

DESIGNING THE TEXTURE OF SPOONABLE SALAD DRESSING & MAYONNAISE:

Solving Manufacturer's Challenges Through Data-Driven Formulation



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Market overview

The global mayonnaise and salad dressing market is a \$14.3B segment, with an average growth rate of 4-5% CAGR. However, while this average growth rate is typical of established regions such as North America and Western Europe, other emerging areas such as Eastern Europe, Latin America and MEA are growing by double digits rates as more consumers in these regions seek convenience and variety (Figure 1).

FIGURE 1: GLOBAL SALAD DRESSING MARKET RSP (\$)

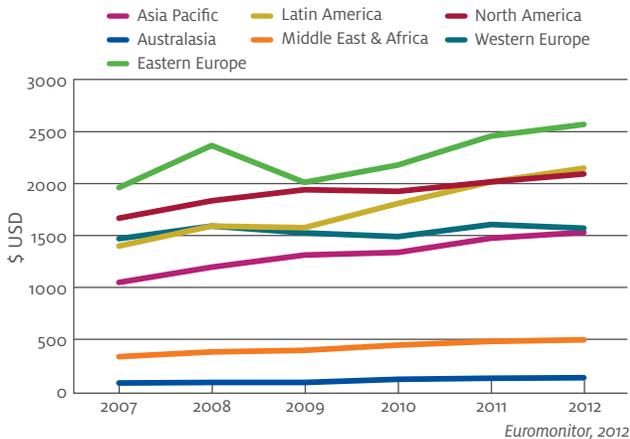
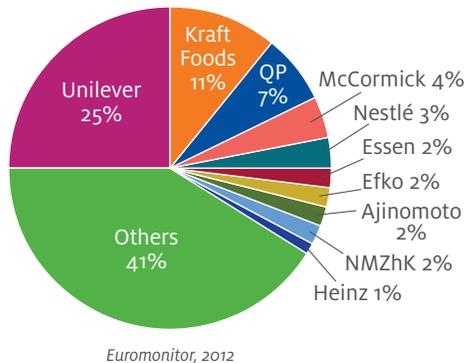


FIGURE 2: GLOBAL MAYONNAISE MARKET SHARE BY COMPANY



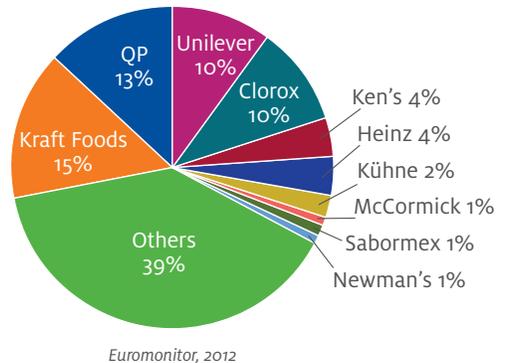
Reduced fat mayonnaise and salad dressings currently represent about 25% of the value of the overall market, yet only 15% of the volume. Additionally, reduced fat products actually command a 60% price premium over regular dressings, so it is important to produce a quality, tasty and acceptable product.

Manufacturers

The top five manufacturers of mayonnaise, all multinationals, represent nearly 50% of the global market. Next down the list are a number of large manufacturers that distribute to targeted countries, followed by a long list of smaller, more regional players. This illustrates the fragmentation of the rest of the market, which shows itself in the regional diversity in taste and texture for these staple products (Figure 2).

In looking at the global salad dressing market (Figure 3), the top 5 manufacturers again represent a little over 50%

FIGURE 3: GLOBAL SALAD DRESSING MARKET SHARE BY COMPANY



of the market, and 3 of the 5 are the same as the top global mayonnaise manufacturers. However, the other two large players in salad dressings are Clorox (Hidden Valley) and Heinz, most likely due to their large share of the pourable salad dressings, which are more predominant in the US market. Nestle and McCormick’s market share in dressings is lower than that of their share in mayonnaise.

Market drivers impacting the salad dressing segment

There are a number of key drivers affecting the salad dressing and mayonnaise segment, creating both opportunities as well as challenges for Dressing Manufacturers:

Market drivers from consumers

- **Health and wellness:** Healthy reduction of fats and oil, as well as the healthy addition of nutritional ingredients
- **Economic:** More pressure on the food dollar, more entertaining at home
- **Convenience:** Easy and fast to prepare
- **Information:** More demand for transparency on nutritional content

Manufacturer challenges

- **Health and wellness:** How to reduce fat, oil or calories without changing the taste, texture or eating experience; How to create value with added nutritional benefits
- **Economic:** How to reduce costly or price volatile ingredients with little change to their product, or risk to their brand
- **Regulatory:** Being able to achieve and support certain label claims

Global health and wellness trends in new product launches in salad dressings & mayo

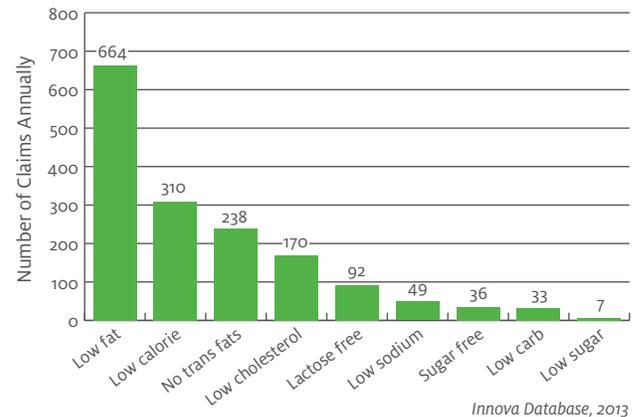
Health and wellness awareness and concerns are growing with consumers. As mayonnaise and salad dressings are tasty additions to most foods, manufacturers are challenged with creating products with reduced fat, sugar, carbohydrates and calories, yet deliver the same creamy texture and flavor experience.

