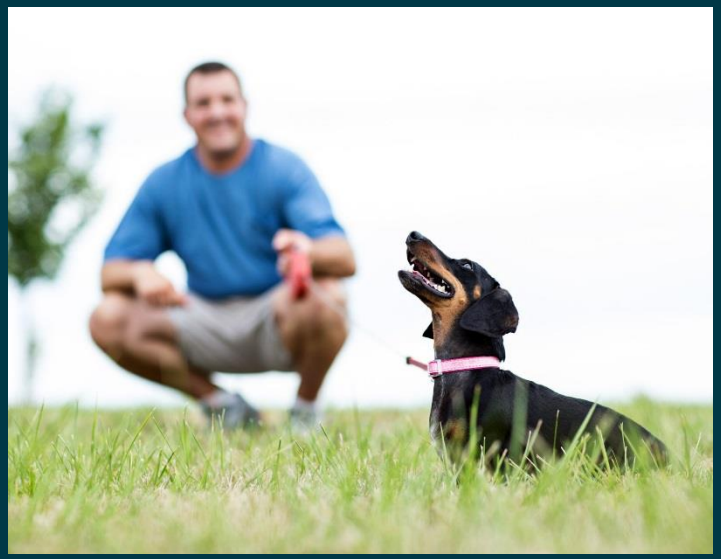
APPLICATION OF POWDERS AND LIQUIDS AFTER EXTRUSION: RISKS AND BENEFITS IN NUTRITION, PROCESSING AND COST

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Introduction / Objectives

- General items about feline & canine palatability
- Overview of the extrusion process
- Nutrition and its relation to palatability
- What is a palatability enhancer (PE)?
- What drives the cost of a PE?
- Coating systems
- How do you know if your chosen coating system is doing what it should?

General Items of Feline Palatability & Nutrition

As obligate carnivores, choose higher protein diets over lower protein diets. Their taste is “tuned” to detect compounds in animal tissues (amino acids, peptides, etc.).

More likely than dogs to avoid spoilage aromas.

Lack lateral jaw movement; texture and size are very important.

Lack molars, and cannot grind their food.

Surface texture plays a role in palatability. Different breeds pick up their food differently with their tongue.

In PAL testing, tend to consume food from both bowls. First choice is less tightly linked to total consumption.

Automated feeding stations provide ability to examine rate of eating or eating patterns over time.

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General Items of Canine Palatability & Nutrition

Tend to respond to a wider variety of flavors, including sugar.

Appear to prefer stronger, roastier aromas.

