Performance-Driving Parameters in Dog Palatants

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Overview

Purpose Statement

Introduction

- Pet Food Performance and Consistency

- Changing Market Landscape

- Continuous Improvement Program

Materials and Methods

Results

Conclusions

Purpose Statement

Identify specific parameters with strong and direct correlations to the performance of a liquid dog flavor

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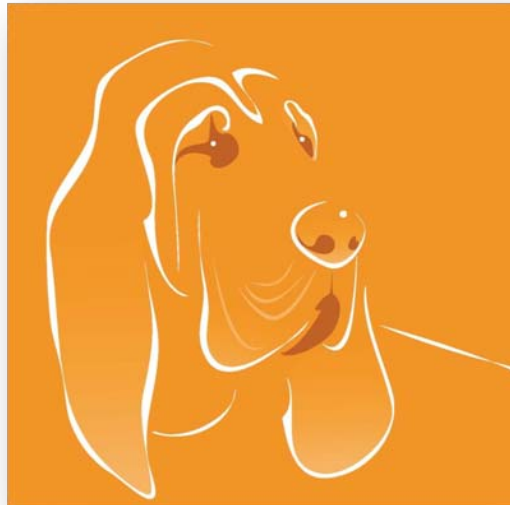- Continuous Improvement Program

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Pet Food

Different Species **–** Dog, Cat, Fish

Materials
– Meal, Vitamins, Minerals, Fat
– Palatants: Dry, liquid

Processing Conditions

In Process Checks and Controls
– Intermediates and Finished Products

Palatants

Complex systems – macro and micromolecules

Liquid

Dry

Functionality

- – Increase product acceptance
- – Enhance pet food taste and aroma
- – Mask potential undesired kibble attributes

Pet Food Performance
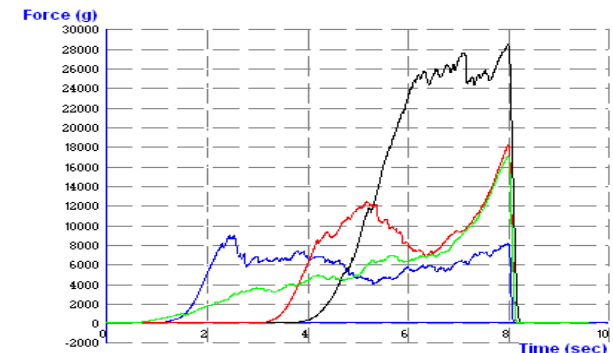
Customer defined and includes:

Palatability

Lot to Lot Consistency

Nutritional Benefits

Stability

Physico-chemical characteristics
- Chemical composition
- Physical characteristics – shape, size, color
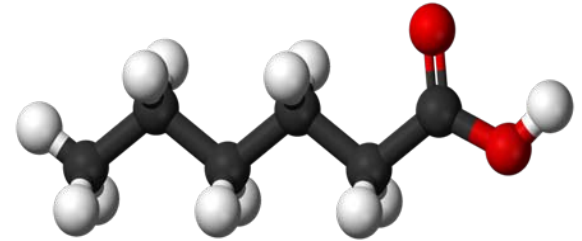- Texture – hardness, chewiness, flowability

Consistency and Quality Measurements

Proximates - Certificate of Analysis
includes:

Moisture

Protein

Fat

Ash

Microbiological Analysis

Issues:

Out of specification products

Correlations to performance:
Is Total Nitrogen always = Protein content?