Passive health claims

Due to an increased awareness of Health and Wellness, consumers are asking for good-for-you and better-for-you options in the products they select.

Accordingly, manufacturers responded with a number of new products that have “healthy reduction” or “passive” health

FIGURE 4: TOP 10 “PASSIVE” HEALTH CLAIMS FOR GLOBAL MAYONNAISE AND SALAD DRESSINGS

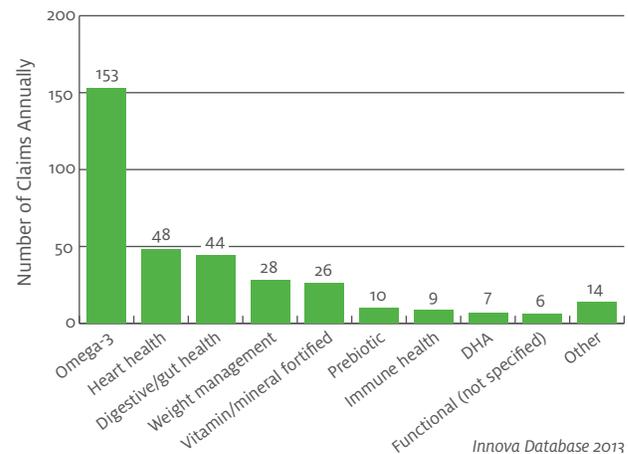


positioning claims associated with them, about 25% of all new product launches.

Innova conducted an Innova Database search of all salad dressing products launched globally, during the last four years (2009–2012) to understand which “passive” health claims were most predominant. Low fat was by far the largest label claim (twice that of the next popular), followed by low calorie, no trans fats, and then low cholesterol. Oil reduction remains a significant challenge for manufacturers — how to deliver as similar taste and texture experience compared to a full-fat dressing while reducing fat for nutritional label improvement or cost reduction (Figure 4). There seems to be a second emerging area of healthy reduction (and potentially consumer interest) in the salad dressing and mayonnaise segment, where there are claims around lactose free, sugar free, low carb and low sugar. Finally, as it is an issue in many foods, sodium content too is a concern for consumers, and a number of manufacturers are highlighting formulations with low sodium (Figure 5).

Active health claims

FIGURE 5: ADDED HEALTH POSITIONING FOR GLOBAL MAYONNAISE AND SALAD DRESSINGS



Another emerging trend is the addition of beneficial ingredients to salad dressings and mayonnaises that improve their healthiness. Ingredient conducted another Innova Database search on the same category globally, for the past four years, to understand which added health benefits were most featured. The addition of Omega-3 ingredients are by far the leading additive, and not surprising for these are oil-based products. This is followed by added ingredients for heart health, digestive or gut health, soluble fibers, weight management, vitamin/fortification and then prebiotics (which have their own category).

Heart health and weight management positioning claims are the result of both passive and active health ingredients (with clinical trial support) — such as low fat, low cholesterol with certain fibers.

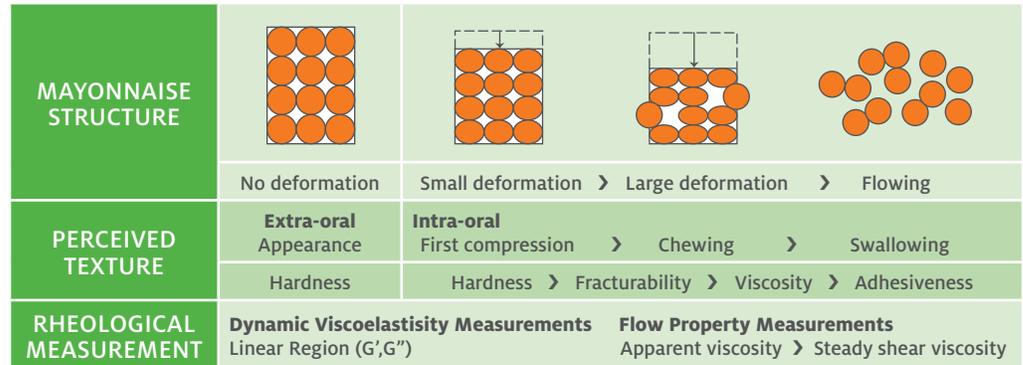
Ingredients and composition

Mayonnaise, which is believed to have originated in Spain, is a creamy condiment that is a stable emulsion of oil, egg yolk and either vinegar or lemon juice. Lecithin and protein from the egg yolk stabilize the emulsion. It is an oil in water emulsion, a network of homogeneously distributed oil droplets. Due to its structure, traditional full-fat mayonnaise exhibits semi-solid, visco-elastic weak gel behavior the fine details of which depend on the size of the oil droplets and their concentration. As the network is disturbed by shearing, as in spreading, pumping or chewing, the structure and behavior will be more typical of a thick liquid as the oil droplets will begin to flow. Thus, the types of changes that this network structure can undergo will dictate the suitability of the product for specific end-uses and for providing desired textures (Figure 6).

There are other ingredients added to mayonnaise and spoonable dressings, including some that can have an impact on texture and are grouped under the “stabilizers” category (basically these consist of starches and other hydrocolloids). Additionally, minor ingredients that do not affect the texture are used such as mustard or finely chopped pickles for flavor, colorants, dairy products, nutrients and preservatives.

