SenseFi®

FUNCTIONAL PLANT FIBERS

BASIC TECHNICAL PROPERTIES

Is completely stable at a wide range of pHs, temperatures, sugar contents and shear forces



Delivers an excellent, smooth and creamy mouth feel



Thickening but not gelling



Clean, neutral flavor



Very high water holding capacity



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What is SenseFi®?

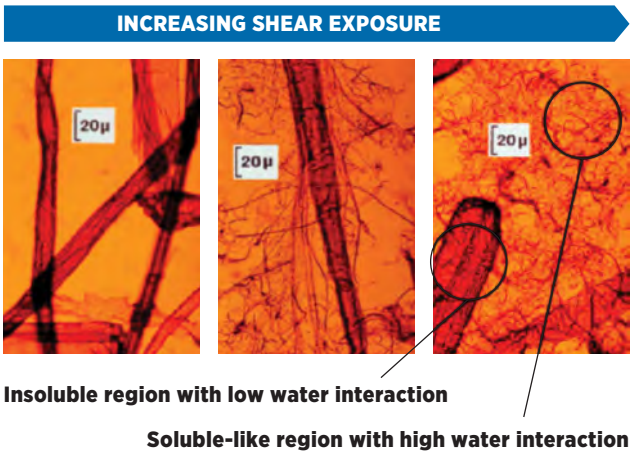
SenseFi® is a new multifunctional plant fiber ingredient designed for the food industry. SenseFi® enables formulation of more nutritious and cost effective food products without compromising mouthfeel, texture or taste.

SenseFi® is a purified, structurally expanded cellulose, prepared by processing alpha-cellulose obtained as a pulp from strands of fibrous plant material, e.g. oats or sugar cane fibers, wood. It is produced by wet mechanical shearing of the cellulose fibres in a water suspension, followed by a drying step, resulting in a finished dried powder product.



Figure 2: 3% SenseFi® Paste

Figure 1: The insoluble fibrils provide structure and the micro-fibrils bind large amounts of water.



During the physical shearing process, parts of the cellulose fibers are structurally expanded (see Figure 1 above), revealing the inherent internal cellulose fibrils. This leads to a very high surface area, which is available to interact with water. The final product is comprised of structurally expanded fibrils, which are fully attached and integrated into the intact non-expanded cellulose fiber. As a result, the part of the product comprised by fibrils interacts strongly with water and the intact fibers provide structure. This combination of properties is what makes SenseFi® outstanding and unique among functional food ingredients. Figure 2 (left) demonstrates the high water binding power of 3% SenseFi® in water.



What can SenseFi® do?

What makes SenseFi® really unique and valuable to the Food Industry is that it allows food formulators to push back the boundaries of what is possible in making formulated foods more nutritious without compromising quality.

The ability of SenseFi® to bind large amounts of water and deliver great texture and mouthfeel with no off flavors is unique. This ability allows product developers to rebalance their formulas to deliver better nutritionals while still delivering a high quality desirable food product.

Many of the leading food manufacturers have a stated goal of making their portfolio of products more nutritious. This trend is being driven by customers being more conscious of what they are eating and governments trying to improve the health of their nations and to halt and reverse the growing obesity problem.

SenseFi® allows production of high quality products even when:

- reducing fat content
- reducing starch
- removing several other stabilizers
- reducing formulation cost





Suspension Stability

SenseFi® has the ability to suspend cocoa and other fine particles in chocolate milk and other beverages including plant based milks.



pH Dependence

SenseFi® is very stable over a wide pH range. From pH 3 to 10 there is very little change in viscosity. In the lower pH range (pH < 3), the texture of SenseFi® will change somewhat.