Changing Landscape

Pet Food Customer Expectations

Time to Market

Innovative Products

Globalization

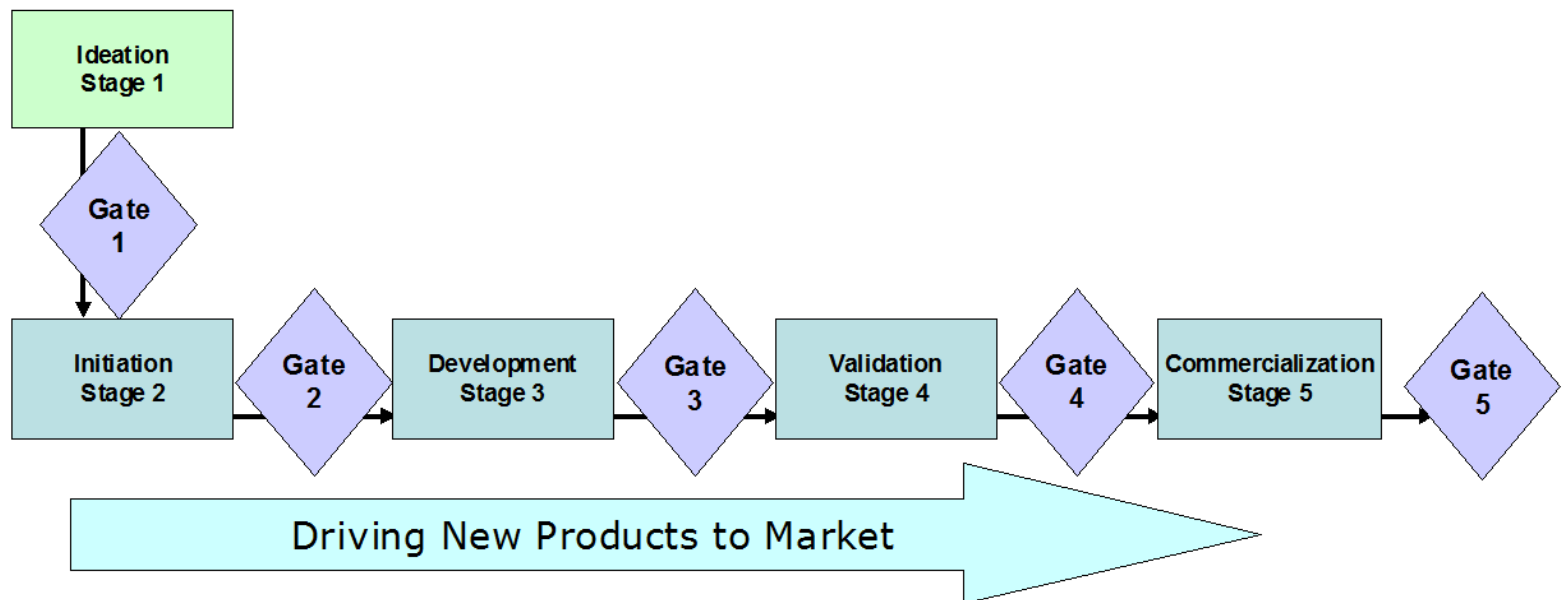Economy – Cost of Quality (COQ)

New Technological Opportunities

AFB's Approach

AFB Innovation Management (AIM) Process

Streamlined process for efficient project management. Project stays open until after one year of product commercialization.

Continuous Improvement Program

Product Champion Program

Comprehensive and extended approach

Identify performance related critical in-process and finished product parameters

Statistical correlations of parameters to performance

Standardized program for longer term monitoring and control of AFB products' performance and quality

Product Champion

Continuous Improvement Program

Incorporate performance correlated parameters for monitoring all products

Utilizing latest technologies for product consistency

Liquid and Dry products – Dog and Cat palatants

Monitoring to ensure excellent customer satisfaction

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Materials: Liquid Dog Product

Commercialized product

Multiple lots manufactured at various time periods collected

Familiarization with formulation and process steps

Corresponding batch sheets

Documentations and sample lots

Methods

Identify potential critical in-process parameters

Identify potential critical finished product characteristics

Palatability tests conducted

Analytical tests conducted

Correlation analyses performed for each parameter and diet's palatability

Methods: Representative In Process Parameters

Process Times

Process Temperatures

pH

Proximates

Methods: Representative Finished Product Parameters

Proximates – Protein, Fat, Moisture, Ash

Free Amino Acid Composition

Headspace (Volatile) Composition

Taste Profiling

Color

Methods:
Pal Test Analysis

Two bowl paired comparison test

22 x 2 Dogs

Expected performance of parity versus chosen target control

Intake Ratio (IR)
Amount [Consumed A/(Consumed A + Consumed B)]

First Choice (FC)
Percent Animals eating out of Bowl A first

Consumption Ratio (CR)
Amount [Consumed A/Consumed B]

Preference
Outside the range 0.45–0.55 IR

P-Value (p)
Probability that A is significantly different from B
At 95% confidence level, desired p value < 0.05

Methods: Free Amino Acid Analysis

- Waters AccQ.Tag method
- Utilizes 6-Aminoquinolyl-N-hydroxysuccinimidyl carbamate (AQC) as the derivatization reagent
- Stabilizes the AA by adding the quinoline tag (stable derivatives for one week)

Amino Acid   AQC

Derivatized Amino Acid   N-Hydroxysuccinimide (NHS)
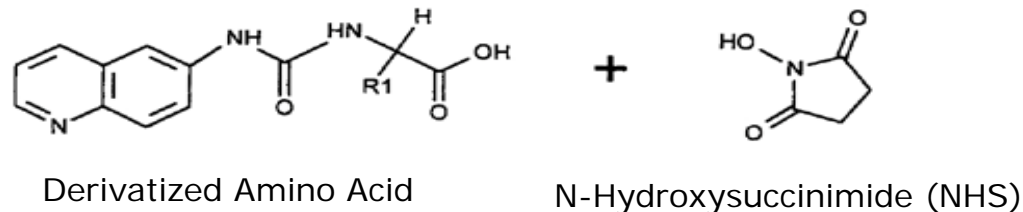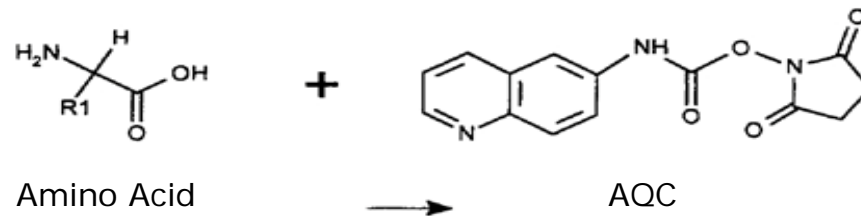
Methods:
Volatile Profile Analysis

