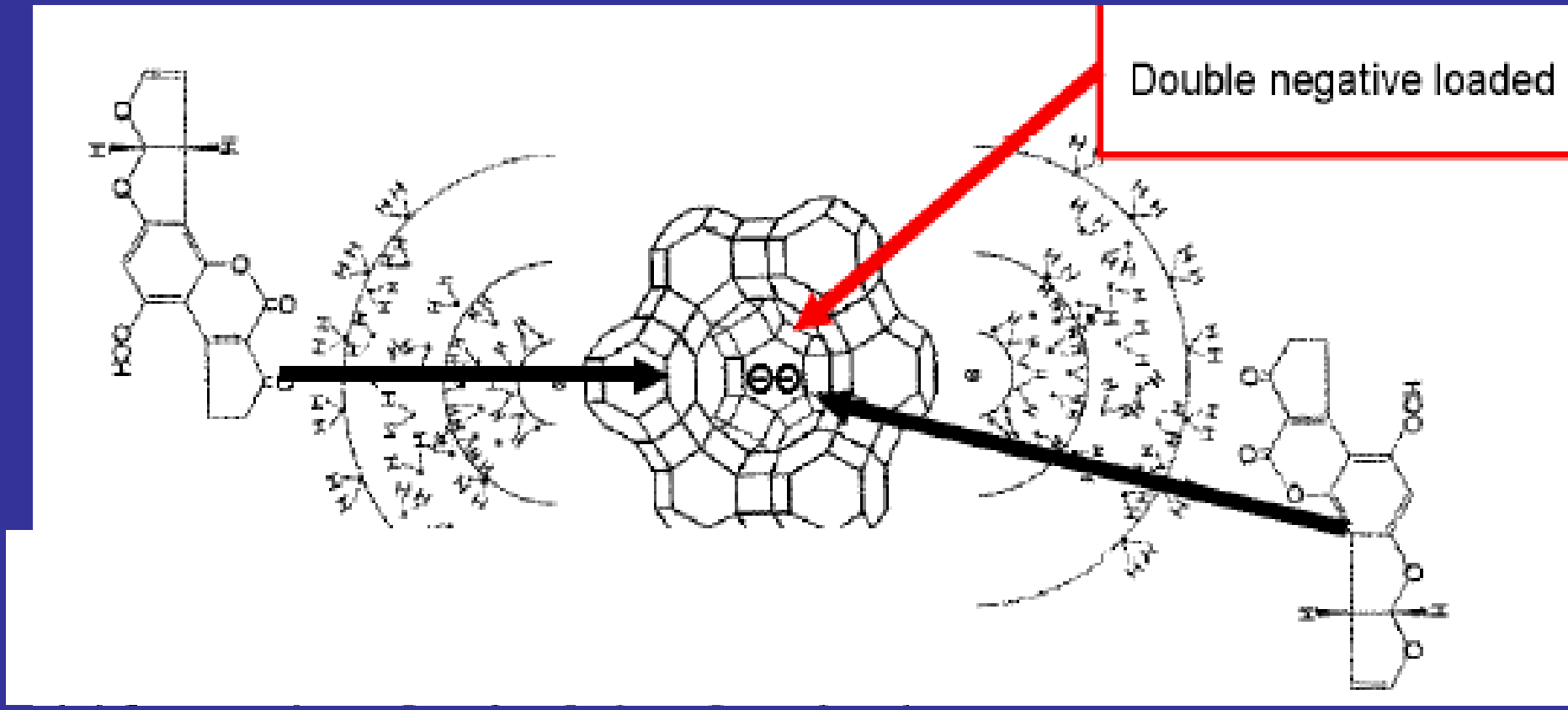
• Aflatoxins	98%
• Ochratoxin A	96%
• Zearalenone	95%
• T-2 Toxin	68%
• Vomitoxin (DON)	81%
• Fumonisins	80%
• Citrinin	78%

Crystalline Features of Klinofeed®

- **Natural Heulandite**
  - High purity (high content)
  - Contains no quartz or any harmful substances
- **Unique crystalline structure**
  (not all hydrated aluminosilicates are the same)
  - Firm rigid framework structure, does not expand
  - Powerful negative charges
- **Fine particles**
  - Over 98% of particles are less than 100nm
  - 1 g contains 59-67 million particles
  - 1 particle has 10,000 to 100,000 pores
  - Vast surface area, 36-39 hectares per kg
  - Vast adsorption surface area
- **Tiny pores** (diameter=4 angstroms=0.4nm)

Klinofeed®

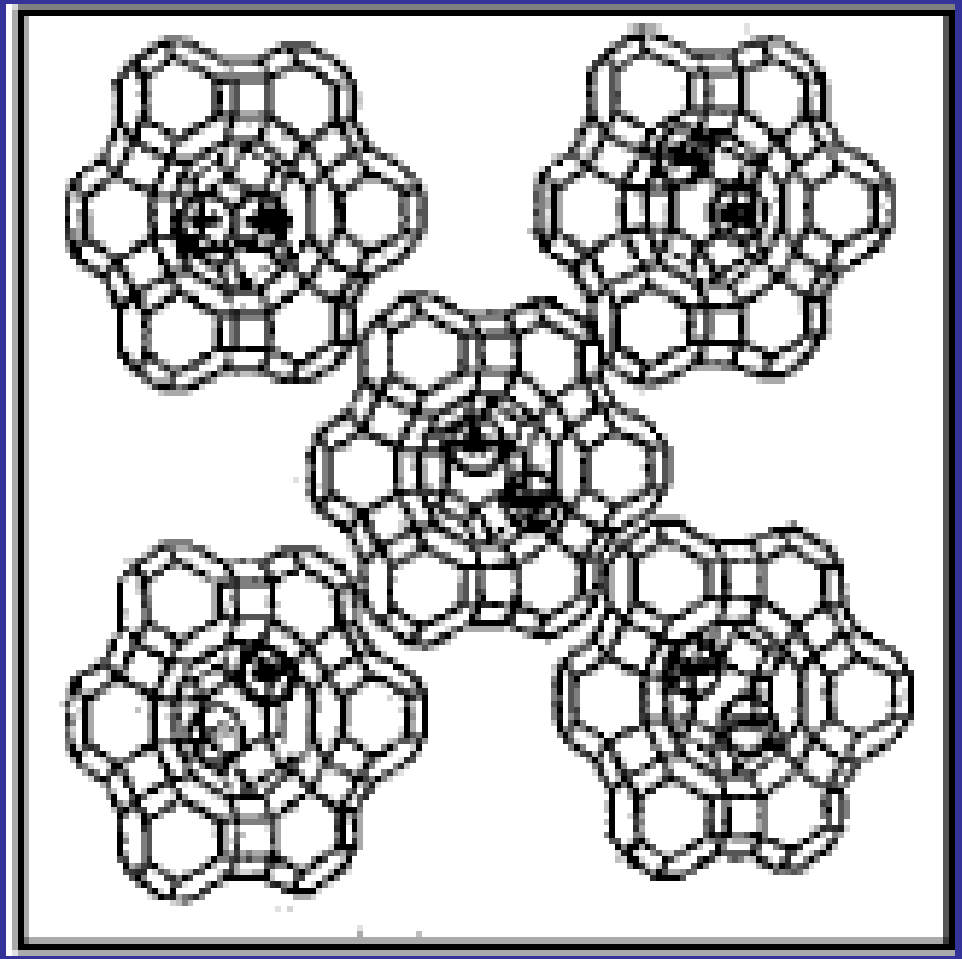
Strong Negative Charges



Crystal Structure of **Klinofeed®**

(enlarged 10,000 times)

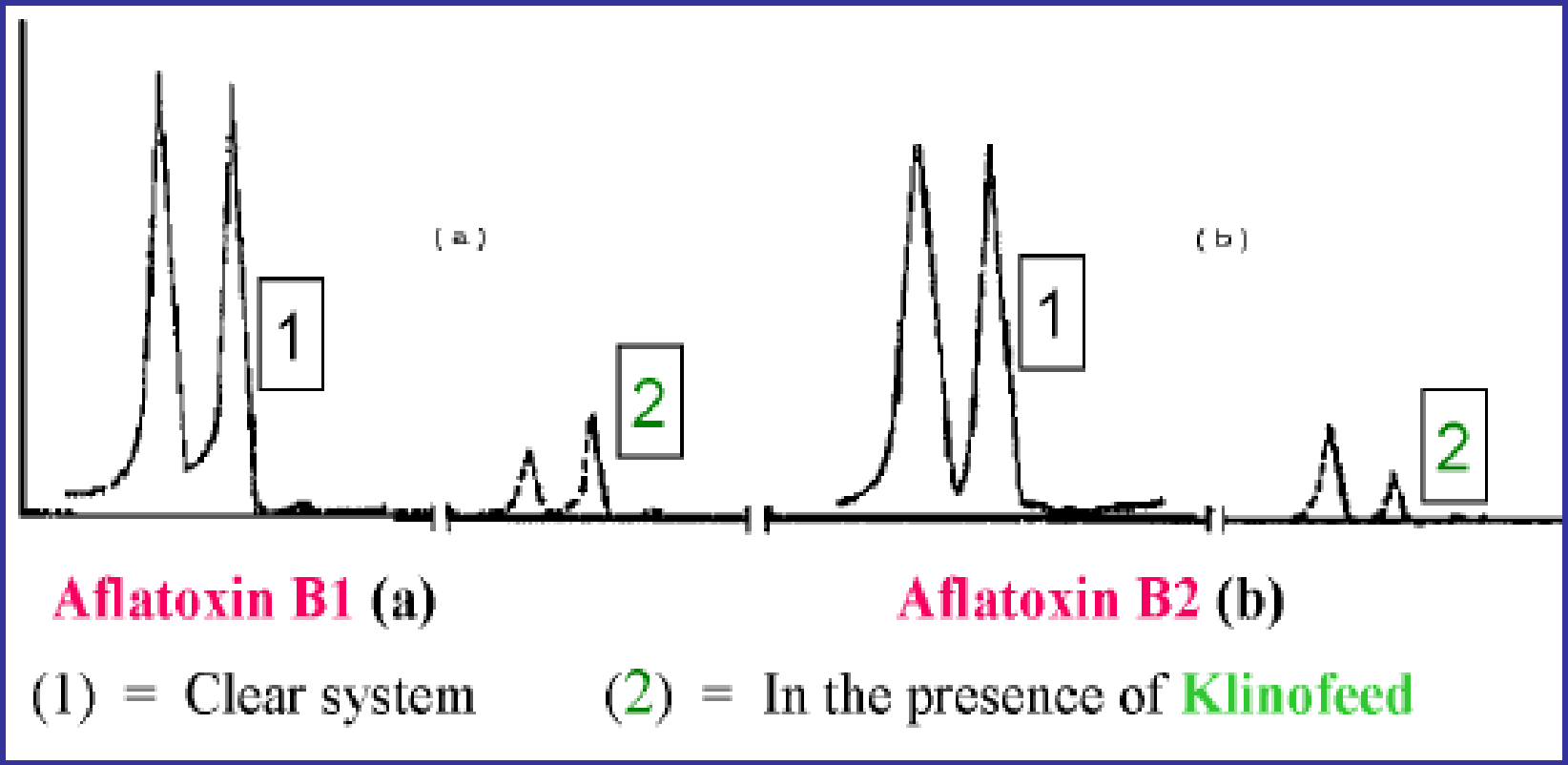
Characteristics of Heulandite



- Crystal network
- Rigid crystal structure
- No expansion = Selective adsorption
- **Klinofeed®** does not contain quartz

