



# ▶ FEED ADDITIVES


- ▶ Prof.Dr. Pınar SAÇAKLI
- ▶ [psacakli@ankara.edu.tr](mailto:psacakli@ankara.edu.tr)

# Feed additives

- ▶ Products or microorganisms, except for feed ingredients and premixes, added to feed to improve feed quality and to prevent feeds from deterioration
- ▶ to improve the animals' performance & health
- ▶ to improve the characteristics of feed, for instance to enhance flavour, to make feed more digestible
- ▶ to improve digestion and microflora of digestive system
- ▶ Prevention of environmental pollution resulted from animal production
- ▶ .

# Conditions for feed additives

- ▶ 1-It should not cause cancer in both humans and animals. Therefore, it should not cause any negative effects on animal health and should not leave residues in animal tissues.
- ▶ 2- Toxic limit should be specified.
- ▶ 3-Since it is used in very small amounts, the determination methods to determine the small amounts should be specified.
- ▶ 4-A cheating should not occur at the end of its participation.
- ▶ 5- It should not pollute the environment and should be used economically for performance-enhancing purposes in animals, otherwise it should not be used.

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- ▶ Feed additives may not be put on the market unless they have been authorised following a scientific evaluation carried out by EFSA demonstrating that the additive has no harmful effects on human and animal health and on the environment.
  - ▶ Authorisation, marketing and use of feed additives is regulated according to
  - ▶ Council Regulation (EC) [1831/2003](#) about additives for use in animal nutrition

# Clasification of Feed Additives

- ▶ 1. Technological additives
- ▶ 2. Sensory additives
- ▶ 3. Nutritional additives
- ▶ 4. Zootechnical additives
- ▶ 5. Mycotoxin binders
- ▶ 6. Anticoccidials and histomonostats

# 1. Technological additives

- ▶ Antioxidants
- ▶ Preservatives
- ▶ Emulsifiers
- ▶ Pellet binders

# Antioxidants

- ▶ Unsaturated fatty acids (vegetable oils, fish oil)
- ▶ vitamin A,D,E
- ▶ Pigments
- ▶ Oxidation -----loss nutritional value
- ▶ Temperature
- ▶ Heavy metals (Fe---catalayse oxidation )

# Antioxidants

- ▶ **Protection of feed from oxidation**
- ▶ -Grains should be stored as whole
- ▶ Grinding increases surface feeds exposed to heat, light, metals



# Antioxidants

- **Antioxidants**
- Butyleted hidroksi annisole (BHA),
- Butyleted hidroksi tolien (BHT),
- Etoxiquin (EQ),
- Vitamin E ( $\alpha$ -tokoferol),
- Ascorbic acid,
- Gallic acid salts

# Presevatives

- ▶ Allow feeds to be safely stored and used for a longer period of time by preventing the organic materials in the feeds from being decomposed by microorganisms
- ▶ **Preservation methods:**
- ▶ Cold (freezing)
- ▶ Heat (Drying, pasteurisation, pelleting)
- ▶ **Preservatives (salt, sugar, organic acids)**


# Presevatives

- ▶ **Formic acid:** Milk replacer 0.3-0.5 % Allow milk to be stored for 3 days by increasing acidity
- ▶ **Ammonium propionate:** propionic acid salt added to feed according to its moisture content by 0.3-1.0 %
- ▶ **Calcium formate:** Lactic acid enhancer for silages
- ▶ **Propionic acid:** It has an irritating odor. It also causes abrasion in metals. For this reason it can be used as low as 0.3% and can be increased up to 4% especially against **Salmonella**. The abrasion effect of propionic acid disappears with salt forms of it.
- ▶ **Citric acid:** A natural fruit acid, completely harmless, odorless, Increases acidity by reducing pH in the digestive tract. It can be added for calf feeds at the level of 0.5-5.0%. This preparation provides stability in the intestinal flora

# Antifungals-Mold Inhibitors

- ▶ Molds are infected feeds before and after harvesting, during storage or feeding
- ▶ They produce toxic substances called mycotoxin
- ▶ Moisture content is important factor for mold growing (above 12%)