Sample Preparation - SPME headspace using StableFlex DVB/Carboxen/PDMS 50/30 µm bonded fiber

Gas Chromatography using DB-5 Capillary Column with temperature programming

Detection by MS: EI Ionization mode

Methods:
Taste Profile Analysis

Measures non volatile chemical species (taste)

Chemical sensor array:
- Seven sensors optimized for food applications
- Specific sensors for assessing different taste attributes in food samples

Obtain overall and specific taste profile and pattern similarities or differences
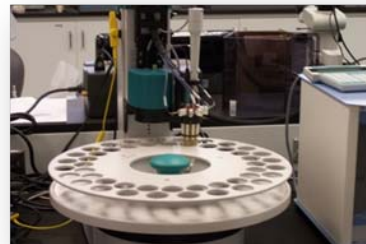
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Results: Pal Test Analysis

A-Ration	Intake Ratio (IR)	First Choice (FC)	Preference	p Value
LD-LOT1	0.51	0.52	8:7	0.413
LD-LOT2	0.54	0.66	9:6	0.159
LD-LOT3	0.55	0.63	6:5	0.208
LD-LOT4	0.74	0.70	15:2	0.000
LD-LOT5	0.48	0.55	6:7	0.353
LD-LOT6	0.47	0.35	4:7	0.291
LD-LOT7	0.38	0.37	5:9	0.011
LD-LOT8	0.59	0.64	11:3	0.019
LD-LOT9	0.51	0.53	8:5	0.423
LD-LOT10	0.43	0.35	6:6	0.089

