

Meats

Some simple guidelines for texture testing...

Food Technology Corporation

What does Texture Analysis mean to the Meat Industry?

Texture is a primary consideration in determining the eating quality of fish, meat and their processed derivatives. Sensory studies have shown that the consumers consider meat tenderness or perceived textural quality to be the most important characteristic upon which satisfaction is based; for example, we do not want a processed meat product to appear rubbery or a steak to be tough!

Texture analysis is an objective and reproducible way of measuring the critical quality attributes of tenderness and eating quality. These instrumental measurements put a number to what would otherwise be a subjective characteristic.

- From a **manufacturer's** perspective, this could be the effect of an ingredient e.g. a processed ham producer adding water to his product and wanting to quantify the maximum level of added H₂O acceptable to the consumer.
- From a **customer's** perspective, this could be the integrity of our reformed ham when used in a convenience food or its performance in a commercial slicer.

Some Texture Analysis Experiences with the Total Quality Loop

RESEARCH & DEVELOPMENT

"...texture analysis allowed us to objectively measure the effect of ageing on meat tenderness"

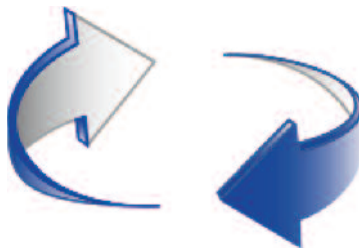
"...we used it to design a hydrocolloid blend to maximise water holding in reduced fat paté"

QUALITY DEPARTMENT

"...critical texture qualities gave us an objective way to check quality inconsistencies in our hotdog plant"

"...texture testing gave us a reproducible way of standardizing our beef burger suppliers"

Total Approach to Quality



PRODUCT DEVELOPMENT

"...texture analysis helped us identify core sensory attributes when we developed a vegetarian hotdog"

"...we used it to develop a reformed ham product for an own label low-cost brand"

PROCESS DEVELOPMENT

"...texture testing helped us to commission our new forming press for making burgers"

"...we used shear testing to measure the slicing properties of our chorizo sausage"

How do I know that I need to measure the texture of meat products?

Food texture analysis is primarily concerned with how food material feels, behaves and performs. There are two approaches that can be taken to measure food texture:



Sensory based

Texture treated as a perception or human experience, which is correlated to what we feel.