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- ▶ Types of Mycotoxins
  - ▶ 300-400 mycotxins are known
  - ▶ Aflatoxins
  - ▶ Deoxynivalenol (DON) or Vomitoxin
  - ▶ T2 toxin
  - ▶ Zearalenone
  - ▶ Fumonisin
  - ▶ Ocratoxin A

# Antifungals-Mold Inhibitors

- ▶ Organic acids are used as antifungal
- ▶ Control mold growth by changing the pH of the feed but
- ▶ Mycotoxins present in the feed are not destroyed by these mold inhibiting substances.
- ▶ *Organic Acids are used as antifungal*

# Toxin Binders

- ▶ Mycotoxines found in feedstuffs are can be removed from digestive tract by permanently attaching some binding agents Additives used for this purpose:
- ▶ Allimunocilicates HSCAS
- ▶ Bentonite == Clay
- ▶ Montmorillonite
  
- ▶ MOS (*Saccharomyces cereviciae* cell wall)


# Emulsifiers

- ▶ Emulsion: a suspension of small globules of one liquid in a second liquid with which the first will not mix.
- ▶ Emulsifier: A surface-active agent that promotes the formation of an emulsion (for homogen mixing of water and oil)
- ▶ -Dilution of whole milk
- ▶ -Preparation of milk replacer



**Figure 1. Nutritional emulsifiers in water environment**



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- ▶ **LECITINE** derived from rapeseed, sunflower and soybean
  - ▶ From egg yolk
  - ▶ Three different forms of the additive are produced:
    - ▶ \*\*Regular liquid lecithins,
    - ▶ \*\*Hydrolysed liquid lecithins and
    - ▶ \*\*de-oiled lecithin powder.

## Typical qualitative composition of Lecithine Products

	Phospholipids (%)	Glycolipids (%)	CHO (%)	Neutral lipids (%)	Free fatty acids (%)	Moisture (%)
<b>Regular liquid lecithins</b>	48-50	6-7	5-6	36-38	1	1
<b>Hydrolysed liquid lecithins</b>	44-46	6-7	5-6	36-38	5	1
<b>De-oiled lecithin powder</b>	75-76	12-14	7-9	1-2	1	1

# Pellet Binders

- ▶ Improved animal performance
- ▶ Decreased feed wastage
- ▶ Reduced selective feeding
- ▶ Improved bulk density
- ▶ Better material handling characteristics
- ▶ Destruction of deleterious organisms
- ▶ Feed dust/disease control

## **Good quality pellets**

**It is not always easy to make a good quality pellet**

# Pellet Binders

<b>Binders</b>	<b>Maximum usage level %</b>
<b>Lignosulfonate</b>	3.00
<b>Bolus alba</b>	3.00
<b>Carboxymethylcellulose</b>	0.30
<b>Polymethyl carbamide</b>	0.25
<b>Mollasses</b>	2-5
<b>Bentonit (Clay)</b>	1-2

## 2. Sensory additives

-Flavoring

-Coloring : carotenoids

egg yolk

### 3. Nutritional additives

- ▶ Such additives supply specific nutrient(s) required by the animal for optimal growth.
- ▶ Vitamin
- ▶ Amino acids
- ▶ Trace minerals
- ▶ NPN materials: (urea) 42-46 % N

## 4. Zootechnical additives

- ▶ Enzymes
- ▶ \*Probiotics
- ▶ \*Prebiotics
- ▶ \*Organic acids
- ▶ \*Herbal extract



# Enzymes

- ▶ Protease
- ▶ Lipase
- ▶ Amlase
- ▶ Cellulase
- ▶ Phytase
- ▶ Polysacharidases (Glucanase, arabynoxylanase)

# PROBIOTICS



# The commonly used probiotics

- ▶ *Bacillus*,
- ▶ *Lactobacillus*,
- ▶ *Lactococcus*,
- ▶ *Streptococcus*,
- ▶ *Enterococcus*,
- ▶ *Pediococcus*
- ▶ *Bifidobacterium*,
- ▶ *Bacteroides*,
- ▶ *Pseudomonas*,
- ▶ yeast,
- ▶ *Aspergillus*,
- ▶ *Trichoderma*, etc.