Results: In Process Parameters (Correlations)
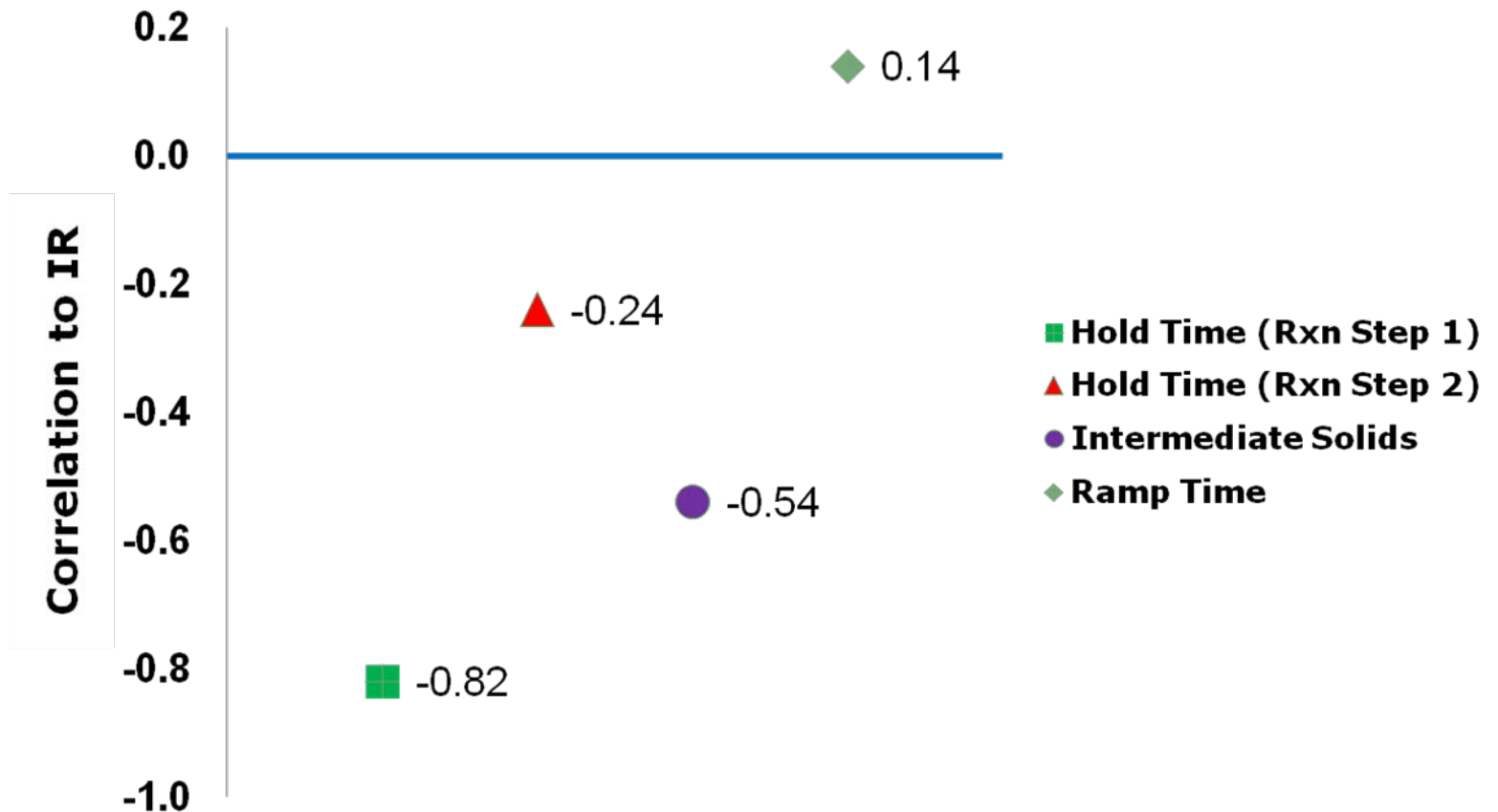
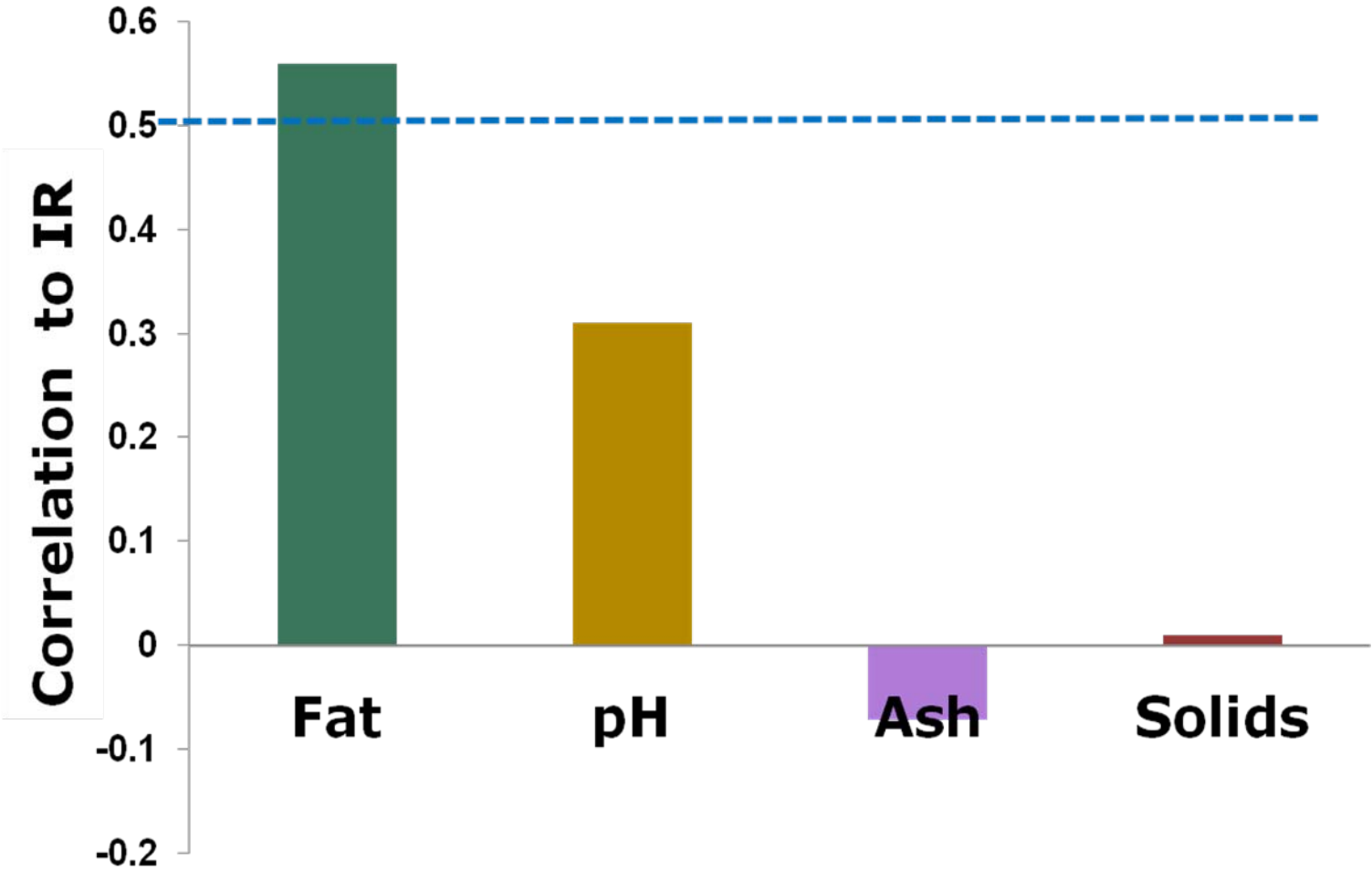Hold Time @ RXN Step 1 has a strong negative correlation to IR