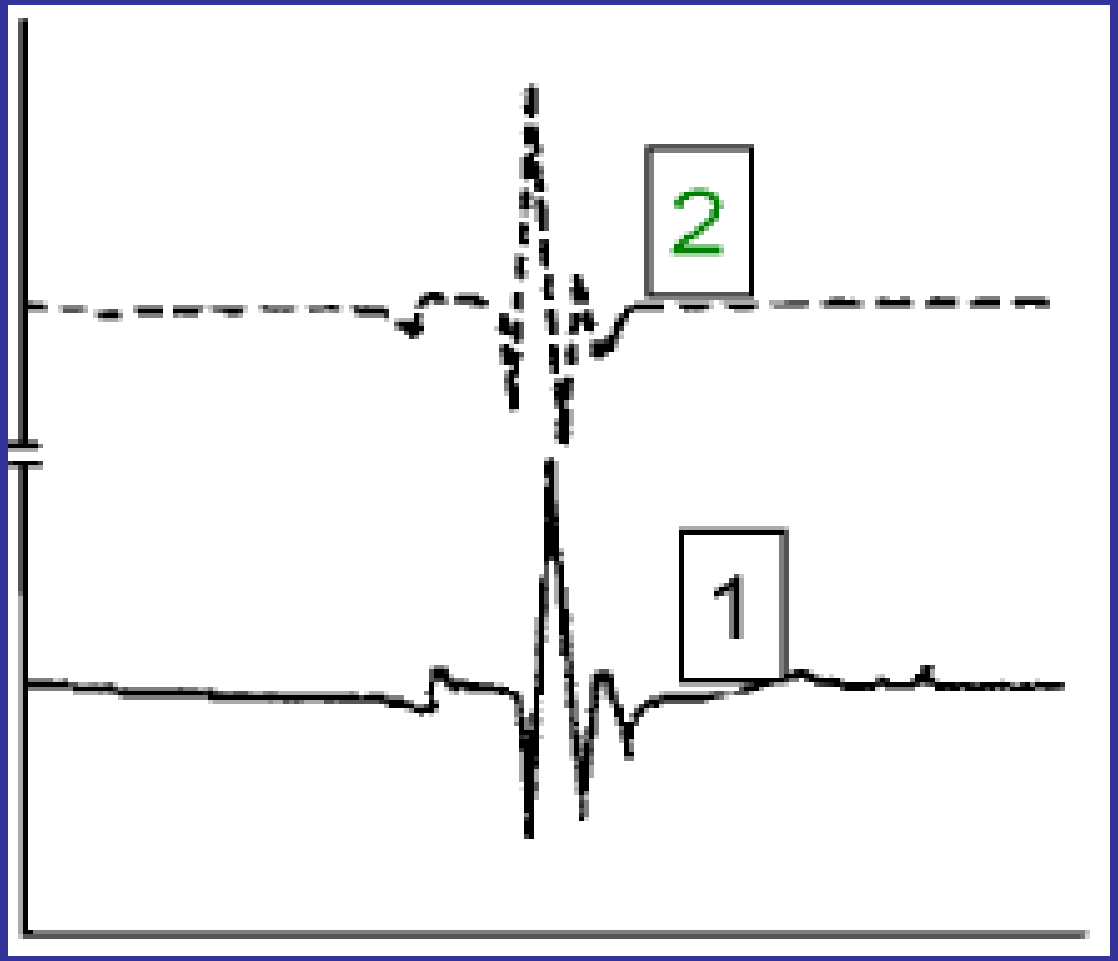
Klinofeed®

Adsorbs Mycotoxins Effectively



Klinofeed®

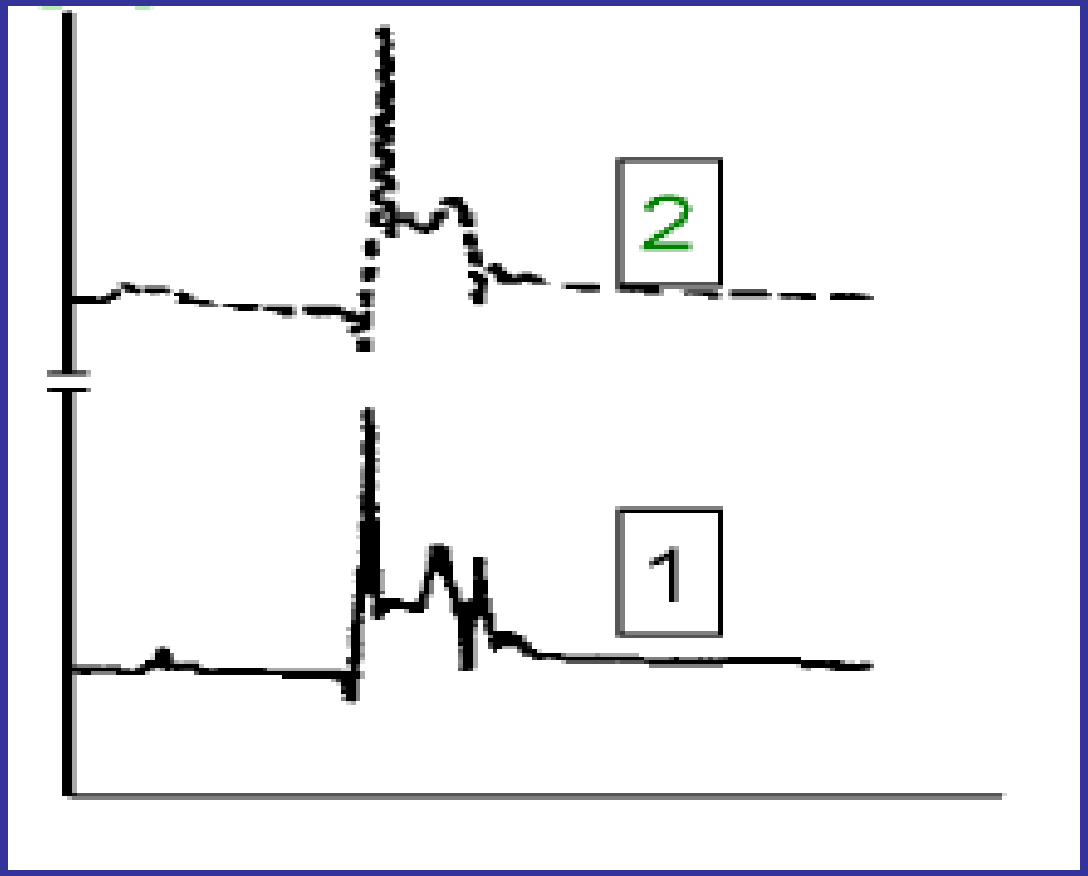
Does NOT Adsorb Vitamin A



- 1=without Klinofeed®
- 2=Klinofeed® added

Klinofeed ®

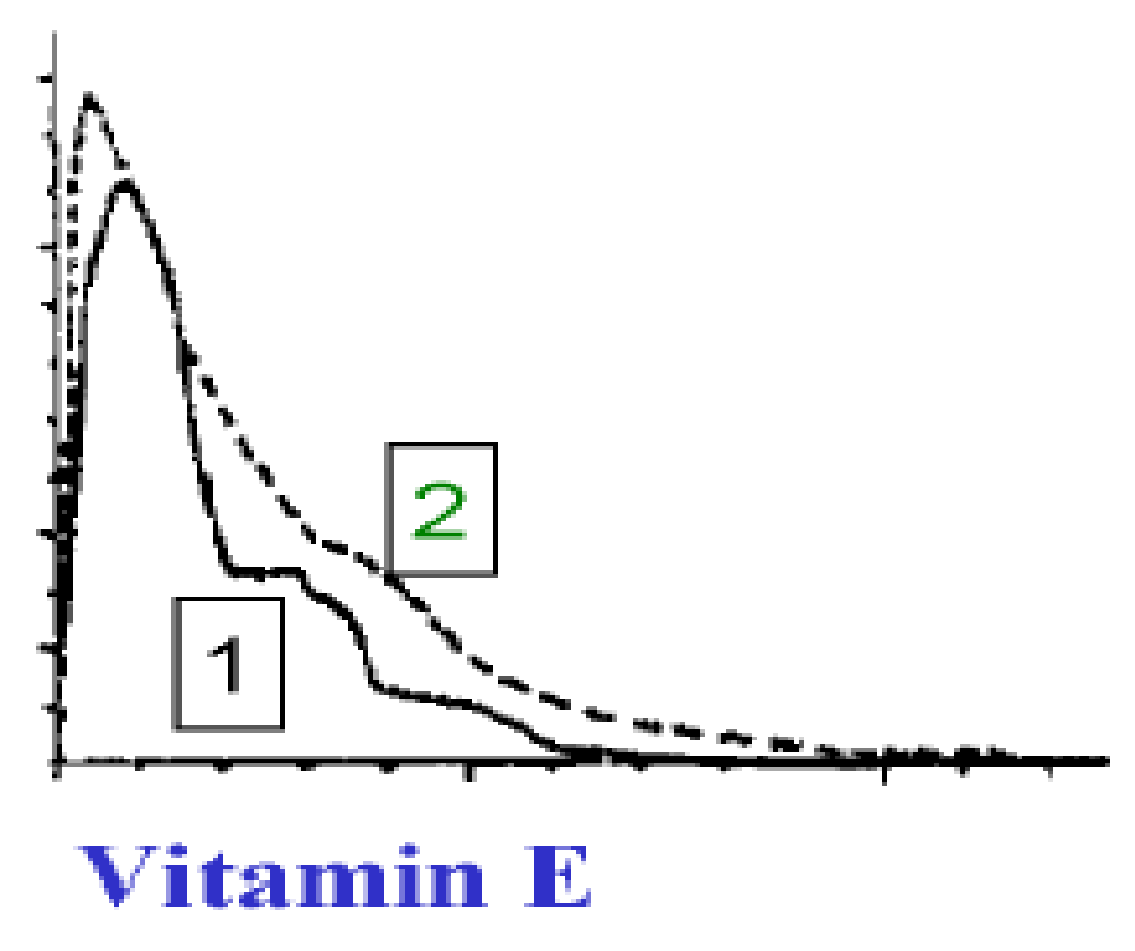
Does NOT Adsorb Vitamin D



- 1 = without Klinofeed®
- 2 = Klinofeed® added

Klinofeed®

Does NOT Adsorb Vitamin E

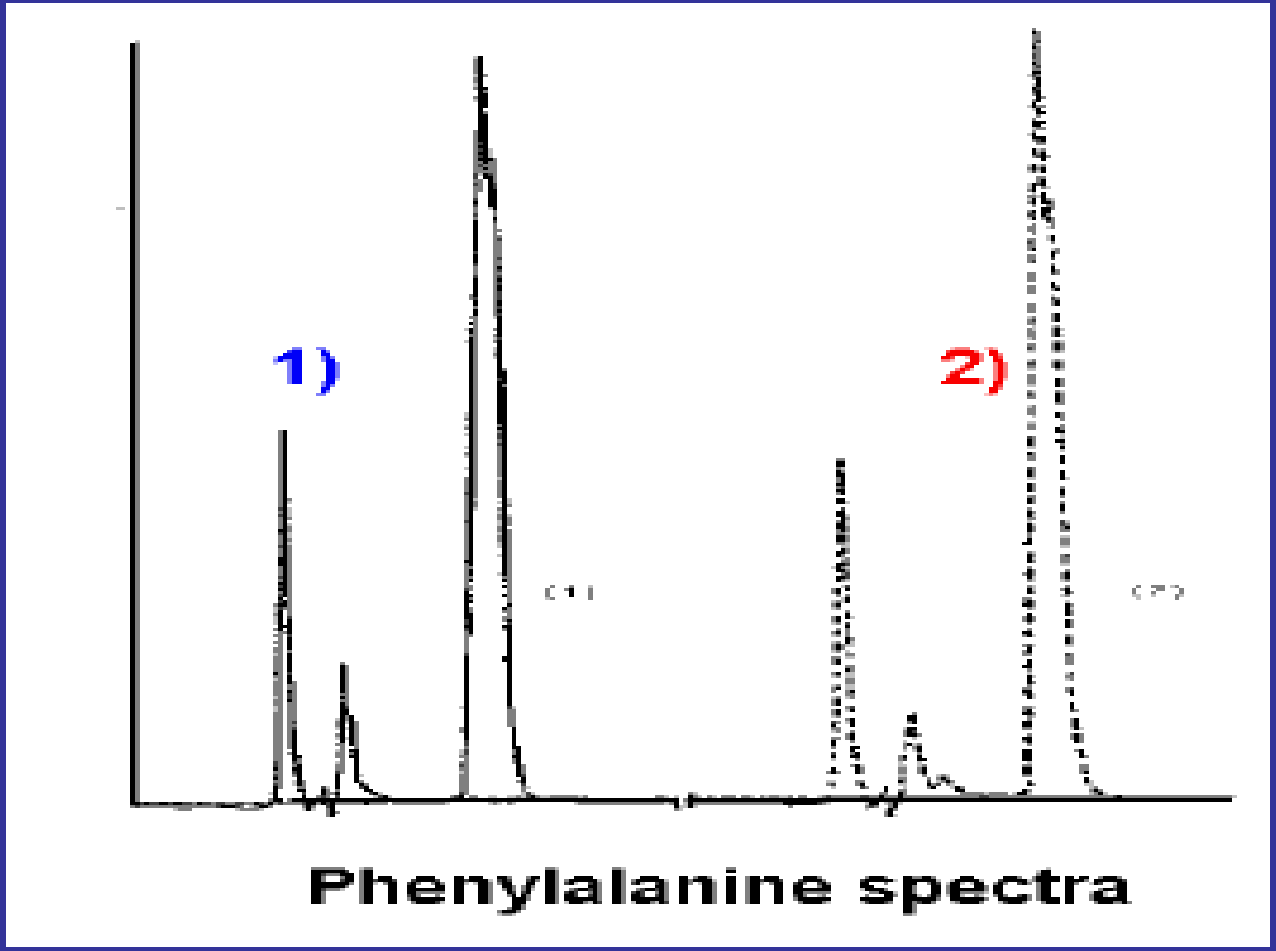