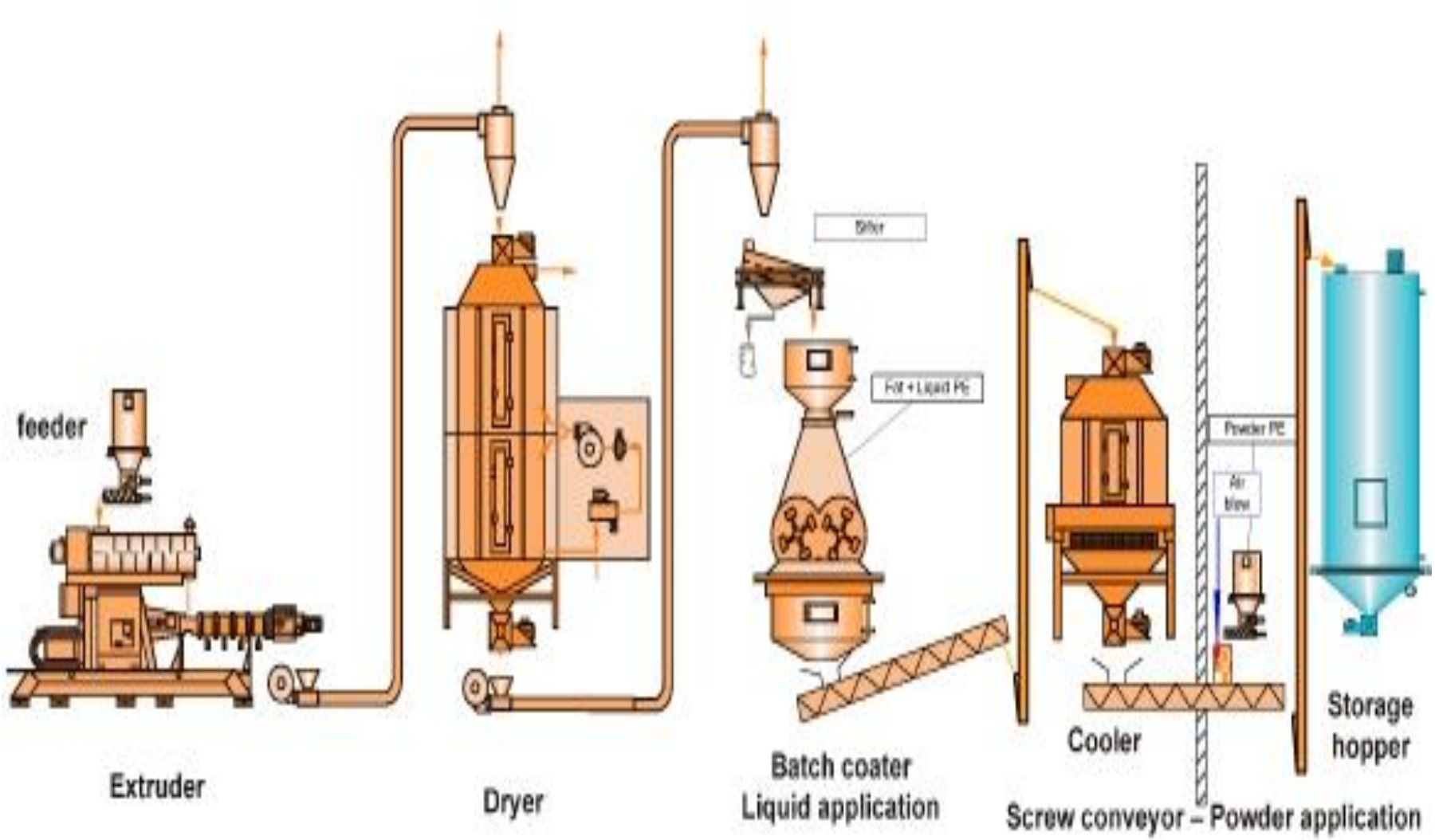
Tend to choose diets based on aroma. PAL testing shows a strong link between first choice and total consumption.

In PAL testing, they are more likely to go to one bowl and stay there. Feeding time is generally 20 minutes.

Prefer liquid + dry palatant combinations. Generally, prefer liquid over dry palatants.

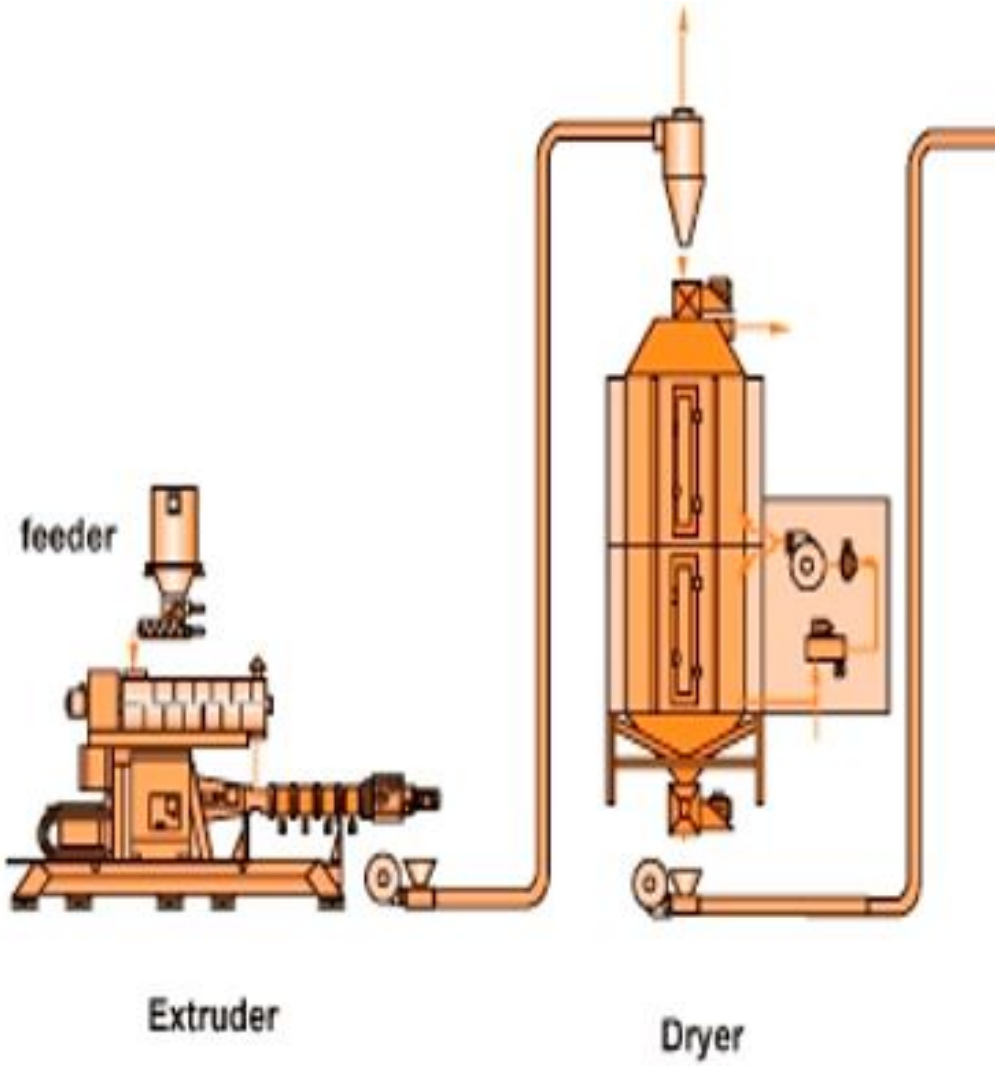
A dog's sense of smell is 10x to 200x more powerful than a human's sense of smell.