Results

Finished Product Parameters

Results: Proximates

(Correlations)

Results: Free Amino Acids

	L2079A03	L2081A16	L2082A11	L2061A09	L2061A10	L2083A181	L1242T01	L2069A06	L2081A181	L2068A06	L12113A10
HIS	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.06
SER	0.12	0.12	0.10	0.11	0.10	0.11	0.09	0.10	0.12	0.09	0.12
ARG	0.19	0.20	0.18	0.17	0.17	0.17	0.14	0.15	0.15	0.15	0.19
GLY	0.09	0.08	0.08	0.08	0.08	0.08	0.06	0.07	0.07	0.07	0.09
ASP	0.21	0.20	0.18	0.20	0.18	0.19	0.16	0.17	0.21	0.16	0.22
GLU	0.27	0.23	0.23	0.24	0.23	0.22	0.20	0.16	0.20	0.16	0.20
THR	0.14	0.14	0.12	0.12	0.11	0.12	0.10	0.11	0.12	0.11	0.14
ALA	0.18	0.19	0.17	0.18	0.17	0.17	0.14	0.15	0.18	0.15	0.18
PRO	0.12	0.12	0.11	0.11	0.09	0.11	0.07	0.09	0.13	0.09	0.12
CYS	0.15	0.02	0.09	0.02	0.07	0.04	0.00	0.02	0.00	0.02	0.05
LYS	0.17	0.18	0.16	0.14	0.14	0.15	0.10	0.11	0.13	0.11	0.15
TYR	0.15	0.14	0.13	0.13	0.13	0.13	0.10	0.12	0.13	0.12	0.14
MET	0.54	0.47	0.48	0.46	0.47	0.44	0.36	0.50	0.41	0.50	0.55
VAL	0.18	0.18	0.16	0.17	0.15	0.16	0.12	0.14	0.17	0.13	0.18
ILE	0.14	0.15	0.13	0.13	0.12	0.13	0.09	0.11	0.14	0.11	0.14
LEU	0.32	0.33	0.30	0.29	0.28	0.30	0.24	0.27	0.29	0.26	0.33
PHE	0.17	0.17	0.15	0.15	0.14	0.15	0.12	0.14	0.14	0.14	0.17
Total Free AA (g/100g sample)	3.21	2.97	2.85	2.75	2.70	2.73	2.13	2.56	2.75	2.50	3.14

Petfood Forum

Petfood Industry

WATT

Free Amino Acids (Correlations)

	HIS	SER	ARG	GLY	ASP	GLU	THR	ALA	PRO	CYS	LYS	TYR	MET	VAL	ILE	LEU	PHE	Free AA	IR
HIS	1.0	0.77	0.99	0.95	0.72	0.64	0.92	0.83	0.69	0.6	0.93	0.93	0.69	0.82	0.86	0.93	0.94	0.92	-0.63
SER		1.0	0.76	0.8	0.98	0.5	0.94	0.94	0.94	0.32	0.76	0.88	0.46	0.96	0.95	0.93	0.88	0.9	-0.66
ARG			1.0	0.94	0.7	0.65	0.93	0.85	0.74	0.58	0.96	0.94	0.63	0.83	0.88	0.94	0.94	0.91	-0.62
GLY				1.0	0.78	0.67	0.92	0.83	0.76	0.68	0.87	0.94	0.73	0.89	0.89	0.92	0.94	0.96	-0.6
ASP					1.0	0.51	0.91	0.92	0.9	0.3	0.7	0.81	0.4	0.95	0.91	0.89	0.82	0.86	-0.59
LYS											1.0	0.92	0.45	0.81	0.87	0.91	0.87	0.86	-0.64
TYR												1.0	0.64	0.94	0.96	0.97	0.97	0.97	-0.75
MET													1.0	0.5	0.51	0.59	0.74	0.74	-0.33
VAL														1.0	0.99	0.95	0.91	0.93	-0.7
ILE															1.0	0.98	0.94	0.94	-0.72
LEU																1.0	0.98	0.96	-0.67
PHE																	1.0	0.98	-0.67
Total Free AA																		1.0	-0.65
IR																			1.0