- 1=without Klinofeed®
- 2＝Klinofeed® added

Klinofeed®

Does NOT Adsorb Amino Acids

Example 1: Phenylalanine

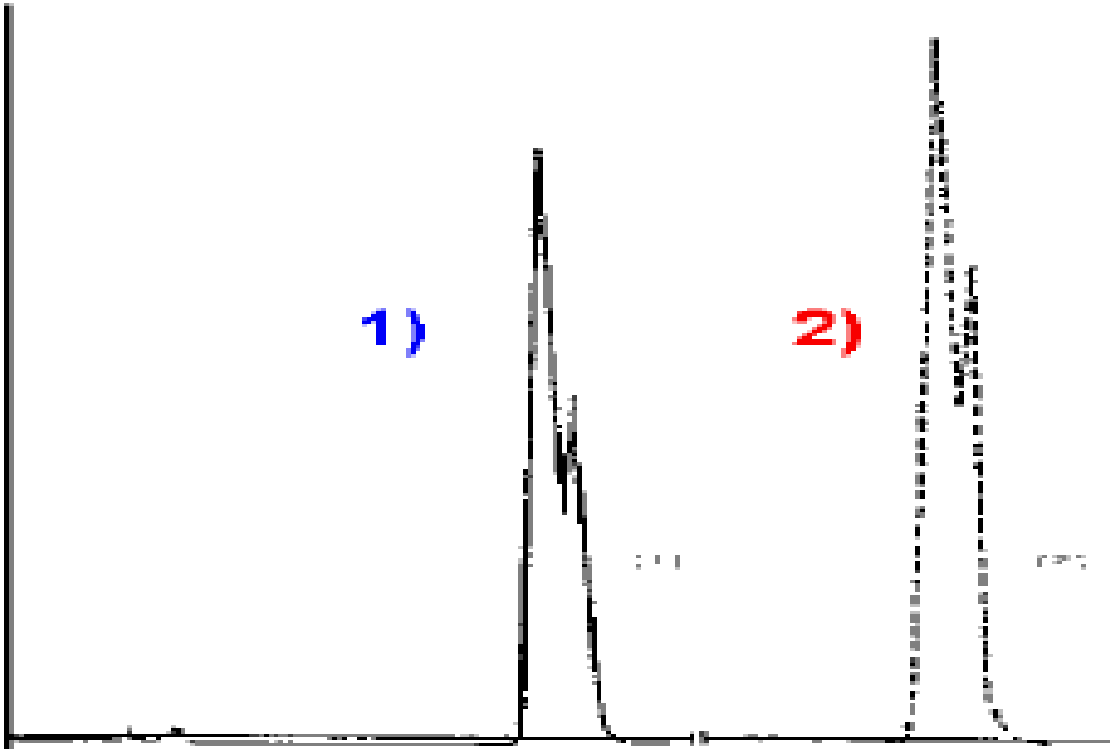


Phenylalanine spectra

Klinofeed®

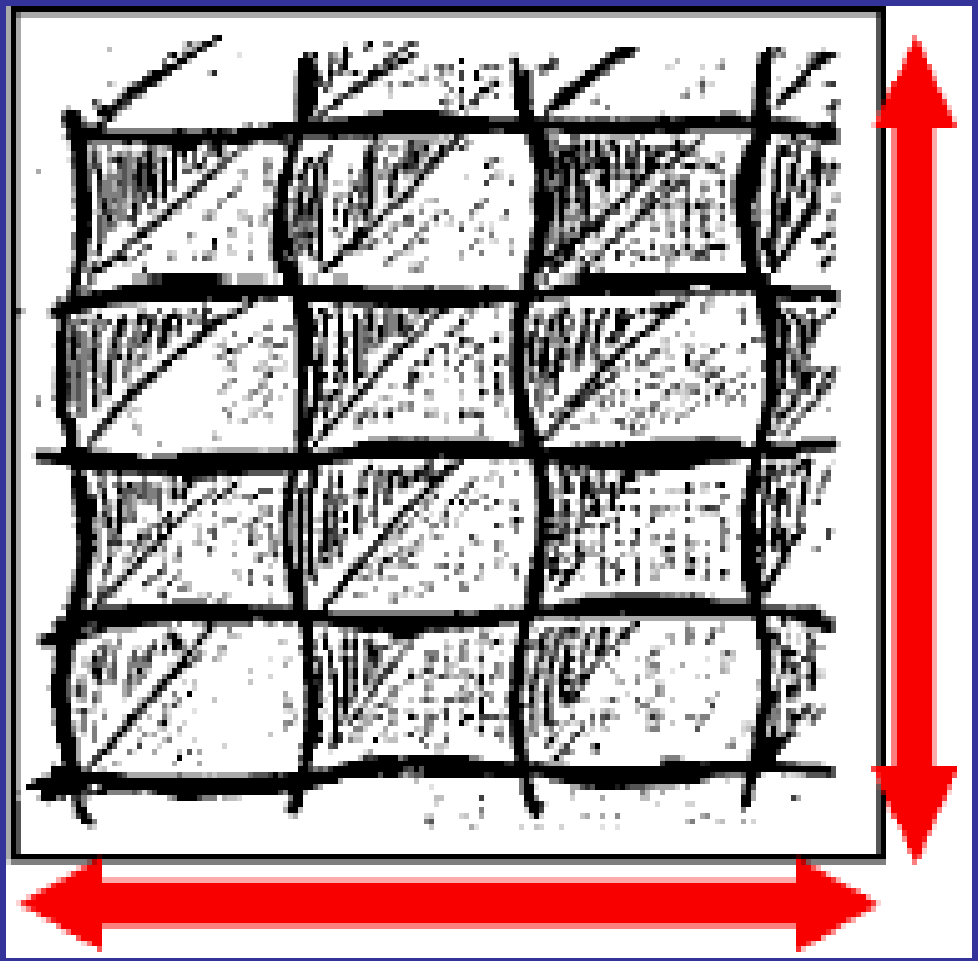
Does NOT Adsorb Amino Acids

Example 2: Tryptophan



Triptophan spectra

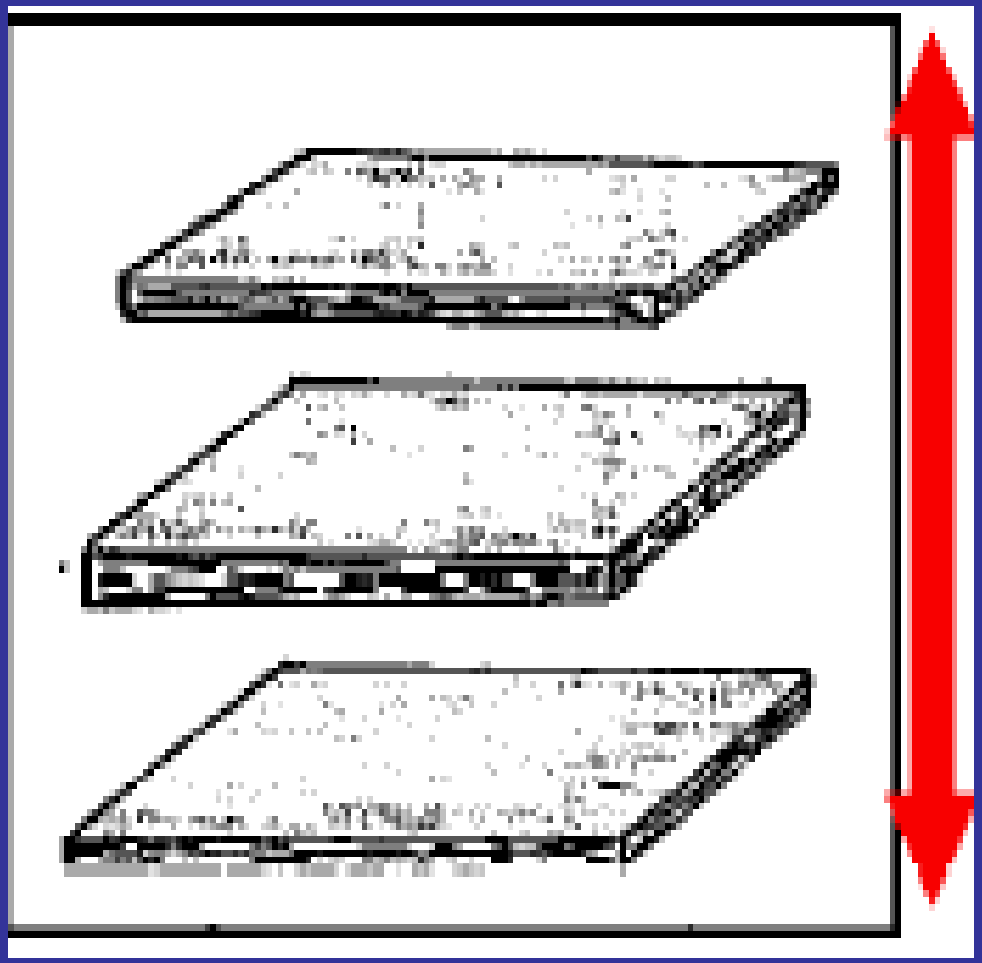
Characteristics of HSCAS
Sepiolite as an Example