Extrusion Process



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Pre-Extrusion & Extrusion Considerations



Adequate mixing of ingredients / hammer mill

Pre-conditioner items

- Resonance time
- Ingredient addition – MDM, etc.

Extrusion items

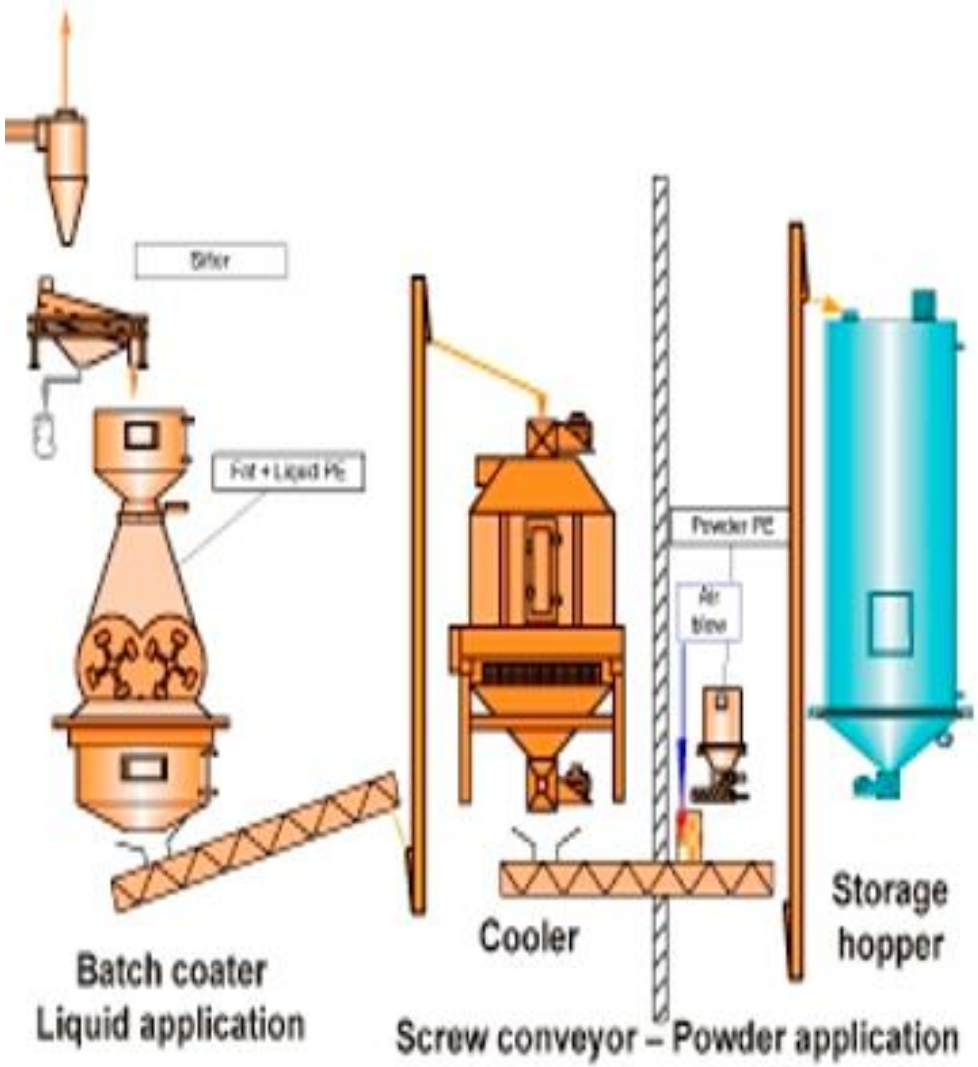
- Barrel / screw configuration
- Kibble size / shape