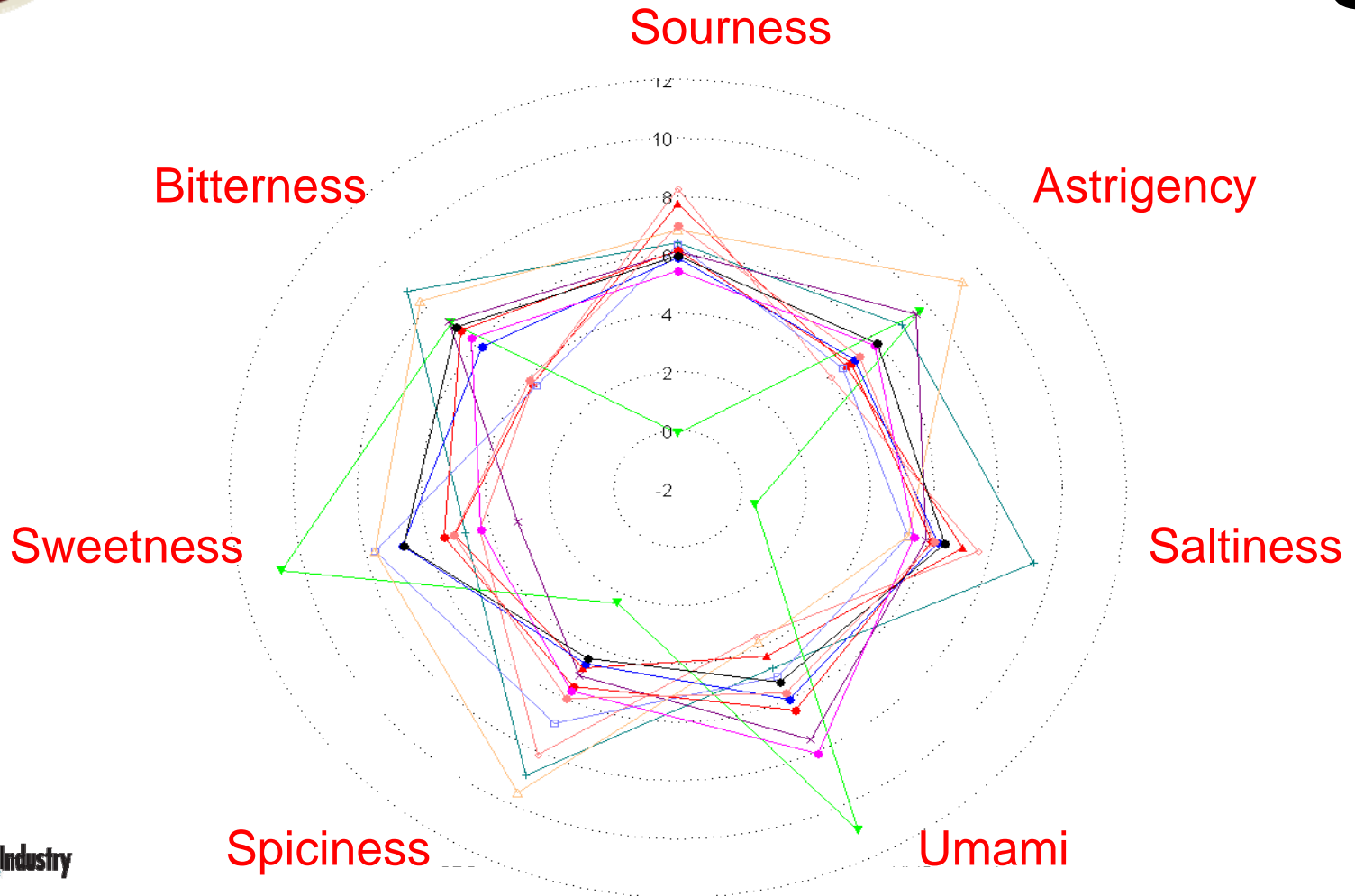## Alanine, Tyrosine, Valine, Isoleucine show strong correlations