- Tubular structure
- Expansion＝ Non-selective adsorption

Characteristics of HSCAS

Bentonite as an Example



- Sheet-like structure
- Expansion＝ Non-Selective adsorption

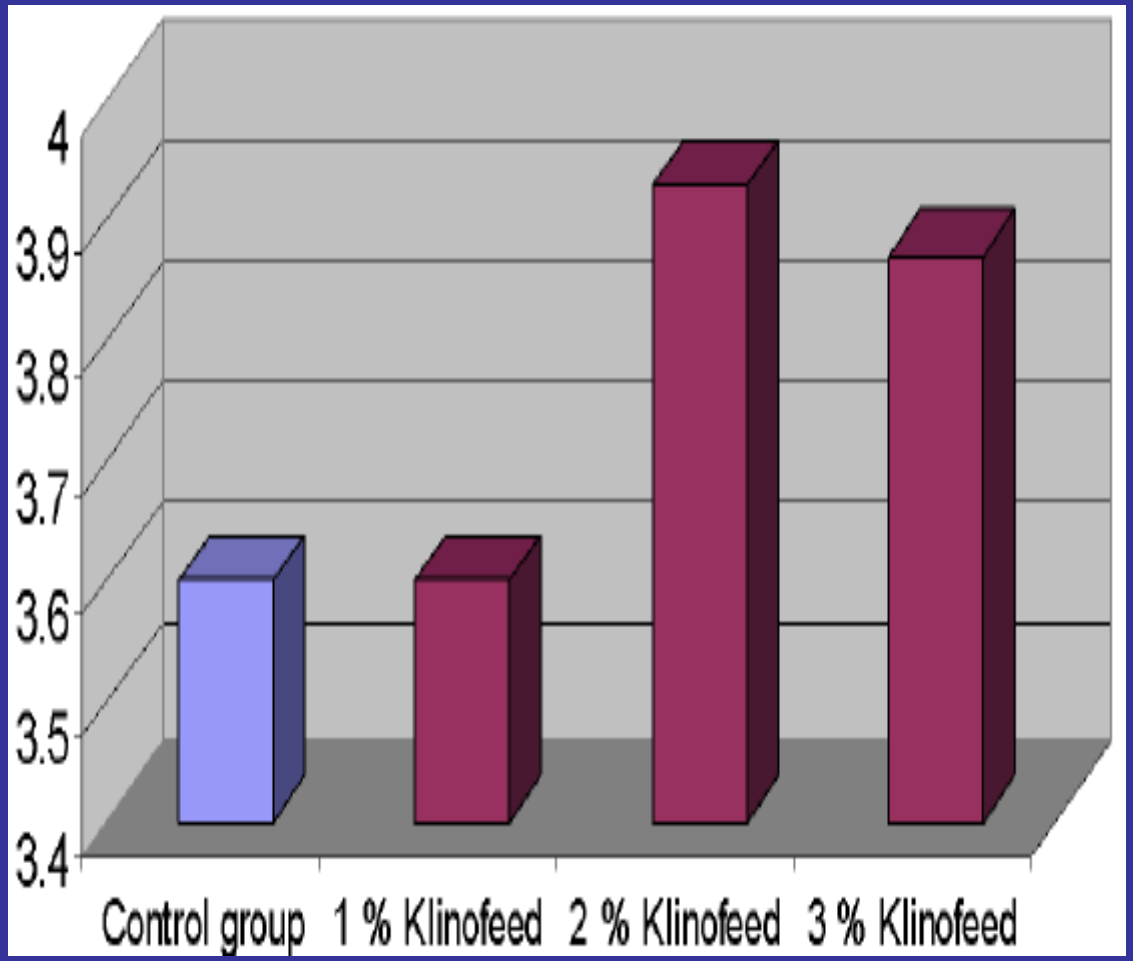
Features of Klinofeed®

Characteristics in Ion Exchange

- **Strong Ion Exchange Power**
  - Strong affinity with cations
- **Preferential Ion Binding**
- - Cs>Pb>NH_4>K>Na>Ca>Mg>Cu>Zn>Mn
  - Binds NH_4 with first priority
- - Does not bind minerals in the feed
- **Strong Ammonium Ion Exchange Capacity**:
  - 23.5gNH_4^+ per kg **Klinofeed®**

Klinofeed® Improves Egg Shell Quality

Period: 20th - 68th week

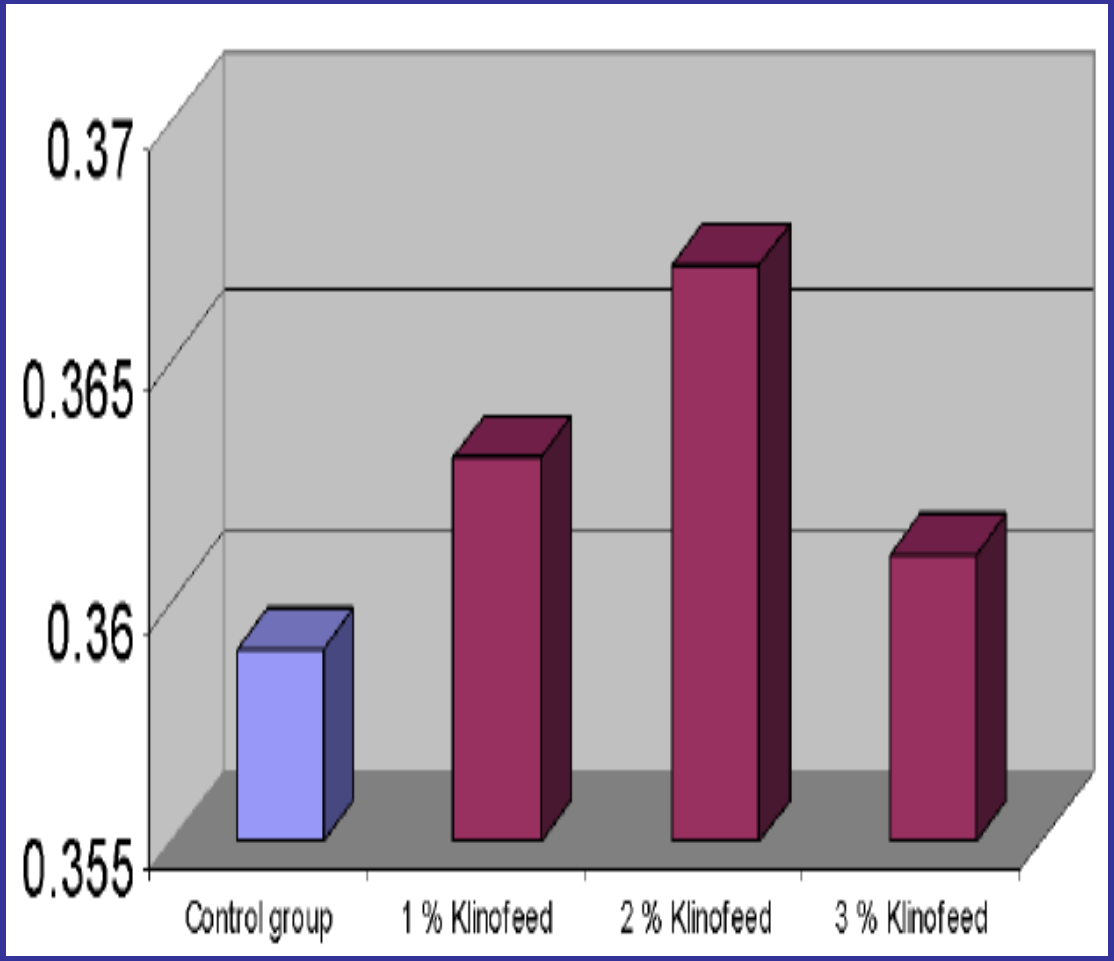


Egg Shell Quality Index

- Blue = Control Group
- Red =Klinofeed® Group

Klinofeed® Improves Egg Shell Quality

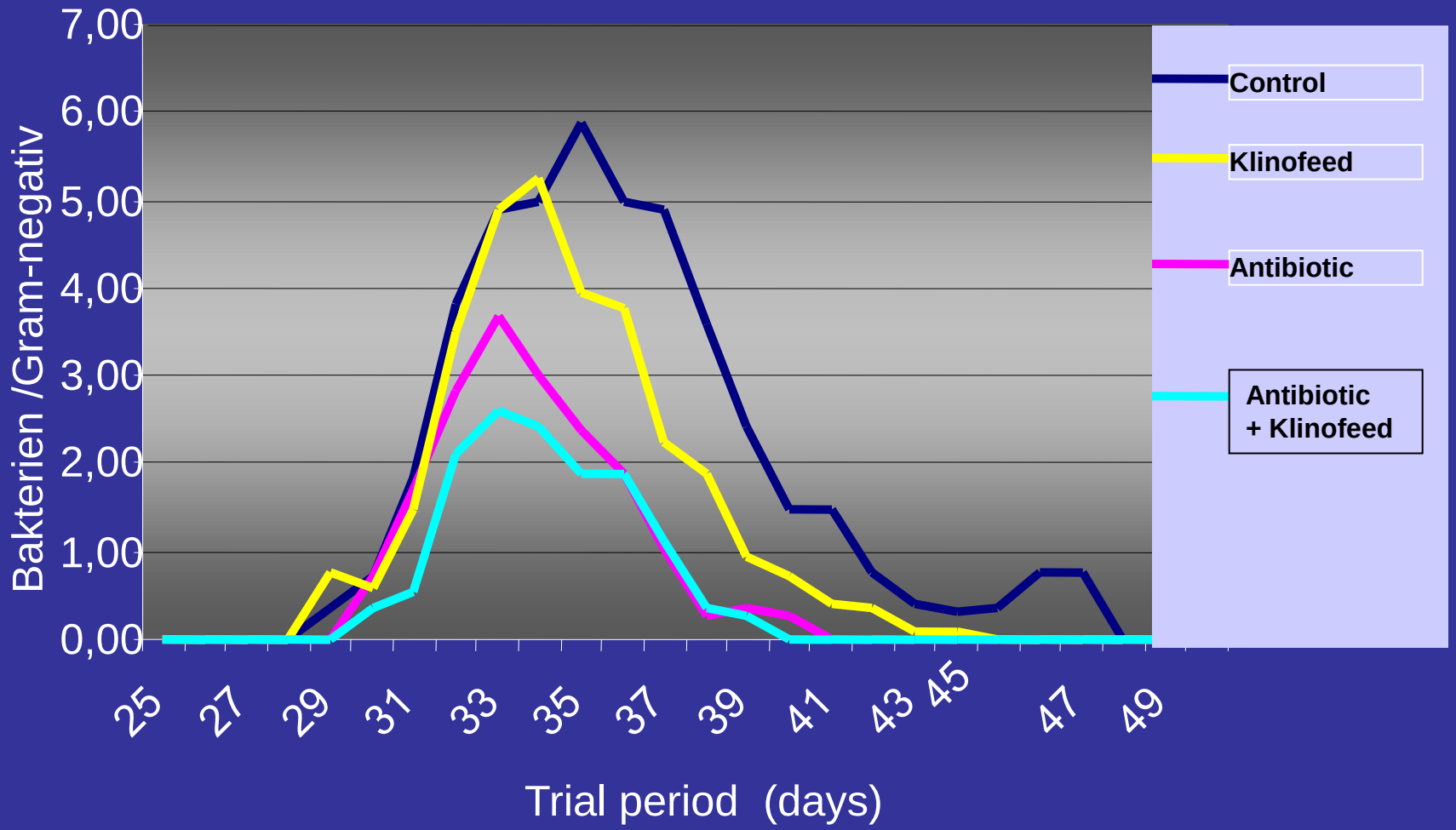
Period: 20th - 68th week



Egg Shell Thickness (mm)

- Blue = Ccontrol Group
- Red =Klinofeed® Group

Influence of Antibiotics and Klinofeed® to the population of the Gram-negative bacteria in the Intestines. (pigs)



Papaioannou et al. (2004).

Klinofeed®

Effect on Feed Additives

- **Klinofeed®** does **NOT** adsorb
  - Vitamins
  - Amino Acids
  - Antibiotics

  because of its tiny size of crystal pores

- **Klinofeed®** does **NOT** adsorb
  - mineral ions

  because of its unique property of preferential ion exchange for NH_4^+ ion

Klinofeed®

Safety Features

- Contains **no harmful substances**, **e.g.,** :
  - Lead
  - Quartz
  - Dioxin
- **No withdrawal** is required
- **Absolutely safe** to Human and Animals
  - Meet the food additive safety standards as set by EU and WHO

Klinofeed®

Usage and Dosage

- Add according to recommended dosage
- Prestater , stater , finisher :- 1 kg per ton of feed
- Control and Removal: Mycotoxins are analysed and detected 2-3 kg per ton of feed
- Use continuously, no withdrawal is necessary

Klinofeed®

An Effective Ammonia Remover

Unipoint AG, Switzerland

Klinofeed®

An Effective Ammonia Remover

Unipoint AG, Switzerland

Theoretically two important considerations can affect the productivity of the monogastric animals over ammonia:

1. The influence of ammonia on the microbiological, ecological system in the lumen and the Intestinal wall.
2. The effect of ammonia on the metabolism of the nutrients in the liver.

Source of Ammonia in the Digestive Tract

Only 35 to 45% of proteins consumed by the poultry or pigs will be transformed into animal products, (i.e., meat, milk, eggs)

Penz (2000)

Source of Ammonia in the Digestive Tract

- Unabsorbed amino acids in the intestines continue being degraded to produce ammonia gas.
- The epithelial tissue is also a source of protein for producing ammonia.
- Microorganisms in the intestines utilize those unabsorbed nutrients to grow and multiply and produce ammonia gas through metabolism.

Effect of Ammonia on the Intestines

- High ammonia concentration in the Intestines causes faster turnover (more frequent renewal) of the epithelial cells .

- Nutrient absorption is affected by frequent epithelial cell renewal in the Intestines resulting in slower growth rate and reduction of production performance.