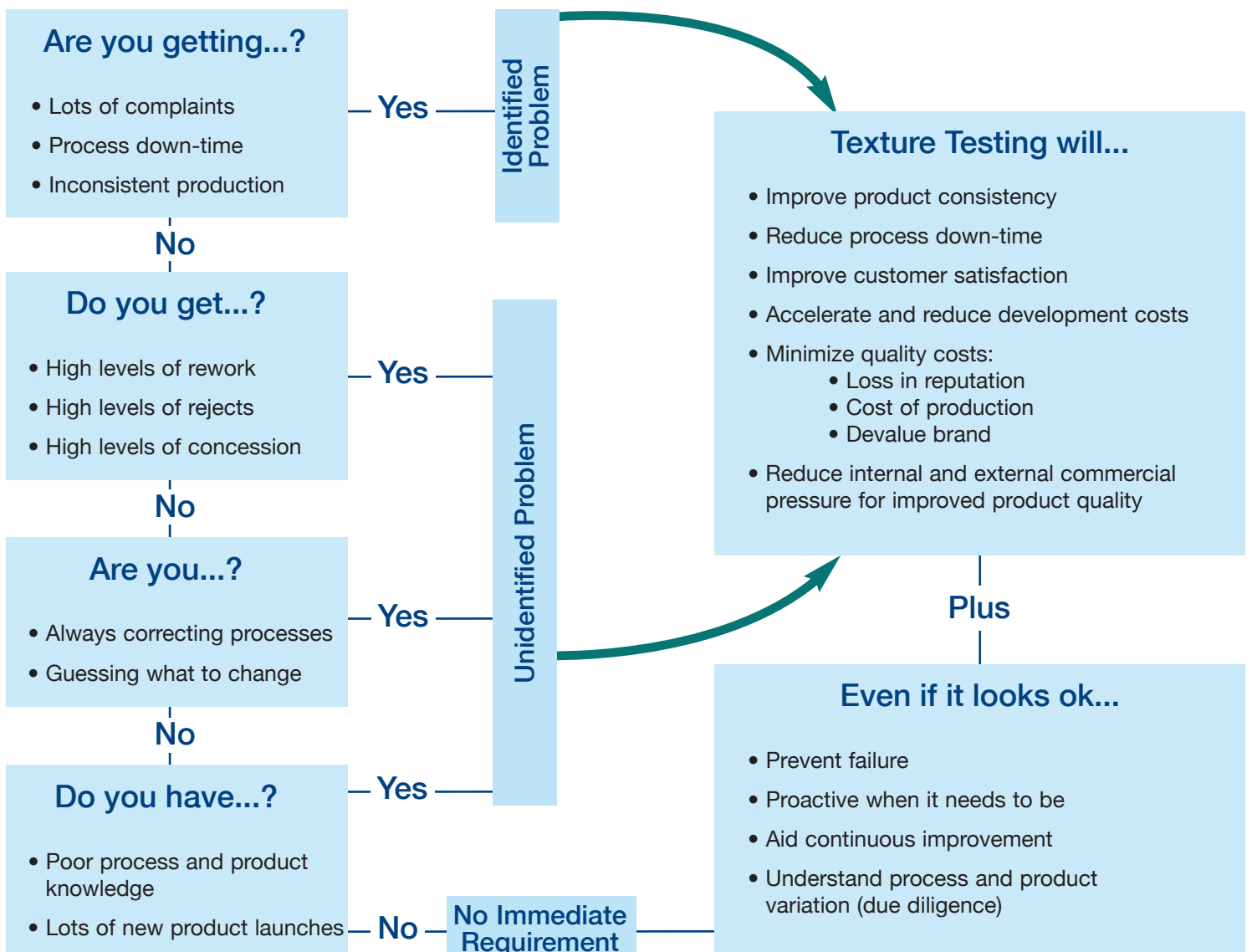


Engineering based

Texture treated as a condition, which can be monitored and manipulated during manufacture.

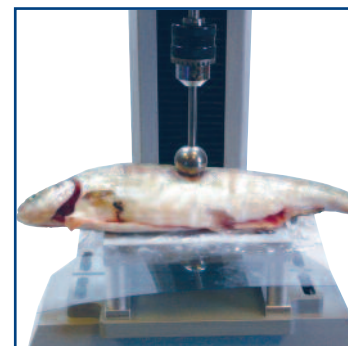
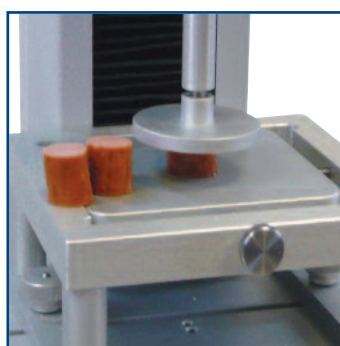
Whatever approach is taken, the methods followed should be simple, practical and, most importantly, generate information of “real” value on the product being tested.

Do I have a texture related problem?



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Product	Description	Core Characteristics
Pastes & Viscous Liquids Meat Slurries Pastes Potted Meats Mechanically Removed Meat Crab Meat Stocks & Concentrates	Thick semi-solid products with weak gelled structures. Supplied in containers due to unsupported structure. May contain particulates such as onions, course muscle fibres and nuts. Food system can be emulsified to support particulates.	<ul style="list-style-type: none">• Consistency and body of gelled structure• Flow characteristics on spreading and pumping• Structure recovery after pumping• Cohesiveness and/or mouth coating properties
Homogeneous Solids Paté Mousses Bologna Liver Sausage Protein Based Gels e.g. Surimi, Meat & Fish Jellies Hotdogs & Frankfurters	Smooth viscous pastes or homogeneous gelled products with uniform structure. Self-supporting, can be cut or spread when under sufficient stress. Highly elastic when lightly squeezed, but fail once maximum resistance is reached. Generally fracture, split or begin to flow once yield force or conditions are reached.	<ul style="list-style-type: none">• Firmness and spreadability• Yield point and flow• Gel strength and break point• Gel relaxation and resilience• Elasticity and springiness
Fibrous Solids Whole Muscle <ul style="list-style-type: none">• Steaks• Fish Fillets• Whole Fish	Bundles of muscle fibers tightly grouped together. Multiple groups of fiber bundles are often found within a single sample, which can result in combinations of fiber orientation. Result producibility is improved when single orientation of fibers is used in traditional shear tests. If muscle tissue is in variable form, multiple point analysis using Kramer shear cell is advised to measure toughest component.	<ul style="list-style-type: none">• Muscle fiber toughness• Bonding strength between fibers• Shear toughness of muscle• Firmness of muscle• Elasticity and resistance to chewing• Maximum bite resistance• Tensile strength an bonding