Dryer items

- Time / temperature
- Moisture

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Post-Extrusion Process



Evaluation of the major coating systems on the market

Coating application

Costs

Available space

Formulas / diets

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Palatants & Nutrition

Palatants are typically applied at low levels (<5.0%)

At these low levels, the nutritional impact is minimal

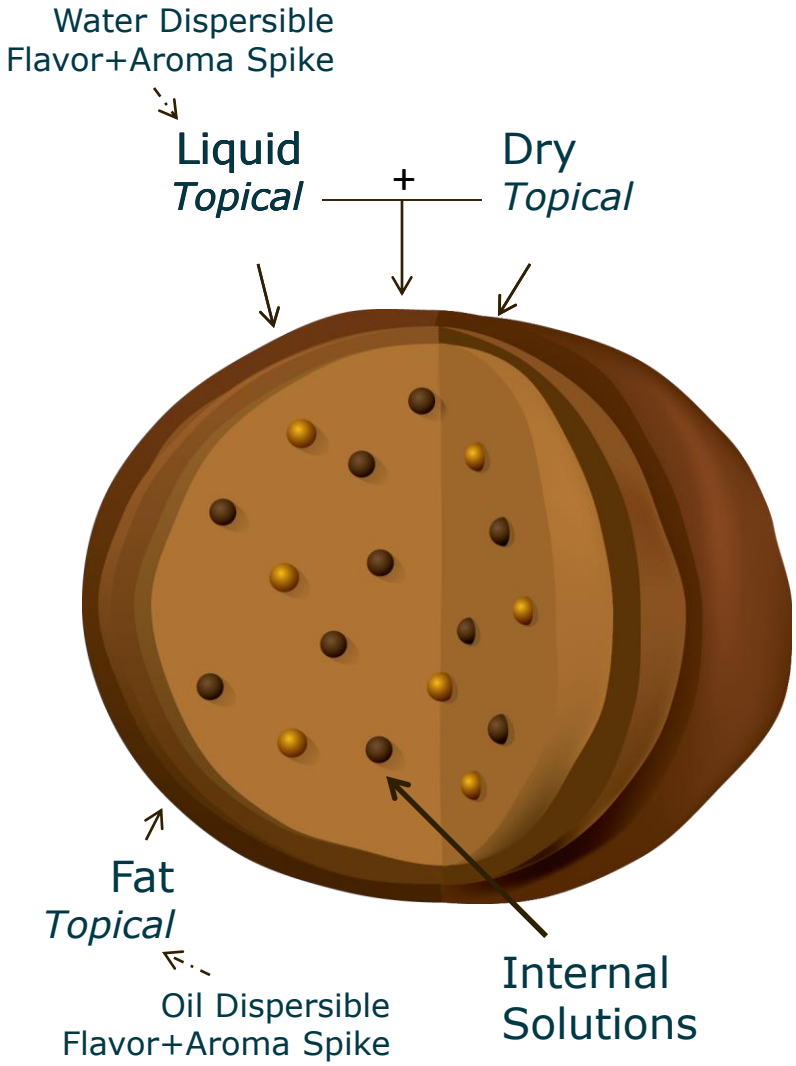
Uncoated [dry] diets have little to no appeal to the animal