Spoonable salad dressings are similar in production and composition to mayonnaise, but allow for many more

FIGURE 6: RELATIONSHIP BETWEEN MAYONNAISE STRUCTURE AND TEXTURAL CHARACTERISTICS



Adapted from Maruyama, et al. Relationship between Rheology, Particle Size and Texture of Mayonnaise. *Food Sci Technol Res.* 2007;13(1):1-6.

variations in formulation and flavors, as they often fall outside of any standard of identity regulations for a particular country.

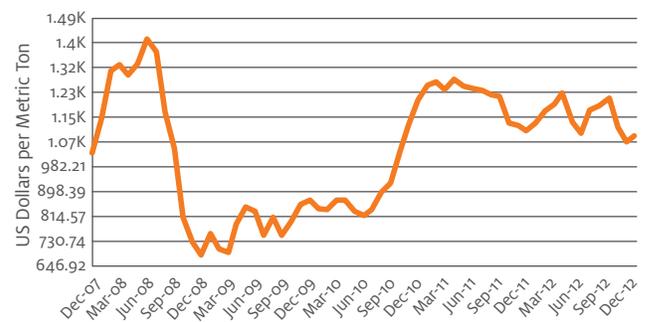
Vegetable oil: Calories and impact on costs

As vegetable oil is a major ingredient in the formulation of mayonnaise and salad dressings, often 70-80%, the finished product is high in nutritional density, with the typical calorie content being approximately 700 kcal per 100g. The amount and type of vegetable oil used has a significant impact on the flavor, texture, stability, nutritional profile and ultimately the overall cost of the product.

Vegetable oils are a traded commodity. In the US, soy oil prices have been volatile during 2008-2012, and have increased 65% from a low in Dec 2008 \$650/ton to \$1,070/ton in Dec 2012 (Figure 7). These swings can have a significant effect on the cost of goods sold for a manufacturer.

Ultimately, manufacturers can address both consumer health and wellness concerns as well as the cost to manufacture by reducing the amount of oil in reduced fat mayonnaise and spoonable salad dressings. But they must ensure that the final reduced oil product is similar in texture and in the eating experience to the original product, or they risk disappointing their customers as well as risking their brand name.

FIGURE 7: SOYBEAN OIL MONTHLY PRICE



Chicago Board of Trade

Textures and uses

Mayonnaise and spoonable salad dressings add flavor, color, moistness, texture and excitement to the foods to which they are applied. They can be used as sandwich spreads, salad binders, dips, condiments or to replace oil for frying — such as for a grilled cheese sandwich.

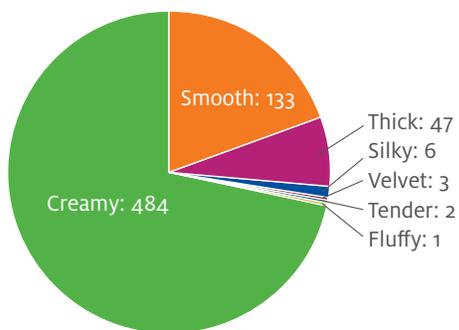
In the Benelux region, mayonnaise is often used as an accompaniment to French fries or “Pomme Frites.” In North America, it is often used as a sandwich spread as well as a binder for tuna fish or chicken salad. In Japan, apple cider vinegar or rice vinegar is often used as the acidulant, and it is typically sold in soft plastic squeeze bottles — so it is much thinner than mayonnaise than in Western countries. They also use it for dips for fried vegetables as well as for pizza. In South America, in particular Chile where they have the world’s third highest per capita consumption of mayonnaise, they use it with fried potatoes “locos,” as well as on boiled chopped potatoes in a salad known as “papas mayo.” With such a range of uses, the textural attributes of mayonnaise and/or spoonable dressing will vary with the consumer expectations and preferences of the region.

Global salad dressing and mayonnaise texture descriptors

Reviewing on-pack texture descriptors for new product launches over the last four years we find at least 20% of all new salad dressing product launches globally featured texture descriptors on their product labels. We see that “creamy” is overwhelmingly the lead descriptor (484 of 676 mentions or 72%). This is followed by smooth (20%), thick (7%), then silky, velvet, tender and fluffy (all below 1%). Some of these descriptors may be used to distinguish items within the same brand family to satisfy different tastes or uses (Figure 8).

However, “creamy,” “silky,” and “velvet” are integrated “consumer” texture terms, which are difficult to quantify and even more difficult to formulate. However, by

FIGURE 8: GLOBAL SALAD DRESSING AND MAYONNAISE TEXTURE CLAIMS



Innova Database, 2012



translating these terms into precise, measurable and actionable key texture attributes — that can be characterized by sensory evaluation and/or instrumental analysis — one can generate the data required to guide product development toward achieving their texture target of creating creamy and/or smooth mayonnaises or dressings.

These descriptors serve to entice the consumer and create expectations for the product, so it is important for the manufacturer to be able to deliver on their promises.

Characterizing texture: Using sensory evaluation and rheological techniques to provide quantifiable data to guide formulation

In order to understand more about the range of texture in mayonnaise and spoonable salad dressing products from around the world, we used our Expert Sensory Descriptive Panel to evaluate 19 samples of mayonnaise and spoonable dressings from around the world: 9 from the UK, 4 from Germany, 3 from Japan and 3 from the US. In addition, 6 of the 19 samples were full fat, regular versions of mayonnaise, and 13 of the samples were lower in fat, ranging from a reduced fat to very low fat.