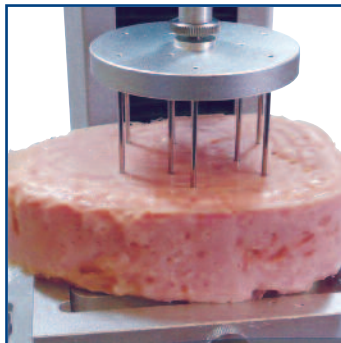
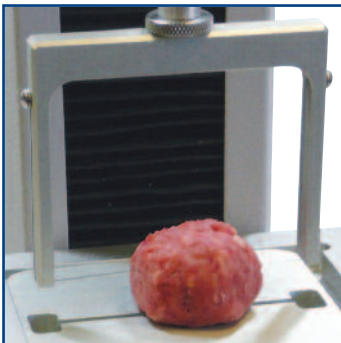


Product	Description	Core Characteristics
Particulates Minced Meats Ground Beef Diced Meats (Steak, Chicken, Fish etc) Pie Fillings Prawns, Squid and other Seafood Reconstituted Meat Pieces and Hams	Small, irregular and non-uniform particulate pieces with fibrous solid structure. Predominantly consumed or handled in bulk encompassing all texture characteristics including those of carriers such as sauces and gels. Bulk test measurements will quantify toughest component providing an indication of bulk firmness from shearing or puncture.	<ul style="list-style-type: none"> • Resistance to chewing of particles • Gristle content • Firmness of reconstituted ground meats • Toughness of muscle fibers

Inhomogeneous Solids Burgers Emulsified Meats (Breaded Products) Sausages Reconstituted Cooked Hams Salami Terrines	Inhomogeneous solid products made up from suspended particulates of varying size and shape. Often incorporate gelling or binding components to create self-supporting and emulsified structure. Presence of gelling agents create elastic structure at small deformations. Products will fail or collapse when squashed to higher levels, reverting to particulate or component structure.	<ul style="list-style-type: none"> • Slicing resilience • Hardness to bite (shearing) • Hardness to touch (compression) • Elasticity and consistency comparisons • Bond strength of emulsion • Sensory comparisons and objective measures • Skin peel strength
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Special Note: For improved testing accuracy

Samples are generally taken from iced carcasses using mechanical borers. Samples must be taken from the same location of different carcasses to compare results. Orientation of fibers within the cored muscle sample must be presented to the test blade in the same direction between samples, as this will directly affect the force reading recorded e.g. if the blade passes down through the fiber bundles the forces will be much lower than if the blade cuts through the bundles themselves. If carcasses are tested whole as with fish, the test site must be in the same position on each sample, e.g. when testing whole salmon for firmness, a site just behind the dorsal fin is used.



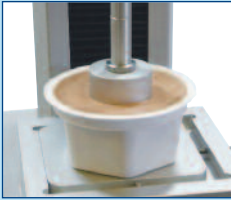

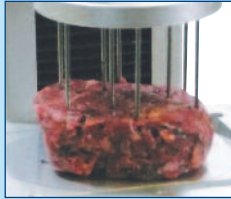
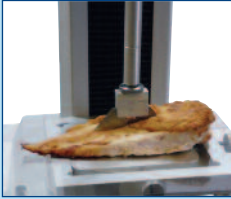
Semi-solid
 Flows if unsupported, poured, pumped, extruded or spread during handling or consumption



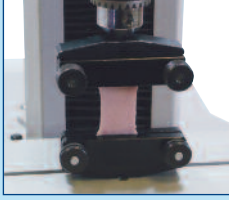
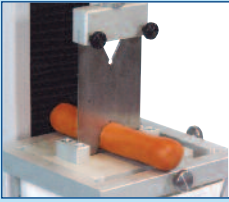



Solid
 Self-supporting structure, deformed, squashed, sheared or snapped during handling or consumption