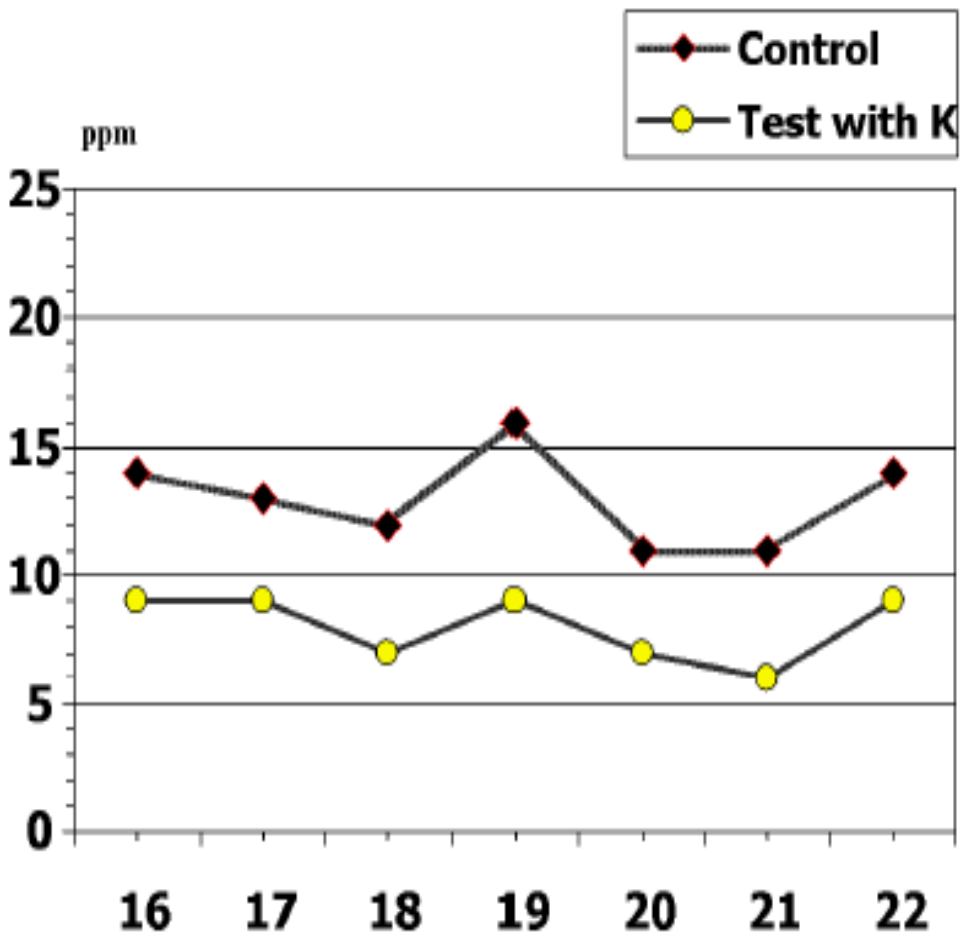
Ziggers (2003)

Ammonia in the Intestines

- The reduction of ammonia produced during digestion can support (favour) more healthy intestinal development for more efficient nutrient absorption.

Ziggers (2003)

Klinofeed® in Feed
Improves Air Quality in Swine Barn



Av. NH_3 Conc. In Air

(ppm)

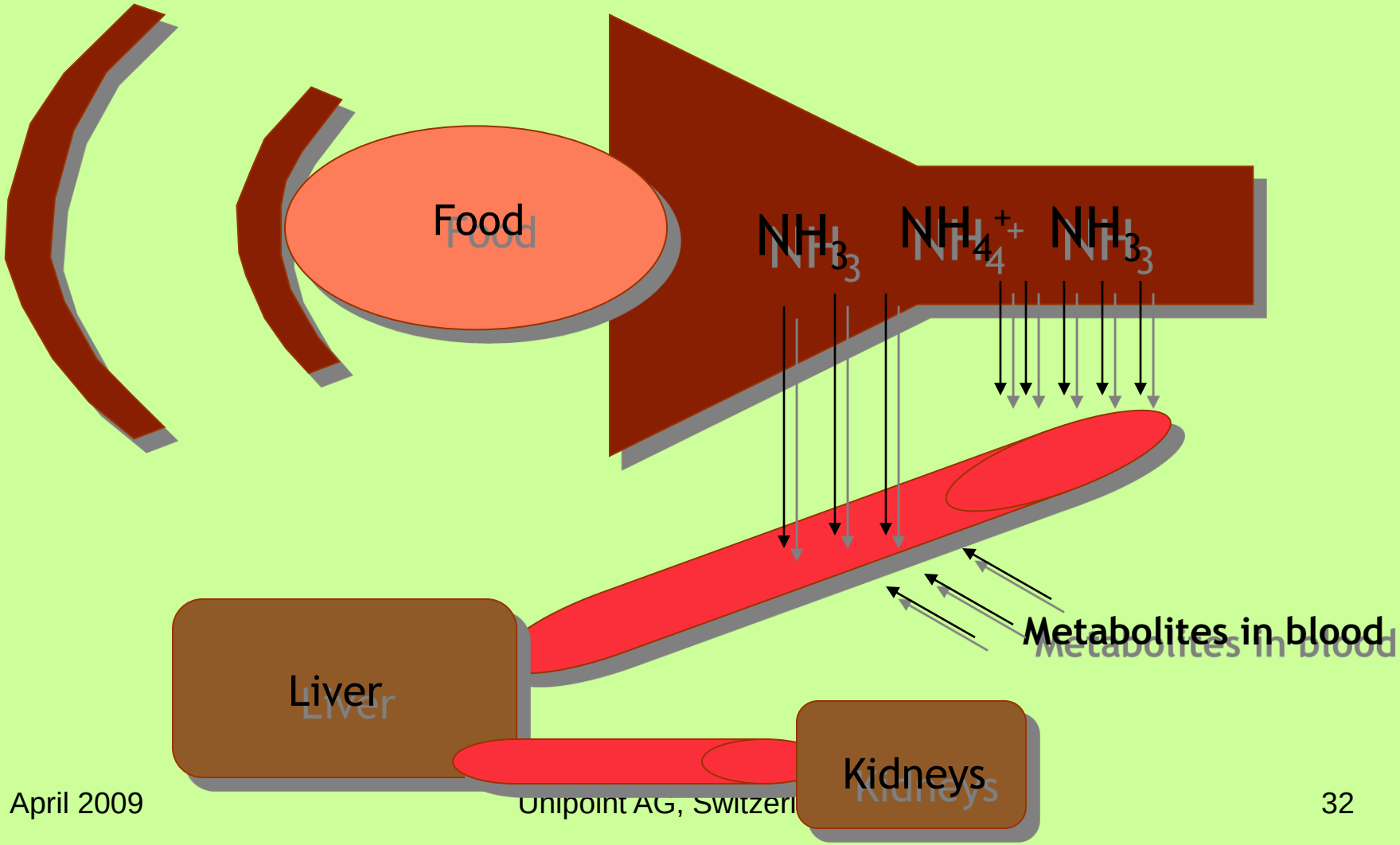
Control 12.3

w. Klinofeed® 8.6

Improvement = 30.08%

Black=Control
Yellow=Klinofeed®

Ammonia overloading in liver and kidneys



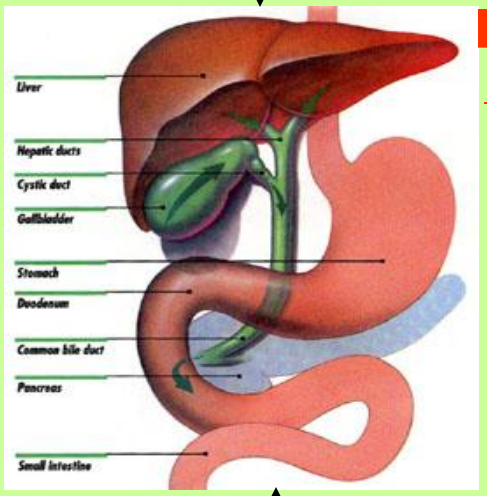
Ammonia in the plasma

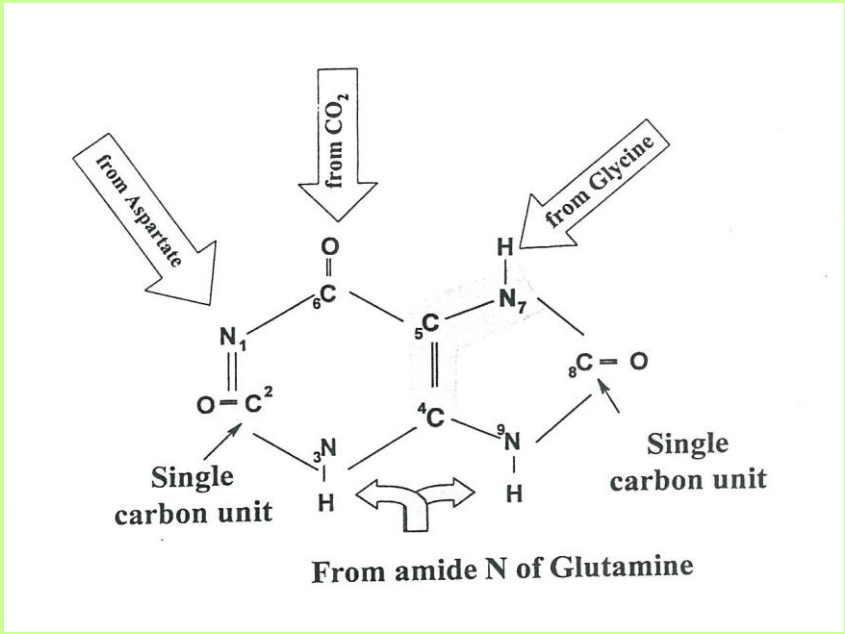
Ammonia is continuously released in the lumen by the Intestinal bacteria and absorbed into the blood as ammonium ions.

Guyton (1996)

The influence of Ammonium Ions on the metabolism of nutrients in the liver

Blood ammonium level high





Uric Acid

Glycine

Normal Metabolism of the nutrients

Effect of Ammonium Ion on Blood Calcium

- Liver has extra work load to detoxify ammonia in addition to regular metabolism
- Uric acid is produced after ammonium is metabolized
- Calcium-Uric acid complex is formed
- Available calcium in the blood is reduced
- Bone health is adversely affected

Leach, Hendricks et al (1990)

Heulandite-Clinoptilolite can help controlling diseases

The use of Heulandite-Clinoptilolite can work as therapeutic means for controlling diseases.

Mumpton und Fishman (1977)

Milene und Froseth (1982)

Kovac et al (1988)

The Effect of Ammonium Ion on Bone Development in Broilers

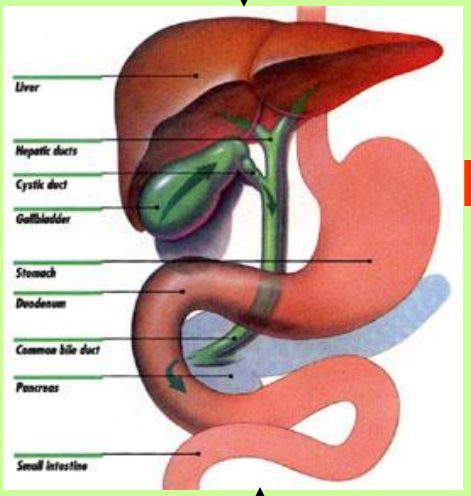
- Heulandite decreases the absorption of ammonium ions and reduces uric acid concentration in the blood
- **Klinofeed®** helps broilers in healthy bone development

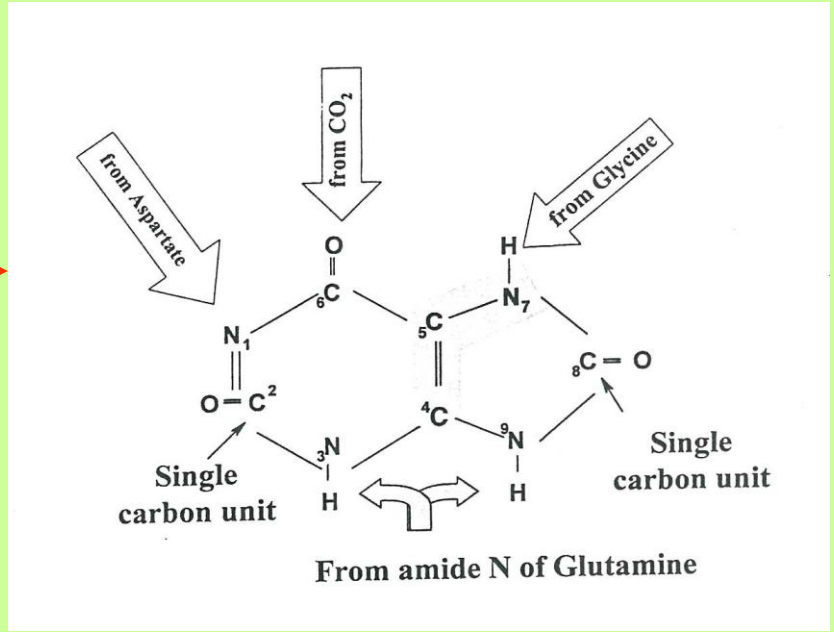
.