- Uncoated kibble is generally bland and has very little volatile aromatic compounds
- Uncoated kibble vs. Coated kibble
- Cats and dogs will eventually eat an undesirable diet when given enough time

Palatants entice the animal the readily consume the [dry] diet, where they receive their daily ***nutritional*** needs

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Types of Palatability Enhancers



Liquid Palatants

Designed for use in Liquid System

Dry Palatants

Designed for topical application

Liquid + Dry Combos

Synergistic combination delivers maximum performance

On-Site Flavor Inclusions

Flavor, aroma spikes mixed in palatant or fat

Internal Palatants

Delivers performance or enhanced product profile when used internally by itself or in combination with a topical palatant

Cost of Palatability Enhancers

Liquid products are typically less expensive than dry products

[Animal] protein source/type may affect the cost

Packaging may affect the price

- Liquid: drums > totes > bulk
- Dry: 50#/25kg > supersacks

Product attributes may affect cost

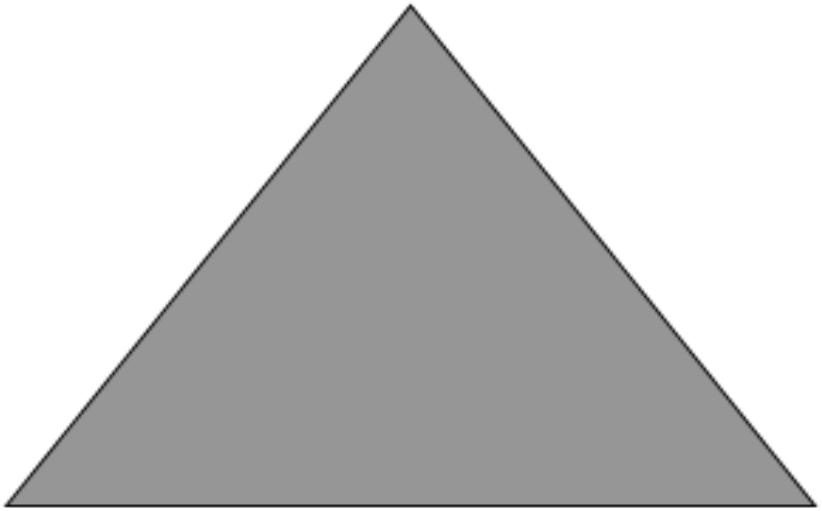
- Grain-Free: Example, soy flour
- GMO Status: Non-GMO materials are more expensive
- China-sourced: Non-China ingredients are more expensive

Level of palatability (super premium vs. premium vs. economy)

Palatability / Nutrition Triangle

Raw Materials

(Fats, oils, meals, palatants, etc.)



Texture, Size, Shape

Processing

(sME, etc.)

Age, Dental Health, Physical Environment, Overall Health

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Evaluation of the Major Coating Systems in Today's Market

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Different Types of Coating Systems on the Market

Hand-coating [drum] system (cement mixer)

[APEC] Spinning Disc / Auger System

[Spray Dynamics] Drum Coating System?

[Dinnisen] Vacuum Coating System

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Hand-Coating Drum System

Used to coat small batches (<100#)

Special nozzles mimic the fat / liquid application of the large-scale systems

Great for new Product Development and other coating evaluations

Inexpensive and easy to maintain

- Drums can/should be sanitized in between batches
- Multiple experiments can be completed in a timely fashion