The panel evaluated each sample for 17 attributes of texture, selected from our proprietary TEXICON™ to describe the similarities and differences between the samples, both visually as well as orally, as these products exhibit both liquid as well as semi-solid food rheology.

TEXICON™ is Ingredion’s food texture language that translates the consumer experience of a product’s texture into precise, measurable, scientific terms that allow food formulators and manufacturers to target and achieve the desired texture, quality and eating experience in their end product (Table 1, page 6).

TABLE 1: TEXICON FOR MAYONNAISE AND SPOONABLE SALAD DRESSINGS

ATTRIBUTE	DEFINITION
APPEARANCE	
Spoon indent (in cup)	The indentation made by the spoon in the sample
Jiggle	The gelatin-like appearance of the product on the spoon
Fluffy/lumpy	The mousse-like appearance of the sample, its aerated (fluffy) and lumpy appearance
TEXTURE BY HAND MANIPULATION	
Firmness before stir	The force required to compress the product
Tailing	Degree to which the product stretches/tails the spoon
Stir viscosity	The force required to move the spoon through the material
Rate of flow	How fast the material flows off the bowl of the spoon
IN-MOUTH TEXTURE	
Thickness in mouth	Perceived thickness of the sample in the mouth
Cohesiveness	The amount of deformation/stringing rather than shear/cut or rupture
Slipperiness	Ease to slide tongue under product
Meltaway	Rate at which the sample dissolves
Mixes with saliva	The degree the sample mixes with saliva and forms a homogeneous mixture
Evenness of mouthcoating	Extent to which the samples evenly spread over the palate during manipulation
Rate of breakdown	The rate/speed at which the sample thins out
IMMEDIATE RESIDUAL TEXTURE	
Total residual mouthcoating	The amount of residue left on the mouth surfaces after swallowing
Residual oily mouthcoating	The amount of oily residue left on the mouth surfaces after swallowing
Residual throatcoating	The amount of residue left in the throat after swallowing

Ingredion, 2013

Mayonnaise and spoonable dressing texture map

The results of the expert panel evaluation for the 19 products, by 17 attributes each, were then plotted using Principle Component Analysis, an exploratory statistical technique, to create a texture map, on which you can

compare the similarities and differences in terms of the texture and eating experience of these products (Figure 9).

Observations

The UK products tested tended to be the most viscous and firm, followed by the US and German products. The Japanese samples were the least viscous and firm — which seems to be typical of their primary use as condiments packaged in soft squeeze bottles. They also had a faster rate of breakdown and meltaway. The US products demonstrated a little less tailing than the UK products, but had more mouth coating as well as being more “set” or having more “gel-like” behavior, as they were higher in spoon indentation as well as being more fluffy/lumpy.

The UK products that had the lowest oil content in their formulation (low fat and very low fat) tended to show more tailing, and be more cohesive

FIGURE 9: SPOONABLE DRESSING GLOBAL TEXTURE MAP



Ingredion, 2013

in the mouth. This may be the result of added fat replacers used to reduce the oil, which may mean the formulation could use some adjustment to create a more similar eating experience to that of a regular mayonnaise that is creamy and smooth.

Reducing oil to address the drivers of health and wellness as well as economic pressures

Whether the reason is to improve the nutritional profile of a product, or to reduce the volatility of the total formulation cost, reducing oil in mayonnaise and spoonable salad dressing and maintaining texture is a challenge. As seen in the sensory results, the goal is to ensure that the reduced oil product has a similar eating experience and visual appearance to its full-fat product. So as oil is removed, the textural attributes must be built back, while minimizing other negative or non-typical attributes.

50% oil reduction, no sacrifice to texture or the eating experience

We looked to reduce the oil by 50% in a spoonable salad dressing, from reducing the oil formulation content from 40% to 20% oil, and build back the texture and the eating experience. We were able to achieve this by replacing

Formulation: Control and resultant recipe

TABLE 2: SPOONABLE DRESSINGS 50% OIL REDUCTION

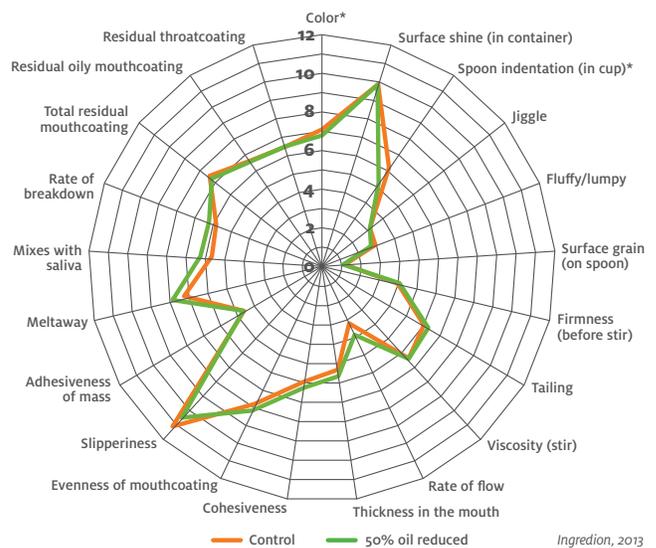
INGREDIENT	40% OIL (%)	20% OIL (%)
Sugar	9.80	9.80
ULTRA-SPERSE® SR	2.70	4.32
Salt	1.20	1.20
Mustard powder	0.04	0.04
Sodium Benzoate	0.03	0.03
Calcium Disodium EDTA	0.03	0.03
Potassium sorbate	0.01	0.01
N-DULGE® 211	0.00	0.33
Water	30.94	49.74
Vinegar (50 grain)	10.00	10.00
PASTE SUM	54.75	75.50
Egg yolk (10% salted)	5.25	4.50
Vegetable oil	40.00	20.00
TOTAL	100.00	100.00