Results: Headspace GCMS Analysis

(Correlations)
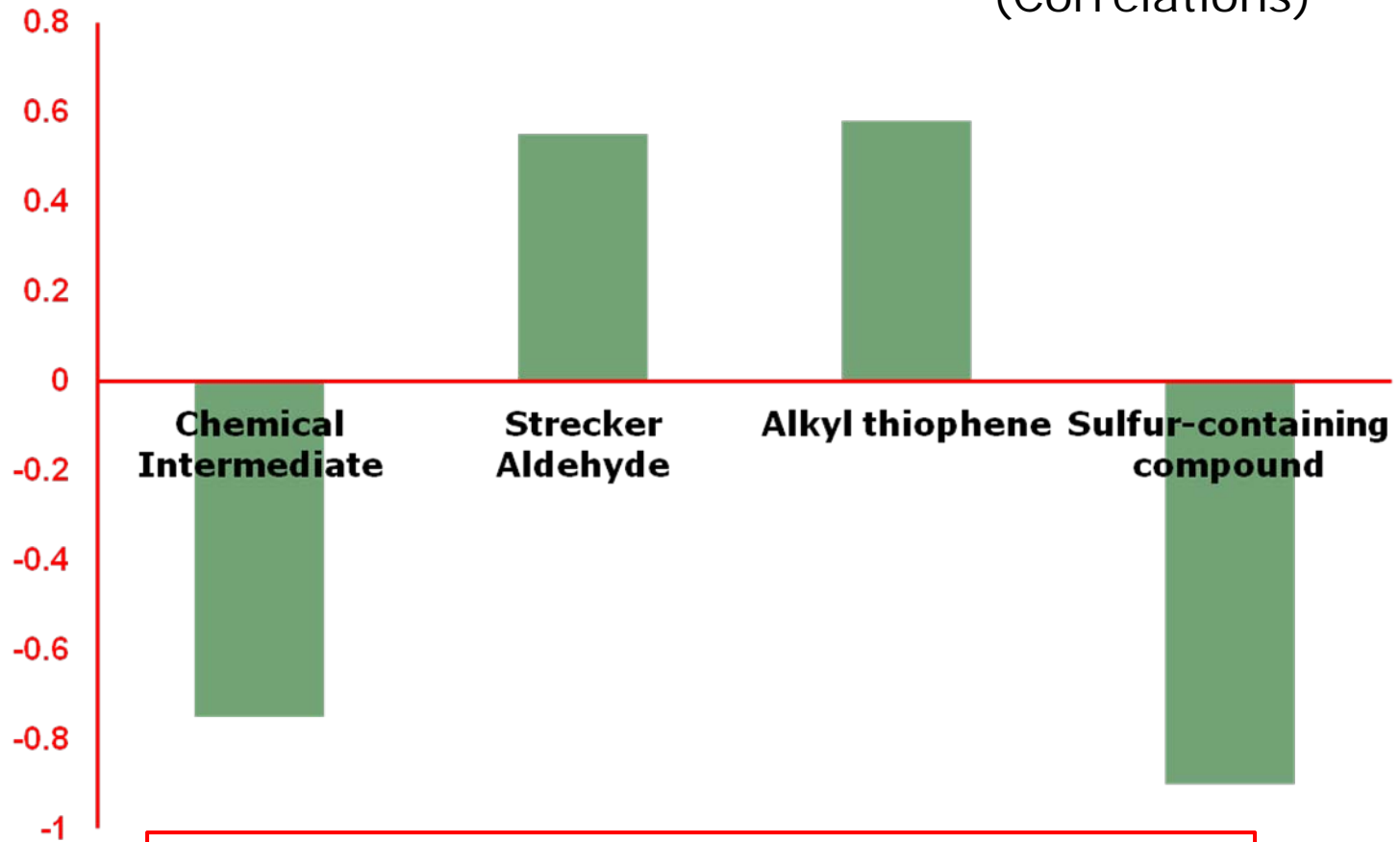
Multiple compounds identified with strong correlations to IR and FC