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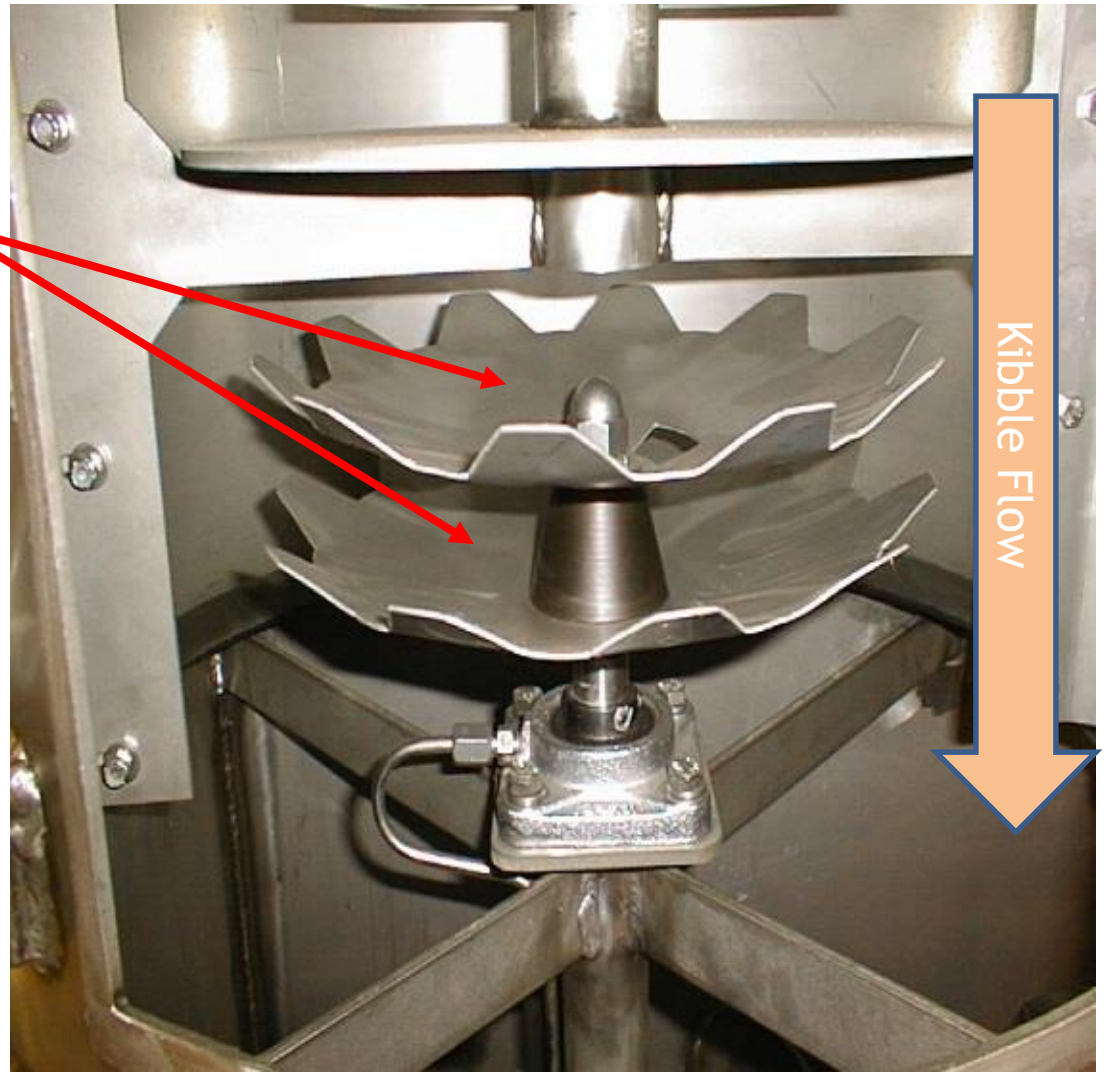
APEC Spinning Disk / Auger System

Multiple liquid palatants, fats or oils can be applied to the kibble

The discs spin as the liquid is dispersed on disc

The droplets coat the kibble as it flows by

Liquids controlled by a volumetric pump



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APEC Spinning Disk / Auger System (cont'd)

The coated kibble falls in to auger channel

The auger screws move the kibble & "rub" the kibble against each other

The length of the auger channel can affect the kibble appearance

The speed of the auger screws will also impact kibble appearance



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APEC Spinning Disk / Auger System (cont'd)