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Preparation:

1. Dry blend sugar, ULTRA-SPERSE SR, N-DULGE 211, salt, mustard powder, and preservatives.
2. Add water and vinegar to a Hobart mixer bowl. Slowly add dries with agitation and mix for +5 minutes on medium, #2 speed using the wire whisk attachment.
3. Add egg yolk while blending on medium speed. Mix for 1-2 min.
4. Slowly add oil while mixing on high speed (#3). Cont. mixing for 2-3 min.
5. Pass the product through a colloid mill at 0.014" to develop final stable emulsion. (42 holes = 1 turns & 2 holes) Pump setting #5.

FIGURE 10: TEXTURE COMPARISON OF CONTROL FORMULATION WITH THE 50% REDUCED OIL SPOONABLE SALAD DRESSING



Scale Used for Evaluation: 0 – 15 points

Scale Displayed: 0 – 12 points

Attributes with an asterisk (*) are those for which the samples were found to be statistically significantly different from one another at 95% confidence.

The two samples displayed on the graph were evaluated within the context of three additional samples (not shown here).

20% of the oil with an additional 1.6% instant agglomerated starch, ULTRA-SPERSE® SR, which is a pH and shear resistant cold-water soluble viscifying starch, along with the addition of a co-texturizer, N-DULGE® 211 at 0.33% + the balance water. The ULTRA-SPERSE SR provided viscosity and body, and the N-DULGE 211 helped to enhance the creaminess of the reduced oil product (Table 2).

Results: Very close alignment with the sensory perception of the 50% reduced oil dressing vs. the original control, as measured by our Expert Descriptive Sensory Panel (Figure 10).

Rheological variables for mayonnaise and spoonable salad dressings

Rheological analysis helps us to understand the relationship between food structure and texture. For spoonable dressings and mayonnaises, rheological methods give insight

TABLE 3: RHEOLOGICAL VARIABLES

VARIABLE	MEANING
G' @ (LVER) Linear Visco-Elastic Region	Stiffness at rest (pre-shear)
G' and G'' curves during breakdown in a Dynamic Strain-Sweep	Response to shear
Viscosity @ 10/s	Thickness of sheared product

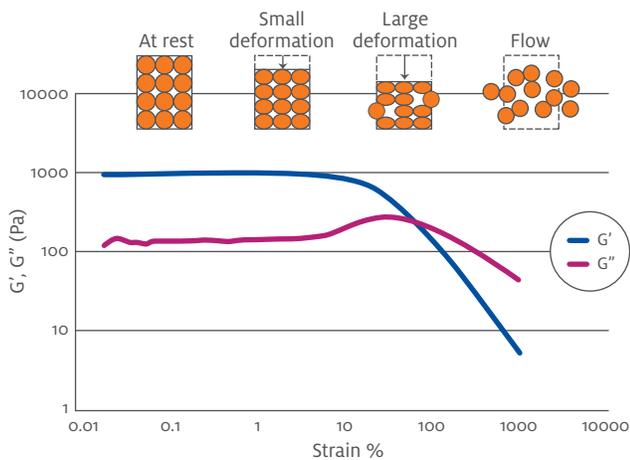
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into a range of texture attributes as follows (Table 3). The texture properties at rest — meaning under small deformation and without structure disruption — are characterized by measuring G' (storage modulus) which is related to the product's stiffness or solid-like behavior. Also, the behavior of the product upon deformation — as when the product is made to flow or spread — is characterized by measuring the breakdown of the product from a solid-like to a flowing state in terms of G' but also G'' (loss modulus) which is related to the liquid-like behavior (Figure 11). Furthermore, properties during flow — after disruption of the original structure by shear — such as thickness can be understood by measuring viscosity.

The results of these rheological measurements provide us with breakdown curves. In the breakdown curves of a typical full-fat mayonnaise, we can see an event characteristic of these products (G'' increase after 10% strain) that results from the disruption of the structure and change from a solid-like to a liquid-like (fluid) state. This phenomenon is related to the destruction of the original structure and is a

FIGURE 11: BREAKDOWN CURVE IN STRAIN-SWEEP OF A FULL-FAT MAYONNAISE WITH SCHEMATIC REPRESENTATION OF STRUCTURAL CHANGES



Ingredient, 2013

viscous response (analogous to a resistance to flow) as the structure is disrupted by the mechanical action exerted on it during large deformation.

Insight into formulation through rheology

We compared the two formulations using rheological profiling in terms of stiffness, measured as G' , and thickness, measured as viscosity. As can be seen in the bar chart, the optimized solution with 20% oil has a similar rheological profile to that of the 40% oil control (Figure 12).

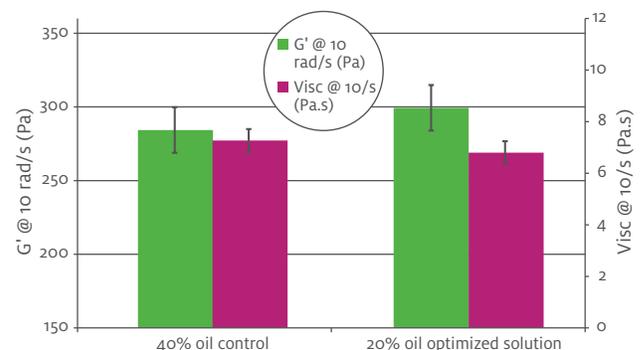
We also compared the breakdown behavior of the products and found that the optimized solution was characterized by the pronounced G'' breakdown event after 10% strain which is typical of full-fat products (Figures 12 & 13); non-optimized formulae do not present the same behavior (data not shown).