LEACH RM, HEINRICHS BS et al - Broiler chicks fed low calcium diets. 1. Influence of zeolite on growth rate and parameters of bone metabolism.
Poultry Science, 1990, 69 (9), 1539-1543.

The influence of Klinofeed® on the metabolism of nutrients in the liver

Blood ammonium level low





Uric Acid

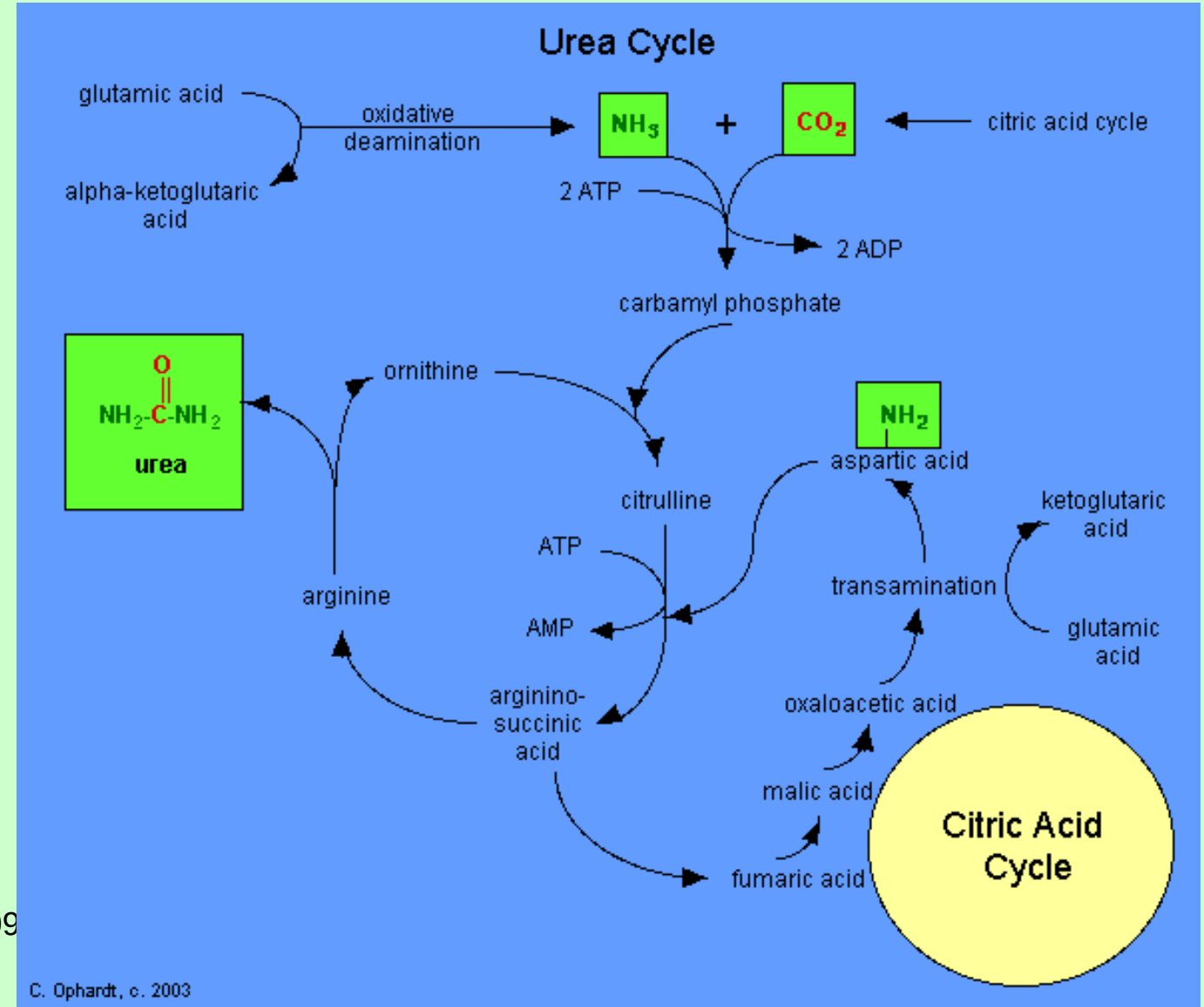
Glycine

Normal metabolism of the nutrients

Reduced Ammonia Improves Immunity

- Liver work load lightened without the task of ammonia detoxification.
- Immunity is improved when the liver works normally.
- Klinofeed® reduces the level of absorbed ammonia thus improves immunity.

Conversion of Ammonia to Urea Needs Energy



Energy Requirement for Production of Urea from Ammonia

Requirement of 3 moles of ATP for conversion of 1 mole of ammonia to urea:

$NH_3 + NH_3$ (from Glu-acid)+ CO_2 + 3ATP
---> $(NH_2)_2CO + H_2O$ + 3 ADP + $3P_i$

Amm + Amm (fr Glu-acid) + carbon dioxide + 3ATP
---> urea + water + 3 ADP + $3P_i$

Energy Requirement for Ammonia Removal

- One mole of ATP represents 30.5kJ (7.3kcal)
- To eliminate one mole of ammonia requires 3 moles of ATP,

  or 91.5kJ (~22kcal)

Klinofeed® decreases energy wastage

- Klinofeed reduces the level of absorbed ammonia thus saves wastage of valuable energy for growth and production.

Klinofeed®

A Reliable Anticaking Agent

Unipoint AG, Switzerland

Klinofeed® absorbs free water in the feed

- Due to its highly porous nature, Klinofeed® absorbs the free water contained in the feed.
- Hence, the dry feed particles can flow freely without lumping or caking problems.

Anticaking Trial
Germany

- 1. Location of Trial : NRG Factory in Hamm, Germany
- 2. Duration of Trial : 6 days
  (from 2nd to 7th July 2007)
- 3. Season : Summer
- 4. Temperature : 25 to 32 Degrees C
- 5. Type of Feed : Piglet Starter
  (Wheat & Soya base)
- 6. Moisture Content : 10 to 11 %
- 7 Klinofeed® Dosage : 2.kg per tonne
- 8. Packing : 500 kg big bulk bag, stacking up to 3 tiers in the ware-house

unipoint® ag

- feed without Klinofeed

- feed with Klinofeed


unipoint® ag

Bridging and Rat-holing in the Feed Bin

- Due to temperature difference between day and night, moisture condensation occurs in the feed bin overnight moistening the feed particles.

- This moistening effect on the feed particles results in phenomenons commonly known as “bridging” and “rat-holing” in which the feed stops flowing out after the feed jams up the outlet of the feed bin or after the feed drops out and creates a hollow channel in the center of the bin.

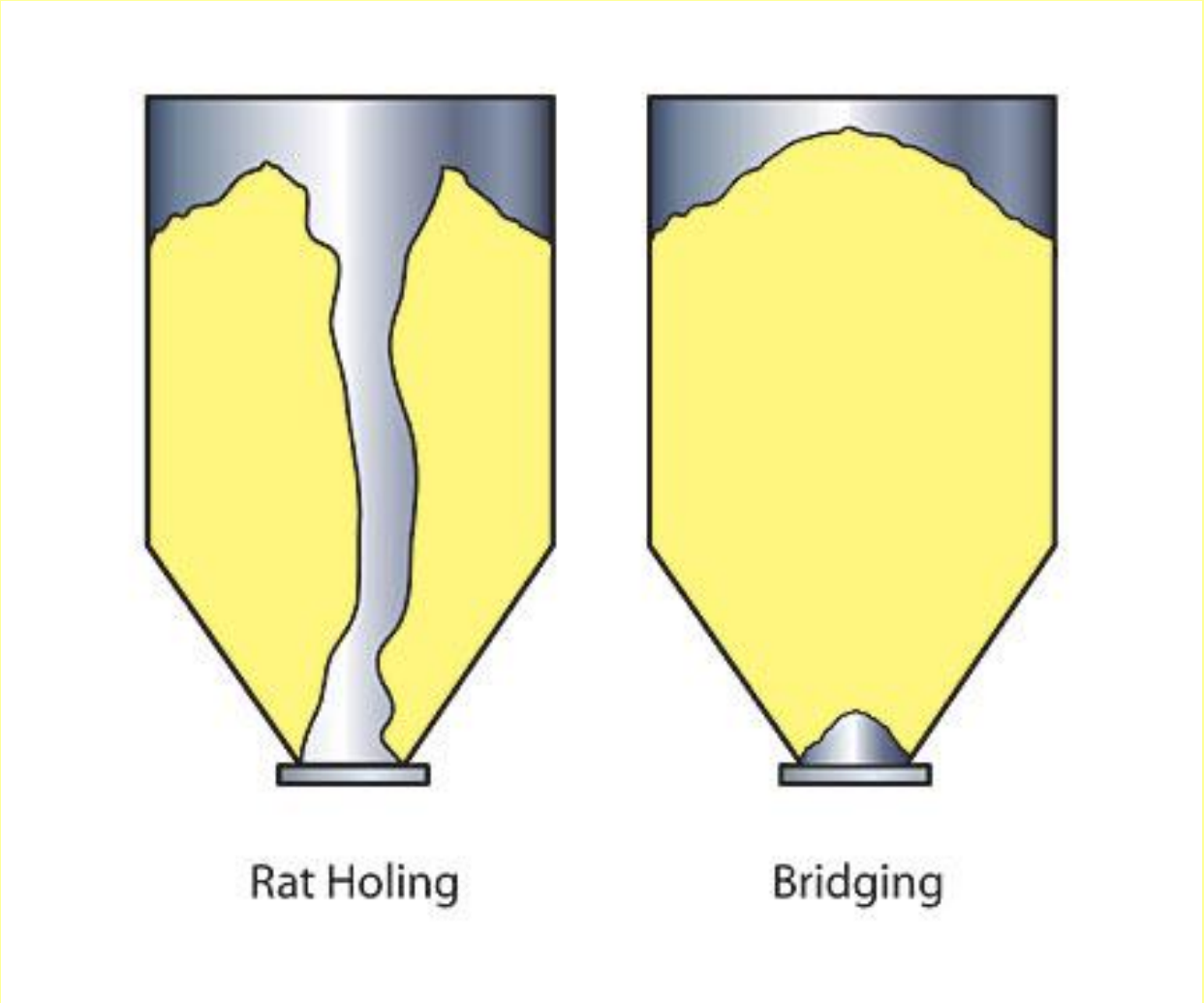
Bridging

Bridging is a no-flow condition in which the pressure of the stored material on itself results in a “bridge” or “arch” formation in the bin or the hopper section of the bin.