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Choosing The Right Fixture

	Extrusion	Bulk Analysis	Multiple Point Analysis
<p>Pastes & Viscous Liquids</p> <p>Meat Slurries Pastes Potted Meats Terrines</p>	<p>Make thick liquids flow, just like pumping a meat slurry or depositing an unset terrine or paté mix</p> <ul style="list-style-type: none"> • TMS Extrusion Cell (432-026) • TMS Extrusion Cone (432-027) • TMS Extrusion Platen Set (432-029) 	<p>Measure individual pieces in bulk as if biting through a mouthful of ground beef or squashing minced meat together to make burger patties</p>	<p>Multiple site tests are used to measure products with variable textures, as if biting into burger patties or reformed ham</p>
<p>Particulates</p> <p>Minced Meats Diced Meats (Steak, Chicken, Fish etc) Pie Fillings Prawns, Squid and other Seafood Reconstituted Meat Pieces and Hams</p>	<p>Back extrusion of thick pastes to measure consistency and body</p> 	<p>• FTC Standard Shear Compression Cell (432-240)</p> <p>Kramer shear blades assess quality and gristle content in ground beef</p> 	<ul style="list-style-type: none"> • TMS Multiple Needle Probe (432-249) • TMS Junior Multiple Probe Fixture (432-252)
<p>Homogeneous Solids</p> <p>Paté Mousses Liver Sausage Protein Based Gels e.e. Surimi, Meat & Fish Jellies Hotdogs & Frankfurters</p>			<ul style="list-style-type: none"> • TMS Multiple Needle Probe (432-249) • TMS Junior Multiple Probe Fixture (432-252)
<p>Inhomogeneous Solids</p> <p>Burgers Emulsified Meats (Breaded Products) Sausages Reconstituted Cooked Hams Salami</p>	<p>Multiple points testing used to evaluate entire cross-section of patties firmness</p> 		<ul style="list-style-type: none"> • TMS Multiple Needle Probe (432-249) • TMS Junior Multiple Probe Fixture (432-252) <p>Shearing of hotdogs etc to assess hardness to bite for product comparisons</p> 
<p>Fibrous Solids</p> <p>Whole Muscle</p> <ul style="list-style-type: none"> • Steaks • Fish Fillets • Whole Fish 		<p>• FTC Standard Shear Compression Cell (432-240)</p>	

Penetration	Shearing	Compression	Tension
<p>Use small cylinders, balls, needles and cones to push into a sample like pushing your finger onto the surface of reformed meat to measure gel firmness</p>	<p>Cut across a section of the sample just like biting through a piece of steak or cutting through a chicken breast</p>	<p>Squash small or cored samples with flat or rounded probes, as if squeezing with your tongue or in the hand e.g. evaluate hardness to touch of hotdogs</p>	<p>Stretch or pull a sample to see how it extends and resists like pulling sliced meats away from your front teeth as you bite into a sandwich</p>
<ul style="list-style-type: none"> • 1" Perspex Hemispherical (432-096) • 1" Ball Probes (432-088) • TMS FMBRA Dough Pots (432-034) 	<p>Ball probe is used to test firmness of elasticity of processed meats</p> 	<p>Compression of sliced sample to evaluate hardness to touch in hotdogs</p> 	<p>Tension tests allow break strength analysis of liver sausage to identify failure point</p> 
<ul style="list-style-type: none"> • 2mm ø Needle Probe (432-087) • 1" Ball Probes (432-088) 	<ul style="list-style-type: none"> • TMS Lightweight Blade Set (432-245) • TMS Large Craft Knife (432-295) • TMS Wire Shear Probe and Plate (432-242) 	<ul style="list-style-type: none"> • TMS 75mm ø Compression Platen (432-010) 	<ul style="list-style-type: none"> • TMS Extensibility Fixture (432-046) • TMS Large Wedge Grip Kit (432-297)
<p>Shearing of hotdogs etc to assess hardness to bite for product comparisons</p> 	<ul style="list-style-type: none"> • TMS Lightweight Blade Set (432-245) • TMS Large Craft Knife (432-295) • FTC Heavy Duty Blade Set (432-014) • TMS Lightweight Blade Set (432-245) • TMS Large Craft Knife (432-295) • TMS Volodkovitch Bite Jaws (432-016) 	<ul style="list-style-type: none"> • TMS 75mm ø Compression Platen (432-010) • 1" Perspex Hemispherical (432-096) • 1" Ball Probes (432-088) • TMS 75mm ø Compression Platen (432-010) • 1" Perspex Hemispherical (432-096) • 1" Ball Probes (432-088) 	<p>Whole fish tested behind dorsal fin to assess muscle firmness and structure</p>  <p>Please Note: Accessories listed in each category are examples of those most suited to the application. Only one accessory is normally required per application to perform the majority of tests.</p>

Who is Food Technology Corporation?

Founded in 1966, Food Technology Corporation is the industry's longest standing provider of quality texture measurement systems. With over 40 years experience evolving from the groundbreaking Kramer Shear Press, our company is able to provide systems for the field, factory and laboratory test environments. Our extensive experience in practical food texture measurements, combined with our cost-effective solutions makes us the ideal partner for your texture instrumentation needs.

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