Proposed mechanism of action of optimized texture system

As shown in Figure 14 (page 9), traditional full-fat mayonnaise and spoonable salad dressing can be characterized as a “weak gel” composed of a network of oil droplets. This structure is a semi-solid with visco-elastic behavior. When taking oil out of these products, the challenge is to substitute the oil droplet network with stabilizers that help to mimic its original structure and its behavior when subjected to end-use conditions. Thus, the ideal texturizer system forms a “weak gel” network compatible with the oil droplet structure. This network will deform to a fluid state when disrupted, in a similar manner to the full-fat product, resulting in rheological and sensory profiles similar to those of the full-fat product.

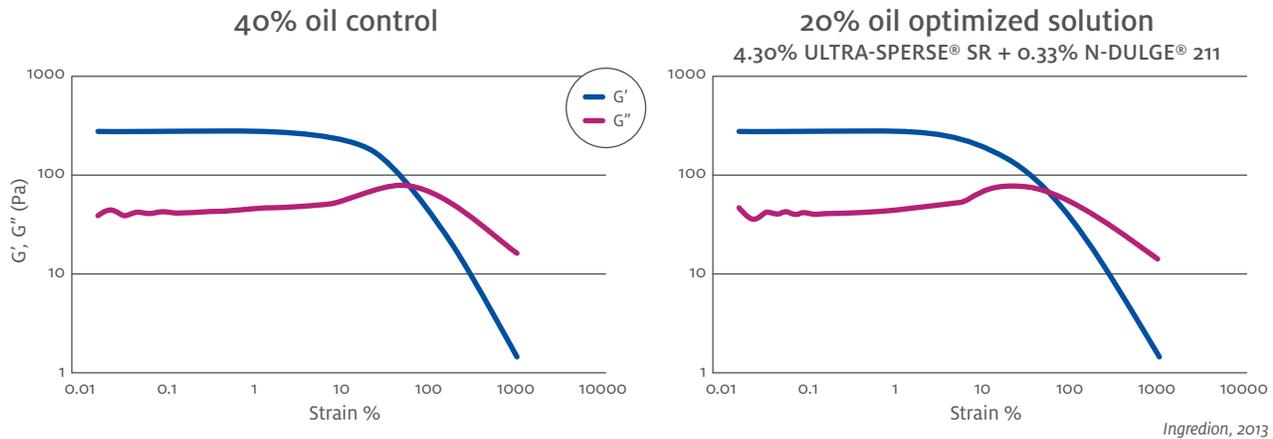
The characteristics of an optimum texturizer system will be related to both its rheological and sensory properties. These

FIGURE 12: SMALL-DEFORMATION (G') AND FLOWING (VISC) CHARACTERISTICS OF SPOONABLE DRESSINGS OF DIFFERENT OIL CONTENTS



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FIGURE 13: BREAKDOWN BEHAVIOR COMPARISON OF CONTROL FORMULATION VS 50% REDUCED OIL



textural attributes are both small- and large-deformation characteristics. Small deformation properties are measured using rheological variables like G' in the Linear Visco-Elastic Region, and can be related to jiggle, spoon-ability, spoon indent and free-flow behavior (self-supporting versus runny). Large-deformation or flowing characteristics are measured by rheological variables such as viscosity and can be related to rate of meltaway, mouth-coating, softness to chew, and thickness in the mouth (Figure 13, page 9).

We were able to demonstrate the close comparability of a 50% reduced oil prototype to that of its control by both sensory and rheological techniques. As a result we have a new product, which has half the oil content and a 40% reduction in calories, at the same or reduced cost. Cost savings will vary with the price of the oil and formulation of the product.

Regulations concerning mayonnaise and salad dressing

The definition of “mayonnaise” and spoonable salad dressing differs between countries and regions. In the United States, Mexico, Germany, the UK, Japan, and Korea, the word mayonnaise is defined by a minimum oil and egg content, and cannot contain starches or other thickeners or

emulsifiers. In the US mayonnaise and salad dressing are standards of identity, regulated by the FDA. In Mexico and most of the EU, mayonnaise is defined by voluntary codes of practice. In other countries, such as France (voluntary) and Spain (by law), mayonnaise is defined by oil and egg content, but thickeners and emulsifiers are allowed. Some of these regional specifications are given in Table 4 (page 10).

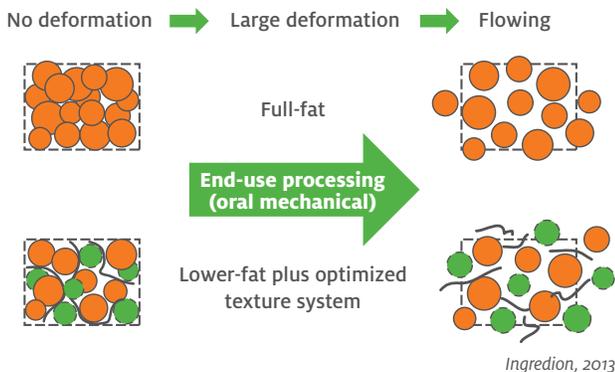
In the United States, label claims for reduced fat products are also defined by the FDA in the Code of Federal Regulations (CFR).