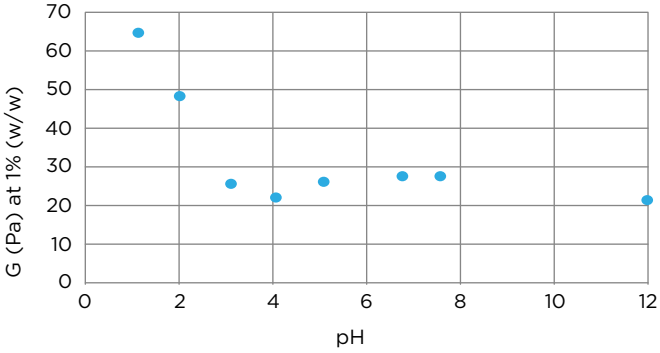


Figure 3: SenseFi® remains functional in extreme food environments such as low and high pH.

Heat Resistance

SenseFi® is highly resistant to heat making it an excellent hydrocolloid to be used when UHT treatment or other high temperature treatment is needed. SenseFi® can be heat treated at 120°C for 1 hour with no loss of viscosity.

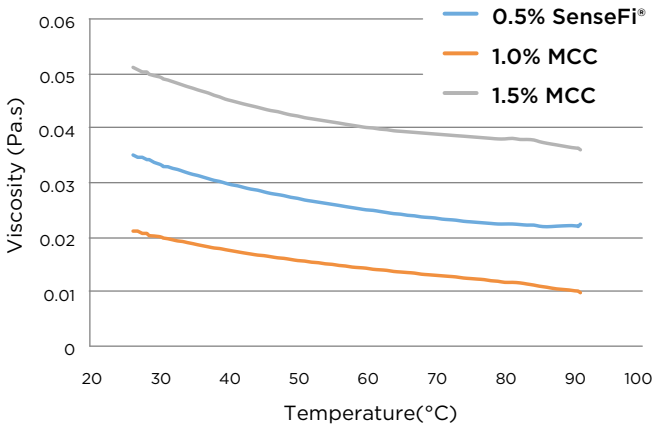


Figure 4: SenseFi® can be used at a much lower dose rate than MCC and has a similar rheological profile during heating.

The high viscosity at low shear rates and high temperatures also makes SenseFi® particularly suited for applications like dinner sauces where cling (e.g. to meat) is desired at high temperatures.

Freeze Thaw Resistance

In food applications like ice cream and frozen emulsified meat products, SenseFi® is completely freeze-thaw stable. This makes it an excellent choice for applications where high freeze-thaw stability is needed.

If a dispersion of pure SenseFi® in water is frozen and thawed it will lose some functionality. The functionality can be regained by use of shear. Hence it is not recommended to store SenseFi® paste suspensions in a frozen state.



Rheological Properties

SenseFi® can enable the control of viscosity and stabilization of various food products. SenseFi® creates a colloidal network when dispersed in water, resulting in a texture and mouthfeel resembling fat. This can be utilized in food applications to deliver the desired texture and stability in formulations like mayonnaise and dressings. The gel strength and viscosity of the network is highly dependent upon concentration. Compared to typical water-soluble hydrocolloids, the insoluble nature of SenseFi® will give a texture that is less gummy and pasty in the mouth.

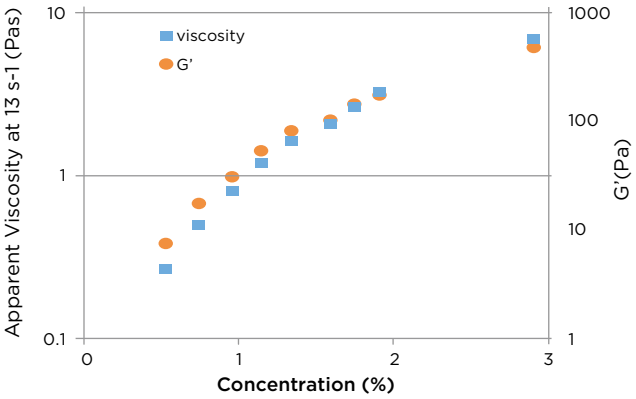


Figure 5. The gel strength and viscosity of SenseFi® is concentration dependent.