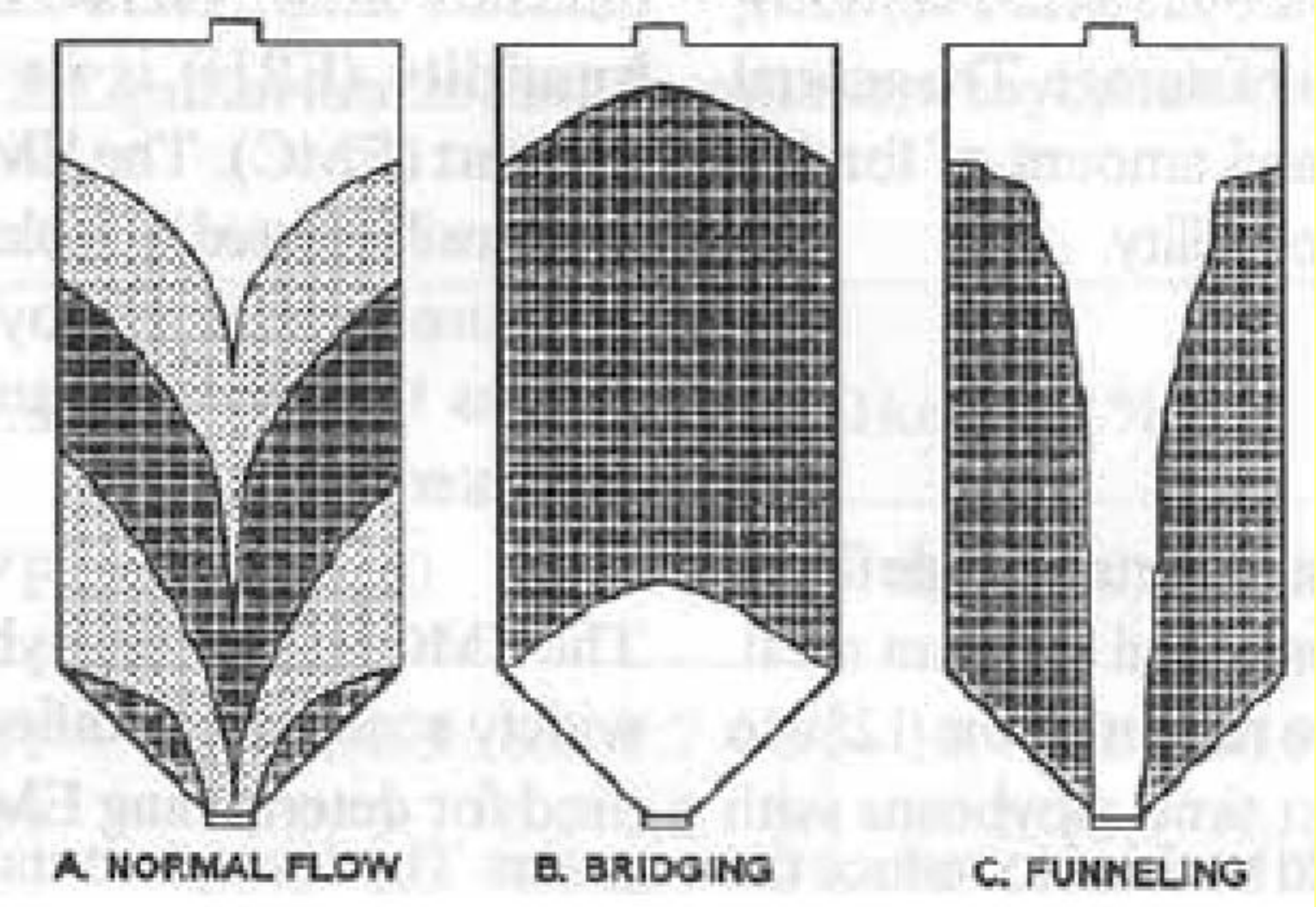
Rat-holing

Ra-holing is a condition in which the stored material does not slough into the central flow stream for discharge and instead forms a core. Problems associated with rat-holing are flooding, substantial variation of density in product, and eventually no-flow.

Bridging and Rat-holing



Feed Flow Patterns in the Bin



Klinofeed® absorbs condensed moisture

- Klinofeed® absorbs the condensed moisture thus maintaining the feed particles in “dry” condition.

- “Dry” feed particles flow out freely without forming a “bridge” or “rat hole” in the feed bin.

Klinofeed®

An Excellent
Feed Pellet Binding Enhancer

Unipoint AG, Switzerland

Conditioning of the Mash Feed

- Before pelleting, the mash feed must be conditioned in a pre-conditioner.
- The aim of “conditioning” is to produce good quality feed pellets.

Role of Pre-Conditioner

- Conditions the mash feed for making good quality feed pellets
- Three functions of the “conditioning process”:
  - Heating
  - Hydration
  - Mixing

Role of Pre-Conditioner

making good quality pellets

Heating

- accomplished commonly and efficiently through direct steam injection
- High quality (dry) steam is critical for maximum heat input

Role of Pre-Conditioner

making good quality pellets

Hydration

- Moisture addition and hydration are very critical in the pelleting operation
- Moisture transfer into feed is much slower than heat transfer
- Reasonable water addition (moistened feed particles) can greatly improve pellet quality

Role of Pre-Conditioner

making good quality pellets

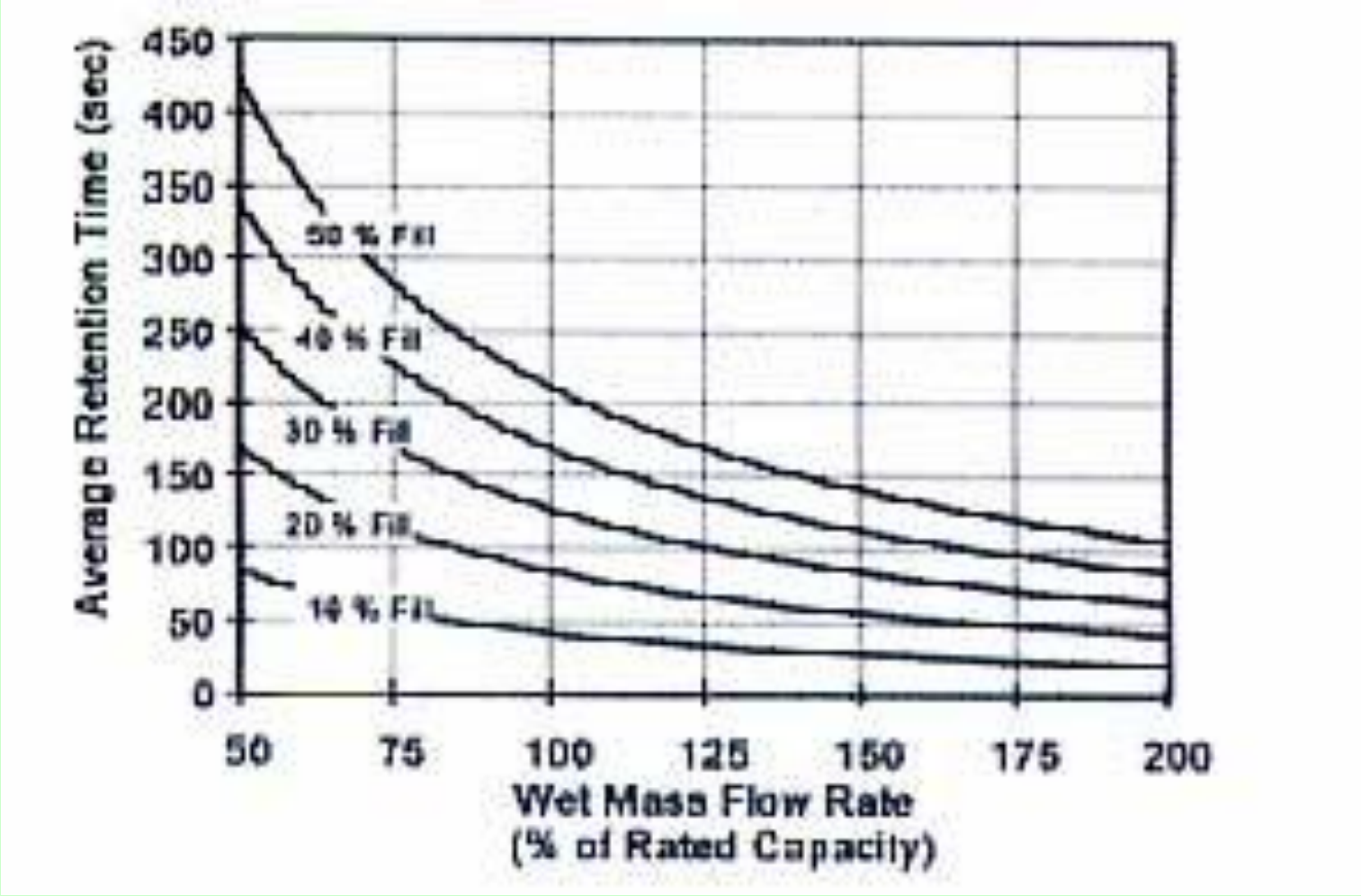
Mixing

- Mixing in preconditioning is a very critical part of the hydration process
- Typical retention times have been two minutes or less with some mills running as short as 30 seconds

Fill Level of Pre-Conditioner

- The fill level of the pre-conditioner determines the pellet production rate
- A fill level of 40-50 % is generally acceptable
- Operating the pre-conditioner at higher fill levels consumes excessive power, reduces the mixing efficiency and risks “choking”

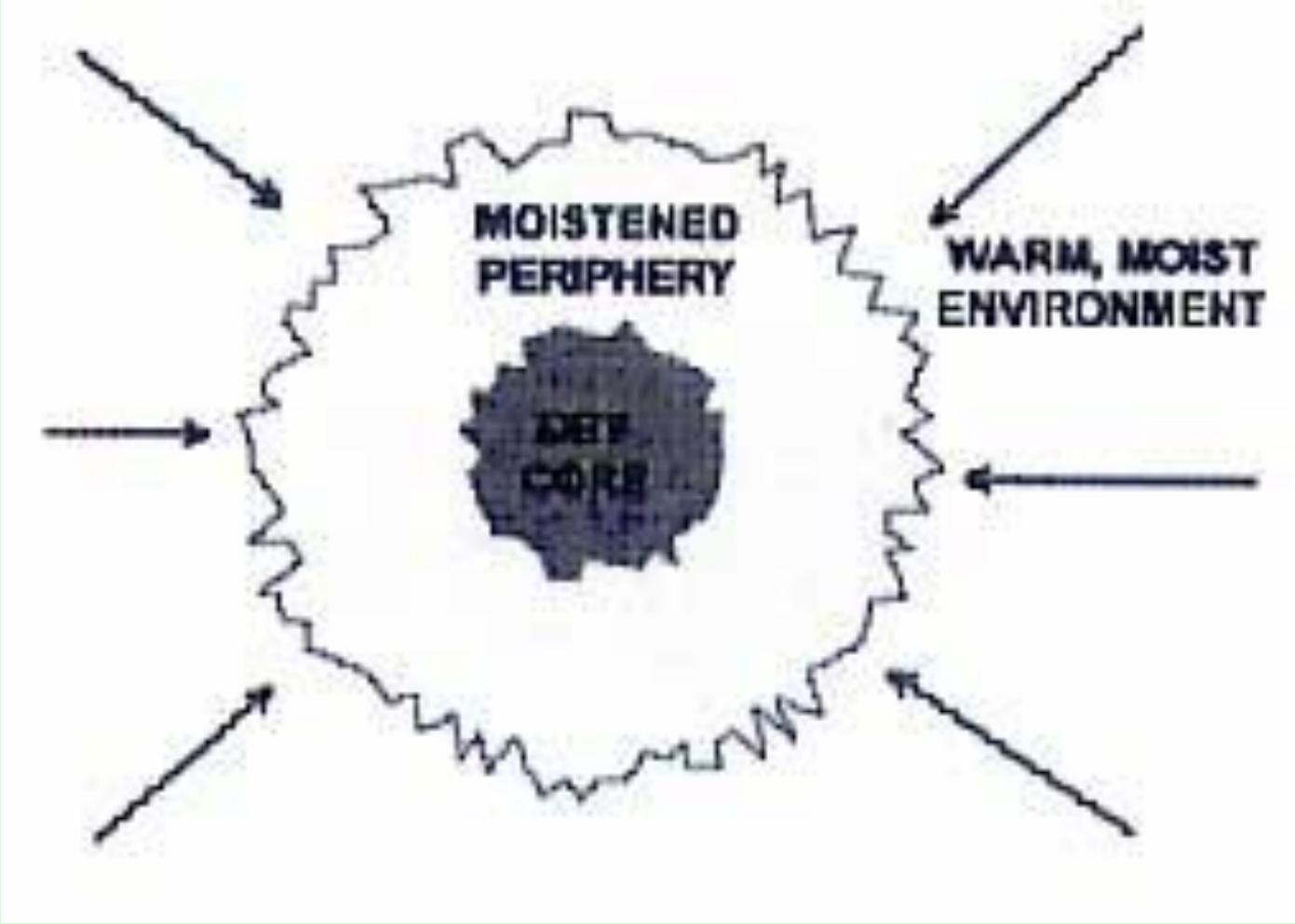
Time vs Rate at Various Fill Level



Adding Moisture

- The purpose of adding moisture is two-fold:
  - increase the starch gelatinization
  - increase the thermal conductivity of the mash
- Distribution of moisture must be uniform throughout the mash feed
- Every feed particle is closely surrounded by high moisture readily to accept moisture into its core