- **Free:** less than 0.5g of fat per serving
- **Low:** less than 3.0g of fat per serving

FIGURE 15: NUTRITION LABELS 40% VS 20%

Nutrition Facts		Nutrition Facts	
Serving Size (30g) Servings Per Container		Serving Size (30g) Servings Per Container	
Amount Per Serving		Amount Per Serving	
Calories 120	Calories from Fat 110	Calories 70	Calories from Fat 50
% Daily Value*		% Daily Value*	
Total Fat 12g	18%	Total Fat 6g	9%
Saturated Fat 2g	10%	Saturated Fat 1g	5%
Trans Fat 0g		Trans Fat 0g	
Cholesterol 15mg	5%	Cholesterol 15mg	5%
Sodium 200mg	8%	Sodium 200mg	8%
Total Carbohydrate 4g	1%	Total Carbohydrate 4g	1%
Dietary Fiber 0g	0%	Dietary Fiber 0g	0%
Sugars 3g		Sugars 3g	
Protein 0g		Protein 0g	
Vitamin A 0%	Vitamin C 0%	Vitamin A 0%	Vitamin C 0%
Calcium 0%	Iron 0%	Calcium 0%	Iron 0%
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:			
	Calories	2,000	2,500
Total Fat	Less Than	65g	80g
Saturated Fat	Less Than	20g	25g
Cholesterol	Less Than	300mg	300 mg
Sodium	Less Than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g
Calories per gram: Fat 9 • Carbohydrate 4 • Protein 4			

FIGURE 14: PROPOSED MECHANISM OF ACTION OF AN OPTIMIZED TEXTURE SYSTEM



INGREDIENTS: Oil, water, vinegar, sugar, egg yolks, modified corn starch, salt, mustard powder, sodium benzoate, calcium disodium, EDTA, potassium sorbate

INGREDIENTS: Water, oil, vinegar, sugar, modified corn starch, egg yolks, salt, mustard powder, sodium benzoate, calcium disodium, EDTA, potassium sorbate

- **Reduced:** at least 25% less fat than a stated reference
- **Light:** at least 50% less fat than an industry average or brand leader

Conclusion

As consumers desire products that are lower in oil and lower in calories, without wanting to sacrifice the eating experience, the use of texture characterization techniques, both sensory and rheological, can help guide the formulation of reduced oil products. And with the use of starch based viscosifiers and co-texturizers, formulators can achieve a similar creaminess and eating experience to the higher oil containing controls.

Enhancing creaminess via the use of starch-based co-texturizers

As we saw from the previous sections, there is a diverse range of products, uses and textures for mayonnaise and spoonable salad dressings from region to region. Next we will demonstrate on how one can manipulate the creaminess profile of their dressings, through the use of different co-texturizers added to the same basic formulation. This enables manufacturers to produce a variety of products on the same equipment, with basically the same formulation, with the addition of a small amount of co-texturizer, depending on the texture and eating experience desired.

The co-texturizer approach: building back creaminess

Creaminess is an integrated term, that we have deconstructed into its key fundamental components for dressings: oral viscosity/set, mouthcoating and meltaway. As mayonnaise and dressings are an emulsion, there is some degree of gel-like behavior and set that accompanies viscosity. Additionally products should be somewhat slippery and smooth in texture as their full-fat market references have oil as a primary ingredient.

Co-texturizers are starch-based ingredients that do not contribute greatly to the viscosity of a product, but instead provide fat mimetic characteristics that help to enhance the creaminess of a product. The approach is to use a base viscosifier to build back some of the viscosity lost when oil is reduced and then added co-texturizer to enhance creaminess.

The base viscosifier selected should be pH and shear tolerant — such as ULTRA-SPERSE® SR, as dressings and mayonnaise are manufactured via a high shear cold process. Then depending on the creaminess profile desired, you can select the appropriate co-texturizer that can increase the degree of one or more of these key fundamental attributes associated with creaminess (Table 5).

TABLE 4: REGULATIONS FOR LABEL CLAIMS BY COUNTRY

COUNTRY	MAYONNAISE	SPOONABLE SALAD DRESSING
USA	21 CFR 169.140: 65% minimum fat content, no added stabilizers	21 CFR 169.150: 30% minimum fat content, 4% minimum egg yolks
UK	The FIC Code of Practice (voluntary): 70% minimum fat, 5% minimum egg yolk, no stabilizers	Not defined
Germany	The FIC Code of Practice (voluntary): 70% minimum fat, 5% minimum egg yolk, no stabilizers Guidelines of the German Delicatessen Industry (voluntary): 80% minimum fat content, no added stabilizers	Guidelines of the German Delicatessen Industry (voluntary): Salad Mayonnaise: 50% minimum oil, no min egg yolk but if labeled- 7.5% of fat
Japan	65% minimum fat content, no added stabilizers	10 to 50% fat content