# PREBIOTICS

- ▶ A prebiotic is defined as a selectively fermented dietary ingredient that results in specific changes in the composition and/or activity of the gastrointestinal microbiota, thus conferring benefit(s) upon host health (Gibson et al., 2004)
- ▶ Oligosaccharides ( FOS, MOS)
- ▶ Polysaccharides
- ▶ Natural plant extracts
- ▶ Protein hydrolyzats



# Organic acids

Carboxylic acids including fatty acids and amino acids, which have the chemical structure of R-COOH with acidic properties

- ▶ Organic Acids are weak Acid & do not disassociate completely in water
- ▶ Organic acids used in animal diets as feed additives

SCFA	
Formic (C1)	Lactic
Acetic (C2)	Malic
Propionic (C3)	Tartaric
Butiric (C4)	Fumaric
	Citric

# ORGANIC ACIDS

- ▶ **Butyric acid**
- ▶ Butyric acid ----Beneficial effects on performance
- ▶ Decrease NE caused by *C. perfringens*
- ▶ Energy source for gut epithelial cells,
- ▶ Stimulate epithelial cell proliferation and differentiation Anti-inflammatory effects
- ▶ Strengthen the gut mucosal barrier by increasing production of AMP
- ▶ Butyric acid, not only antibacterial but also an AGP-replacement effect.

## PLANT EXTRACTS (PHYTOBIOTICS)

- ▶ Plant materials are used widely in traditional systems of medicine
- ▶ Antimicrobial,
- ▶ Antiinflammatory,
- ▶ Antioxidative,
- ▶ Antiparasitic activities

## Many plants have beneficial multifunctional properties derived from their specific bioactive components

- ▶ Biologically active constituents of plants are secondary metabolites,
- ▶ Terpenoids      Phenolics      Ethers
- ▶ Glycosids      Alkaloids      Lactons
- ▶ Ketones      Esters



Plant extracts are generally considered safe and effective against certain bacteria. They are extensively used in feed as growth promoters and health protectants

Bitki ismi	Kullanılan kısmı	Aktif maddesi	Etki şekli
Kimyon (cumin)	çekirdek	Cuminaldehit	Sindirim uyarıcı
Anason (anise)	tohum	Anethole	Sindirim uyarıcı
Karabiber (pepper)	meyva	Piperine	Sindirim uyarıcı
Hardal (mustard)	tohum	Allylisothiocyanate	Sindirim uyarıcı
Zencefil (ginger)	rhizoma	Zingerole	Sindirim uyarıcı
Sarımsak (garlic)	soğan	Allicin	Sindirim uyarıcı, antiseptik
Adaçayı (sage)	yaprak	Cineole	Sindirim uyarıcı, antiseptik
Defne (bay laurel)	yaprak	Cineole	İştah artırıcı, sindirim uyarıcı, antiseptik
Kekik (thyme)	bütün	Thymol, Carvacrol	Sindirim uyarıcı, antiseptik, antioksidan
Tarçın (cinnamon)	kabuk	Cinnamaldehyde	İştah artırıcı, sindirim uyarıcı, antiseptik
Karanfil (clove)	çiçek	Euganol	İştah artırıcı, sindirim uyarıcı, antiseptik
Kişniş (coriander)	çekirdek, yaprak	Linalol	Sindirim uyarıcı
Hindistan cevizi (coconut)	tohum	Sabinene	Sindirim uyarıcı ve ishal önleyici
Biberiye (rosemary)	yaprak	Cineole	Sindirim uyarıcı, antiseptik
Nane (mint)	yaprak	Menthol	İştah artırıcı, sindirim uyarıcı, antiseptik

## 5. Coccidiostats and Histomonostats

These products are used to control intestinal health of poultry through direct effects on the parasitic organism

Eimeria

# Coccidiostats

## ▶ 1-Ionophors

- ▶ -Salinomycin
- ▶ -Monensin
- ▶ -Narasin
- ▶ -Maduramicin
- ▶ -Semduramicin
- ▶ -Lasalocid

## ▶ 2-Chemicals

- ▶ -Robenidin
- ▶ -Diclazuril
- ▶ -Nicarbazin+Narasin
- ▶ -Decoquinate
- ▶ Nicarbazin