Results: Taste Profiling

Green sample has a different overall taste profile
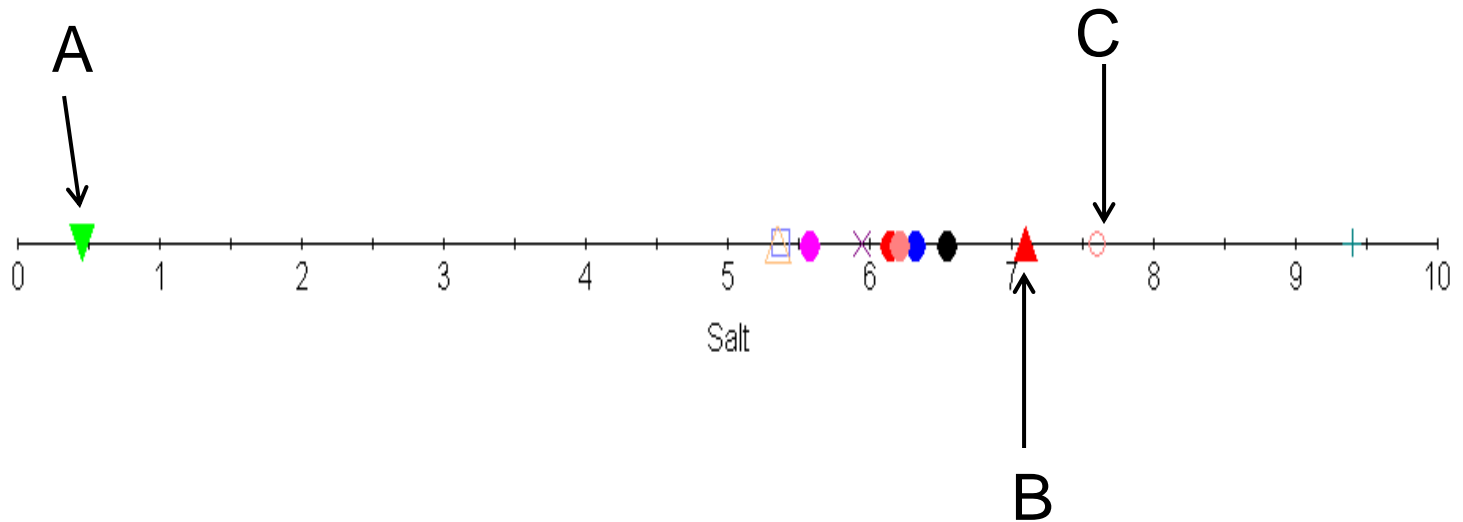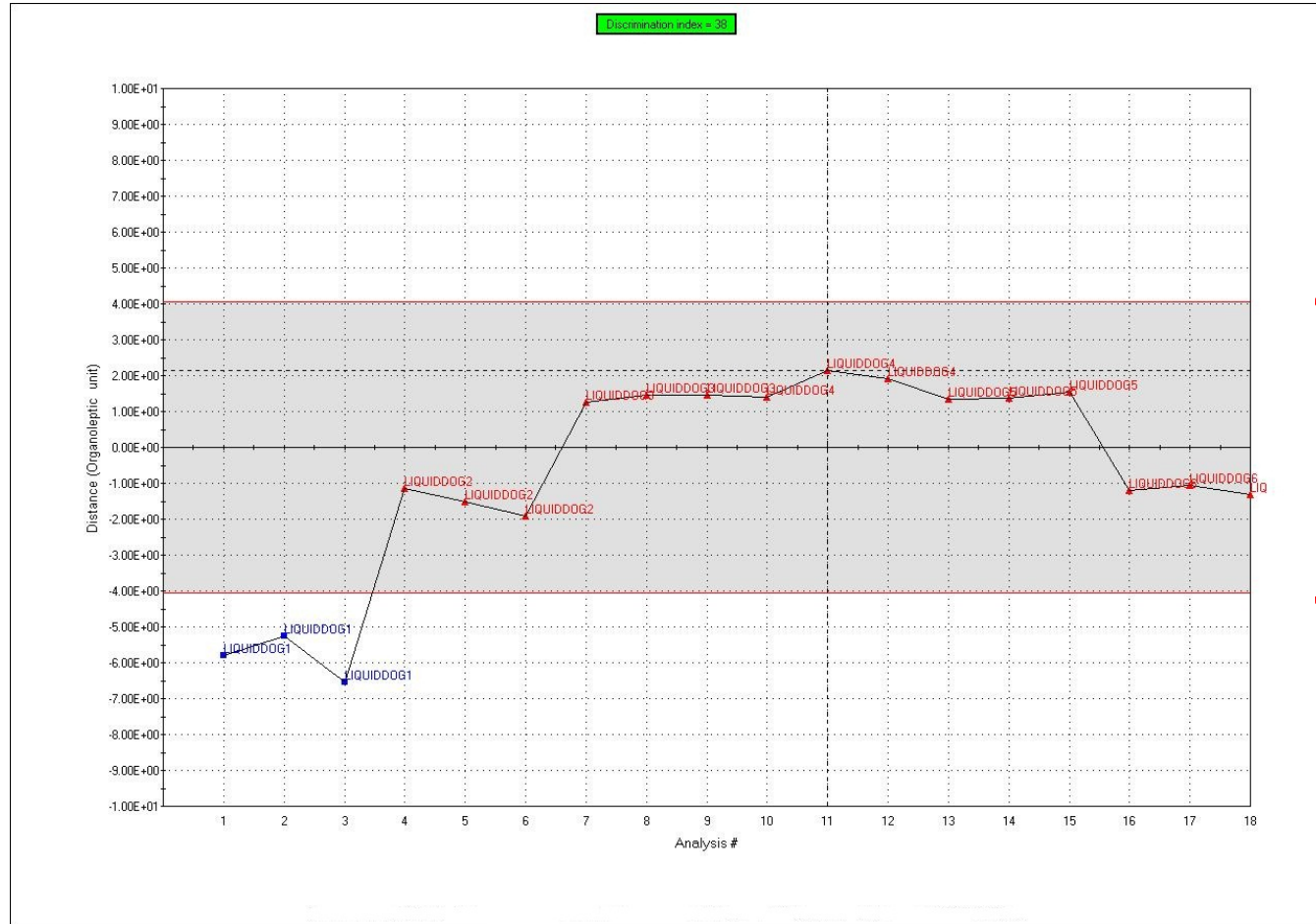
Results: Degree of Saltiness

Samples A, B, and C show significant differences in IR and FC to control

Overall Flavor Profile
Demonstrates Consistency

Shows min and max acceptable variation in ENT profile

Three replicates of each lot analyzed

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In process variables including processing hold time are critical performance driving parameters

Finished product characteristics including fat,

Traditional proximates alone do not completely define petfood performance

Degree of saltiness of dog product shows correlation to performance and consistency

Comprehensive and extended monitoring required for continuous customer satisfaction

Thank You

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