Formulation and process: Control and resultant recipe

TABLE 5: 20% OIL CONTROL VS CO-TEXTURIZERS

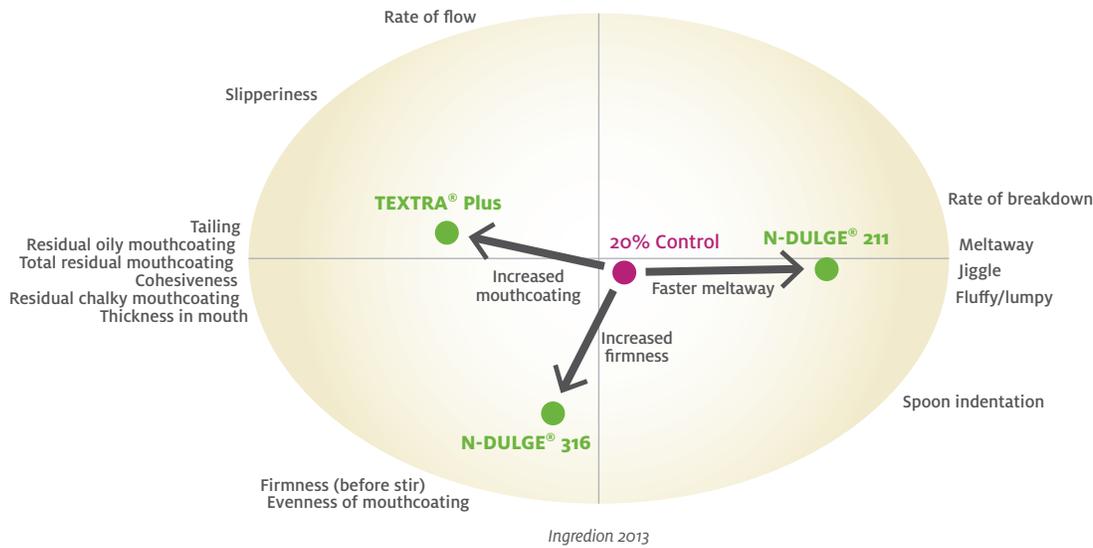
INGREDIENT	CONTROL (%)	CO-TEXT. (%)
Sugar	9.80	9.80
ULTRA-SPERSE® SR	2.70	3.75 – 4.65
Salt	1.20	1.20
Mustard powder	0.04	0.04
Sodium Benzoate	0.03	0.03
Calsium Disodium EDTA	0.03	0.03
Potassium sorbate	0.01	0.01
Co-texturizer	0.00	2.00
Water	49.89	47.74 – 48.64
Vinegar (50 grain)	10.00	10.00
PASTE SUM	75.50	75.50
Egg yolk (10% salted)	4.50	4.50
Vegetable oil	20.00	20.00
TOTAL	100.00	100.00

Ingredient, 2013

Preparation:

1. Dry blend sugar, starches, salt, mustard powder, and preservatives.
2. Add water and vinegar to a Hobart mixer bowl. Slowly add dries with agitation and mix for +5 minutes on medium, #2 speed using the wire whisk attachment.
3. Add egg yolk while blending on medium speed. Mix for 1-2 minutes.
4. Slowly add oil while mixing on high speed (#3). Cont. mixing for 2-3 minutes.
5. Pass the product through a colloid mill at 0.014" to develop final stable emulsion. (42 holes = 1 turns & 2 holes) Pump setting #5.

FIGURE 16: TEXTURE MAP COMPARING CREAMINESS-RELATED ATTRIBUTES OF ADDED CO-TEXTURIZERS TO A 20% OIL SPOONABLE DRESSING



We selected a base formulation containing 20% oil, developed during previous oil reduction work, and then added different co-texturizers (all at 2.0% use level) and compared their textural profiles based on characterization by our Expert Sensory Descriptive Panel and by rheological testing (Figure 16).

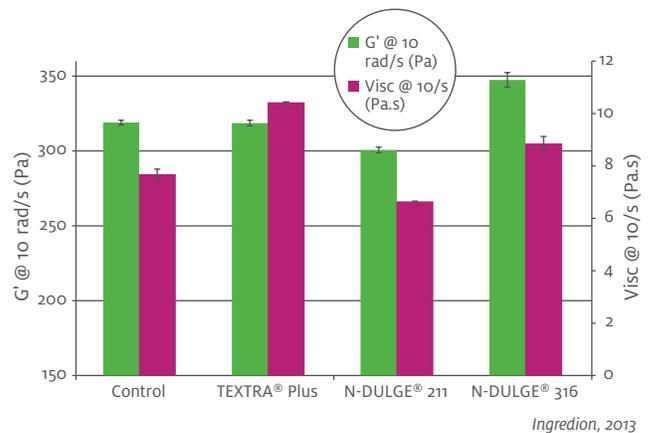
We see that by adding the N-DULGE® 211, we increased the rate of meltaway vs the control 20% oil formulation (without any added co-texturizers). Conversely, when we replace the N-DULGE® 211 with N-DULGE® 316, we see that the meltaway is slowed and the rheological viscosity increases, whereas the product is more firm and with gel-like properties which correspond to a greater rheological stiffness (G'). Finally, when we added TEXTRA PLUS® as the co-texturizer, we increased the mouth-coating properties of the product which coincided with an increase in rheological viscosity while maintaining a similar stiffness (G') to that of the 20% control (Figure 17).

Conclusion

The use of co-texturizers can enhance subtle textural attributes that serve to enhance creaminess and the eating experience of a product through targeted manipulation of sensory

and rheological profiles. It helps manufacturers produce great tasting and high quality salad dressing products that are low in oil, without sacrifice to taste or texture. They can also serve to create a range of products — targeted to different uses or groups of consumers — yet can be manufactured on the same equipment, with many of the same ingredients.

FIGURE 17: SMALL-DEFORMATION (G') AND FLOWING (VISC) CHARACTERISTICS OF SPOONABLE DRESSINGS WITH 20% OIL AND DIFFERENT TEXTURES ACHIEVED USING CO-TEXTURIZERS



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