Water Holding Capacity

The SenseFi® network created when SenseFi® is properly activated can bind and hold high amounts of water, and the moisture loss upon heating is limited. This makes SenseFi® an excellent choice for decreasing moisture loss during cooking or frying of emulsified meat products, and to hold moisture in food applications like yogurt or other dairy applications.

The water holding capacity is several times higher than MCC and also higher than other available hydrocolloids.

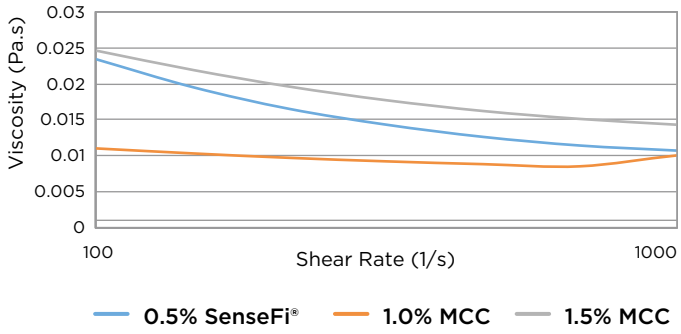


Figure 6. SenseFi® is highly shear thinning making it easy to handle in a food processing operation. It's high viscosity at low shear rates make it particularly suited to give good cling properties to sauces and dressings.

Sensory

SenseFi® has a clean and bland flavor, and a creamy mouth-feel due to the weak colloidal network.

The clean neutral flavor of SenseFi® gives it a significant advantage over other hydrocolloids. In blind sensory evaluations, an expert group found that SenseFi® had no detectable flavor or aroma.

	Flavor Attributes
SenseFi®	None Detectable
Corn Fiber	Fatty
Locust Bean Gum	Carboard, Musty
Citrus Fiber	Sour
MCC	Metallic
Guar Gum	Green, Nutty

The expert group also noted that SenseFi® was the most fat-like in terms of melt / dissolving properties in the mouth. This contrasts with the gummy mouthfeel associated with most hydrocolloids and the pasty mouthfeel associated with starches.



Hydration of SenseFi®?

Hydration is the critical step of activating the large surface area of SenseFi®, and to activate its functional properties. SenseFi® is insoluble in water and will hence not form lumps or fisheyes, and does not require long hydration and swelling time. However, SenseFi® does need relatively high shear to be fully activated and allow it to bind the optimum amount of water.

The shear needed to fully activate SenseFi® will be dependent on the type of equipment, the concentration of SenseFi®, the dispersion medium (water, milk, other ingredients, etc.) and the volume within the tank or vessel. SenseFi® can be hydrated using a moderate to high shear mixer. Common process equipment, such as high speed disk mixers, low pressure impact homogenizers or rotor/stator mixers typically provide sufficient dispersive forces. Activation time is a function of intensity and volume.

Generally, it is recommended to hydrate SenseFi® in pure water prior to adding additional ingredients like salts, as salts will retard activation. Figure 7 shows an example of aSenseFi® dispersion test performed in the lab. SenseFi® was dispersed in deionized water at 1.4% (w/w) concentration using different stirring speeds by using an Ultra-Turrax® handheld homogenizer. This shows the importance of having sufficient shear force to fully activate SenseFi®. Failure to fully activate SenseFi® will result in lower viscosity and water binding. This could mean overdosing to achieve a target viscosity and less that optimal use rates of SenseFi.

Figure 8 shows examples of what poorly and properly hydrated samples look like under a microscope.