Moisture surrounding the feed particle

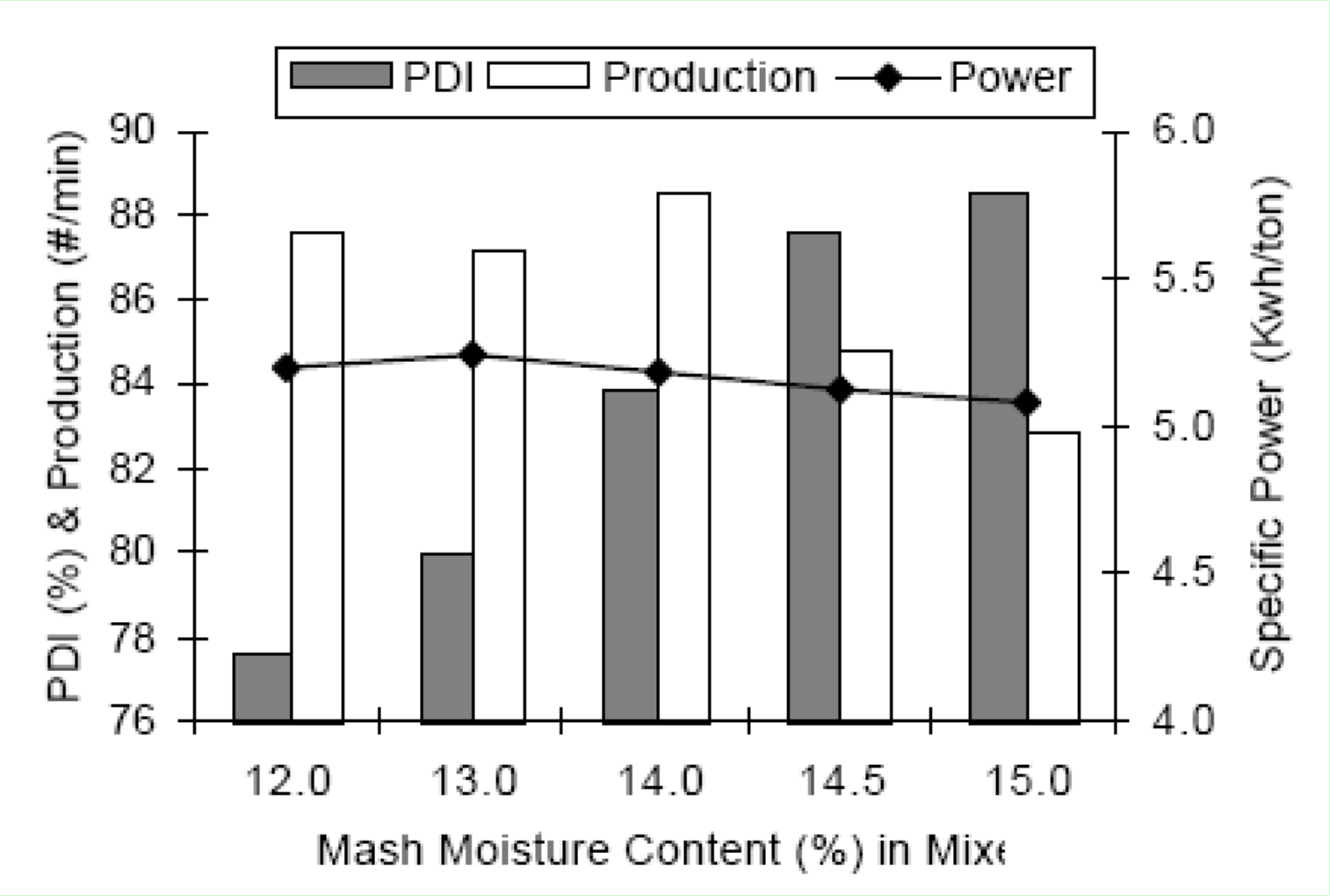


Adding Moisture before Pelleting

Fairchild and Greer (1999) have demonstrated that increasing the moisture content of mash feed at the mixer subsequently decreased pellet mill energy consumption and increased pellet durability.

Fairchild, F., and D. Greer. 1999. Pelleting with precise mixer moisture control. Feed Int. 20(8):32-36.

The Effect of Cold Mash Moisture Content on a Pellet Mill Operation



Study by Fairchild and Greer

They found that by

- increasing feed mash moisture at the mixer by 3% can increase pellet durability by 10%, and
- decrease pellet mill energy usage by 2.3%,
- Resulting in
  - improved pellet quality
  - reduced milling cost

Adding Moisture to Broiler Diet

Moritz, J. S., *et. al*., (2002) reported that

adding moisture to a corn-soybean-based broiler diet may significantly increase pellet mill production rates while maintaining similar pellet durabilities and fine percentages

J. S. Moritz, K. J. Wilson K. R. Cramer, R. S. Beyer, L. J. McKinney, W. B. Cavalcanti, and X. Mo (2002) J. Appl. Poult. Res. 11:155-163

Study by Moritz, *et. Al.*

They also found that increasing the water to starch ratio before pelleting significantly improved starch gelatinization which may aid in creating a more durable pellet.

Add Moisture to Cold Mash

Muirhead (1999) found that adjusting cold mash moisture to 14 percent through mixer water addition optimized pellet mill operation and pellet durability

Muirhead, S. 1999. Precision in Mash Moisture Management Improves Pellet. FEEDSTUFFS, volume 71, number 10. Miller Publishing Co., Carol Stream, Ill.

Benefits of Increasing Moisture before Pelleting

- Keep high moisture condition as closely as possible around the feed particles
- Allow higher temperature in the conditioner and improves starch gelatinization resulting in improved binding of feed particles and better pellet quality
- High moisture helps lubricating the passage through the die
- Lower energy required for squeezing the feed through the die
- Faster pellet production

Function of Klinofeed® in Pelleting

- Klinofeed® particles removes moisture droplets in the steam so as to raise the temperature higher to achieve better starch gelatinization.
- Klinofeed® particles distribute evenly among the feed particles and maintain high moisture condition surrounding feed particles.
- Klinofeed® particles helps enhance moisture.
- Klinofeed® particles cleanses the passage wall in the die.

Effect and Benefits of Klinofeed® in Pelleting

- **1. Improves pellet quality**

  - Higher moisture improves starch gelatinization for better binding of feed particles and improved the pellet quality in both hardness and durability

- **2. Facilitates pellet production**

  - High mositure lubricates the passages in the die for faster feed pellet production
  - Cleansing of the die passage improves feed throughput

Effect and Benefits of Klinofeed® in Pelleting

- **3. Cleans the die passage way during pelleting**
  - Easier maintenance of die, no sticky mess to clean up
- **4. Saves energy cost**
  - Easier pellet passage
    = Reduced Energy Consumption
    = Cost Savings

Klinofeed® Helps Optimizing the Pellet Cooling Process

- Retains moisture uniformly within feed pellets
- Optimizes the moisture content of finished feeds by avoiding excessive moisture loss.
- Surface condensation risk is minimized and free water activity of the feed is reduced
- Feed shelf life is increased.
- Better pellet quality (assessed by durability test) is obtained.

Additional Benefit of Klinofeed® in Pellet Cooling Process

- Reduces moisture loss during cooling
  = Reduces weight loss
  = Improves profit gain
  (every tiny bit counts)

(trials on going)

Conclusion: Klinofeed®
Is An Effective Pellet Binding Enhancer

Klinofeed®

- Removes moisture droplets for possible temperature increase in the pre-conditioner
- Keeps moisture closely around feed particles
- Improves binding of feed particles by increasing starch gelatinization
- Facilitates the feed squeezing through the die passage
- Saves energy during the pelleting process
- Prolongs working life of the die
- Increases pellet production rate
- Reduces pellet weight loss

Klinofeed® Saves Costs

Through **savings** in

- **power consumption**,
- **faster production,** and
- **reduction of weight loss.**

Klinofeed® provides the

extra cost savings

crucially required in this era of ever-rising energy cost.

Korean Trial

- Feed manufacturer : H Feedmill
- Trial feed : Duck feed (pellet)
- Trial condition : Wheat 10% + Pellet binder(0.3%) in feed
- Trial date : Jan. 18. 2008

Klinofeed® as a Pellet Binding Enhancer

Product Information	Company	Distributor	A	B
	Product Name	Klinofeed®	Brand A	Brand B
	Ingredient	Heulandite	Guar gum	Gelatine
Performance (ton/hour)		10ton	10ton	8.6ton
Fines (%)		7.9	8.0	5.5
Hardness Index		4.8	4.7	4.4
PDI		96.2	96.3	96.7
Price (per kg) ratio		1	2.2	2
Dosage		0.3%	0.3%	0.3%

Korean Experience - Conclusion

Results of 48hours after production of feed (Keeping in sample bag)

Product	Klinofeed®	Guar gum	Gelatine
Gravity	.644	.637	.634
Hardness	4.0	4.2	4.0
Fines (%)	4.0	7.4	2.5
PDI	97.2	97.4	97.8

No difference among the 3 products, but Klinofeed® is most economic

KLINOFEED as Pellet Binder (Korean Trial 2)

Parameter	Treatment	1	2		3
	Product	Klinofeed®	BrandX		BrandY
	Ingredient	Heulandite	Guar gum		Lignosulfonate
Hardness Improvement		16%	16%		19%
PDI Improvement		17%	0%		17%
Price (per kg) Ratio		1	-		0.8
Dosage （kg / ton）		3	2		10

Conclusion

: There is slight difference with lignosulfonate group but with cost consideration, Klinofeed is still the best choice.

: Distributor succeeded in making contract with this feed mill for 13tons Klinofeed per month.

Klinofeed®

Safety Features

- Contains **no harmful substances**, **e.g.**, :
  - Lead
  - Quartz
  - Dioxin
- Can be used **continuously without interruption**
- **No withdrawal** is required
- **Absolutely safe** to Human and Animals
  - Approved by WHO as food additive (Reg No. EU 554)
  - Approved by EU as feed additive (Reg No. E 568)

GMP Certificate

Station fédérale de recherches en production animale
Eidgenössische Forschungsanstalt für Nutztiere
Swiss Federal Research Station for Animal Production
Stazione federale di ricerche per la produzione animale

CH - 1725 Posieux,
Tel. 026 - 40 77 111
Fax 026 - 40 77 300

23rd July 1999

numéro direct / Direktwahl 026 40 77 245
votre référence / Ihr Zeichen
notre référence / unser Zeichen DG-fo

To whom it may concern

CERTIFICATE

The Swiss Federal Research Station for Animal Production, Posieux, Switzerland, hereby certifies that the firm **UNIPOINT AG, Langenmoos 9, 8467 Truttikon, Switzerland**, is duly authorized, in conformity with the pertaining laws, to manufacture according to GMP and to sell throughout all parts of Switzerland and to export the products

KLINOFEED AND KLINOSAN

SWISS FEDERAL RESEARCH
STATION FOR
ANIMAL PRODUCTION
Feedstuffs and Additives
CH-1725 POSIEUX/FR

Dr. D. Guidon

Swiss quality

unipoint® ag

Versatile Functions of Klinofeed®

- Mycotoxin Binder
- Ammonia Remover
- Anti-caking Agent
- Pellet Binding Enhancer

PLUS

Many Other Benefits

ONE PRODUCT WITH MANY FUNCTIONS

Klinofeed®

ONE PRODUCT

TO ACHIEVE

MANY PURPOSES

Klinofeed®

ONE PRODUCT

TO BENEFIT

MANY CUSTOMERS:

- Farmers,
- Premix Manufacturers,
- Feed Concentrate Formulators, and
- Feedmills

Mycotoxin Binder

Protects Liver

Ammonia Remover

Klinofeed®

Deodorizes the Air

Improves Immunity

A Versatile Useful Multi-Purpose Product

Swiss quality

Unipoint AG, Switzerland

Anticaking Agent

Pellet Binding Enhancer

Improves Blood Quality