A dry palatant can be applied at the beginning of the auger channel

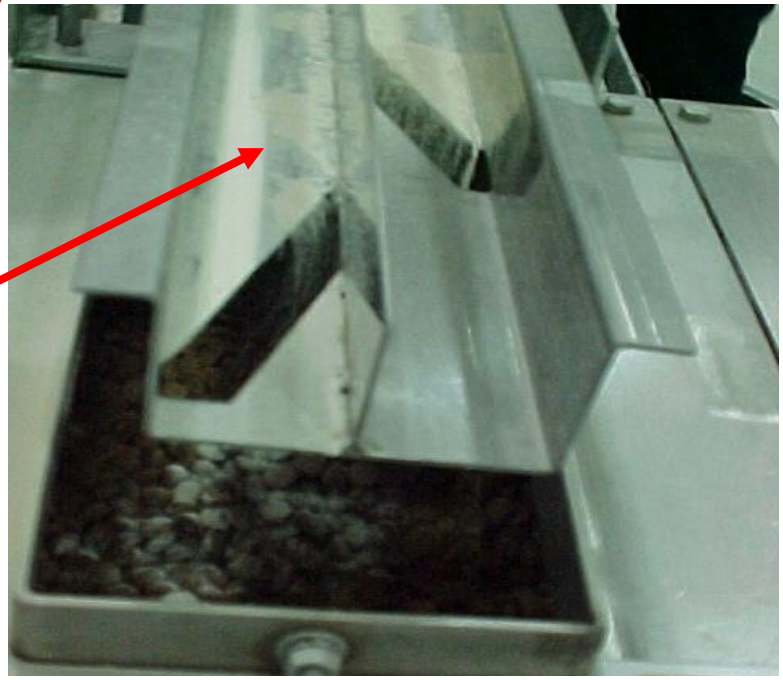
GF-1 Auger Volumetric Feeder

Powder flows out of the feeder auger

The shaker channel applies the dry powder on the kibble

The powder is dispersed on kibbles via the auger(s)





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Spray Dynamics Coating Drum

The kibble flows into the drum

Multiple liquids/fats/oils can be applied via a manifold

Baffles on the side of the drum mix the kibble

The angle of the drum determines how fast the kibble moves through the drum



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Spray Dynamics Coating Drum (cont'd)

A dry palatant can be applied via a volumetric auger channel



The dry powder is applied after the liquid(s) are coated

The length / size of the drum affects the kibble appearance



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Dinnissen Vacuum Coating System