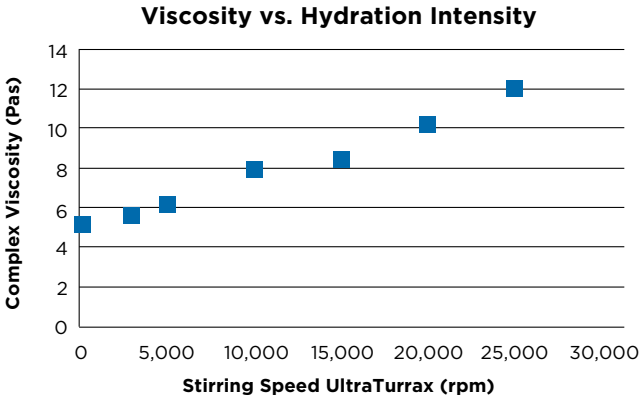


Figure 7: Dispersion of SenseFi® (1.4% (w/w), 40 ml) in deionized water by use of UltraTurrax® (5 minutes) at stirring speeds from 3,000-25,000 rpm.



Poorly Hydrated Fibers



Properly Hydrated and Activated

Figure 8. With poorly hydrated fibers, a large fraction of the fibers are still aggregated, whereas properly hydrated fibers will display a more homogeneous pattern when viewed through a microscope.



Applications to Foods

Salt Tolerance

SenseFi® will remain functional at high salt concentrations. It is, however, important to disperse SenseFi® in water prior to adding the salts if possible, as salts might prevent full dispersion of the product.

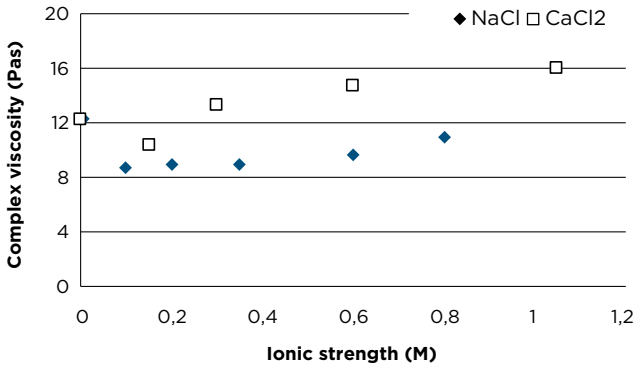


Figure 9: The complex viscosity of SenseFi® solutions remains quite stable over a range of ionic strengths.

Safety	Labeling
	SenseFi can be labelled as the source of the fiber used ie. SenseFi Oat Fiber can be labelled as Oat Fiber. The product uses CMC (or: Sodium Carboxy Methyl Cellulose; NaCMC; Sodium CMC cellulose gum, carboxy methyl cellulose or E466) as a processing aid.

Intended Use

Application	Properties	Typical dosage
Beverages	Increases mouth-feel, opacity, stability, suitable for UHT.	0.2 - 0.4%
Mayonnaises, Sauces & Dressings	Fat replacer, adds texture, body and creaminess. Improves cling, adds opacity. Stabilizes emulsions. Allows pumping without viscosity breakdown. Reduced boil out in sauces	0.5 – 2.5%
Meat Products	Fat replacer, very good water binding, increased yield, increases juiciness, no off-taste and improves stability.	0.5 – 2.0%
Dairy Products	Fat replacer, imparts full-fat mouth-feel. Provides stability, decreases syneresis.	0.3 – 1%
Ice Creams & Frozen Desserts	Fat replacer, increases mix stability, imparts full-fat mouth-feel, neutral taste. Slows down melt down, controls ice crystal growth. Improves extrusion characteristics.	0.25 - 0.8%
Jams, Pastes & Fillings	Decreases boil out, improves spreadability and texture retention. Bake stability. Freeze/thaw stability.	0.5 - 2%
Margarine & Spreads	Freeze/thaw stability, improves texture and water absorption. Reduces staling.	0.5 - 2%
Bakery Products	Fat replacer, imparts full-fat mouth-feel, provides stability and spreadability.	0.3 - 1%
Batters & Breadings	Improves adhesion, reduces oil pick-up, improves crispness.	0.5 - 1%

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