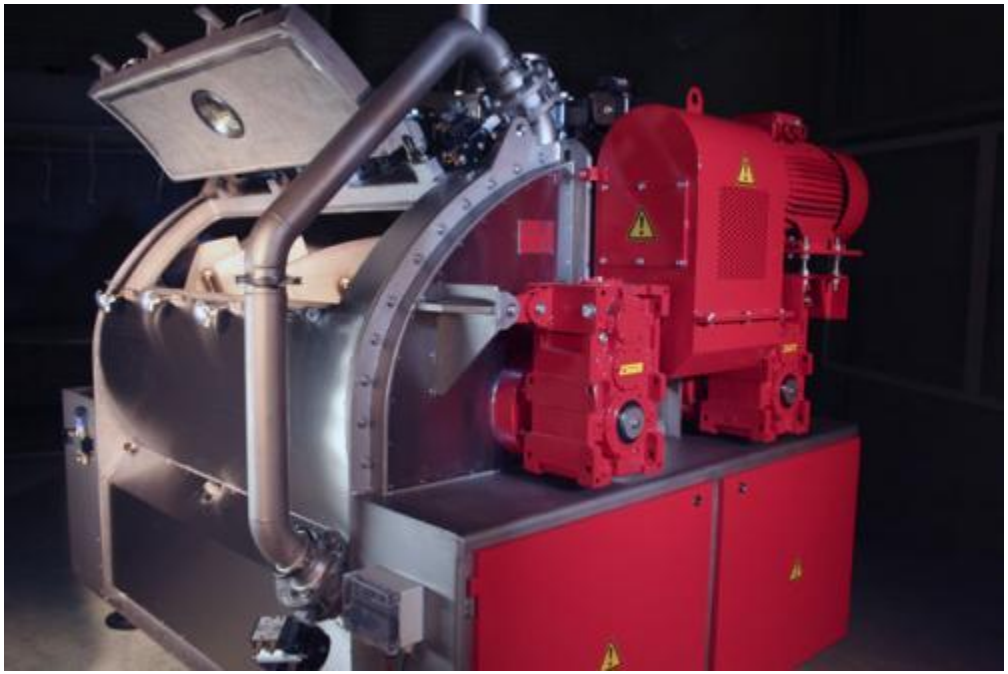
Batch system

Can topically coat fat / oil in excess of 20%

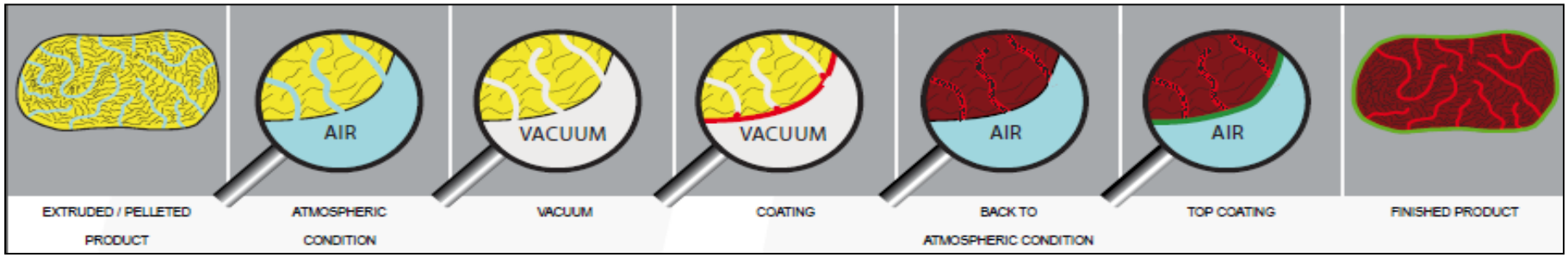
Kibble is metered into the hopper

Palatants are also metered in, as needed

Due to this metering, it’s the most accurate system of the 3



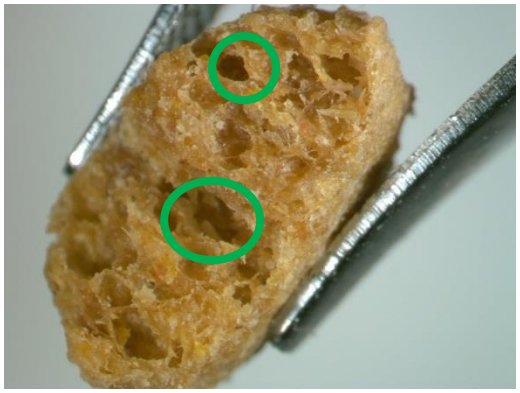
Dinnissen Vacuum Coating System



Kibble is very “porous” by its nature

The vacuum pulls the fat/oil & palatant(s) into the kibble’s cell structure

This aspect is what makes this system very applicable for the new high fat diets





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Coating Systems Overview

Production points

- In-Line vs. Batch system
- Available plant space
- Replacements parts, maintenance

Cost will vary by size, scope & options

System choice will vary by diet / formulation

Preventative maintenance schedule

- Calibration of pumps, feeders
- Cleaning – nozzles, air lines, auger channels
- Checking application accuracy

How to tell if your coating system is doing what it's supposed to do

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Use of a Visual Marker to Evaluate Coating Eveness

AFB has developed several methods to help evaluate palatant application

A powder blend containing potato protein, tapioca starch & a [dry] UV dye was used

This powder was applied to kibble at 1.0% (after 5.0% poultry fat) in the hand-coater, the APEC and the drum system

This method does not evaluate the % coating on the kibble

Conclusions from the Visual Marker Study



DRUM



APEC



HAND LIQUID

The drum appears to coat more evenly

The APEC appears to have the most uniform coating

When the UV was used in a liquid palatant, only the fat was “dyed” and showed specks

It was also discovered that each system takes time to equilibrate before the coating became consistent

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Evaluation of Coating Precision (%)

Kibble was coated with 5.0% poultry fat + dextrose

Samples pulled at T-0, 4, 8, 12, 16, 20 & 24 minutes

A dextrose analysis was conducted to check %

With numerous other variables, the APEC & Drum were very good

System / Minutes		% Glucose	Target
APEC	T-0	2.2	2.0% (Mean = 1.9)
	T-4	1.8	
	T-8	1.9	
	T-12	1.9	
	T-16	1.8	
	T-20	1.9	
	T-24	1.7	
Drum	T-0	2.3	2.0% (Mean = 2.6)
	T-4	2.8	
	T-8	2.2	
	T-12	2.7	
	T-16	2.5	
	T-20	2.8	
	T-24	3.1	
Hand Coater		2.4	2.3%

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Summary / Conclusion

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Questions?

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