VIDOFIBRES BF 5 C
sugar beet fibre in flour blends

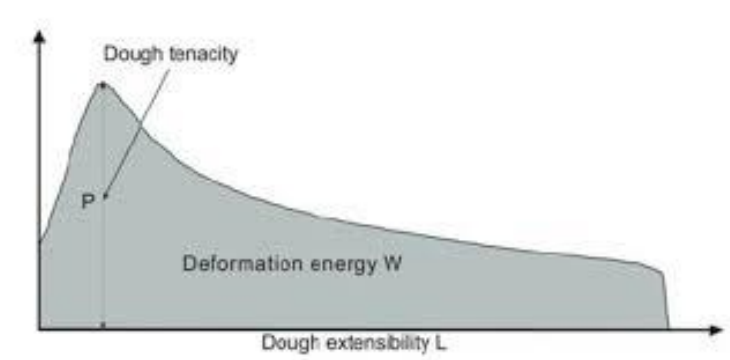
Strong flour – explanation & advantages

‘Strong Flour’ is made from 'hard' wheat varieties which are high in gluten. This makes ‘Strong Flour’ ideal for bread-making where dough needs to expand and rise well in order to produce a high and voluminous loaf. Strong flour is versatile and tolerates over-proofing well.

Weak and cake flours can be used in soft doughs are more suitable for e.g. sponge cakes.

Poor quality flours are normally unusable for bread making, however, there are ways to make flour stronger with plant fibre.

Flour strength – W index



The W index measures the flour strength.

The peak of the curve, identified by P, represents the toughness of gluten, while L represents the extensibility; the higher the value of L the more elastic is the dough.

Flours between 90 and 160 W are called 'weak flours'. They have a low protein content, usually 9%, and are used to produce scones, pie crust and cakes.

Flours between 160 and 250 W are stronger, and are used, for example, in cookies and muffins.

Flours of ≥300 W are called 'strong flours', because they have a great resistance to the deformation of gluten. Used in quality and artisan bread, pizza dough etc.

In general, the longer the rising time a bread product requires, the more important it is to use a flour with a high W, because it better retains the carbon dioxide produced during the fermentation.

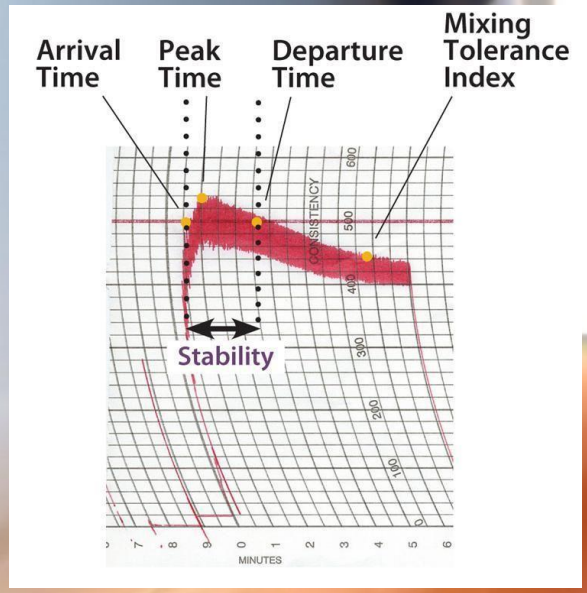
Strength (W) vs Stability (S)

Stability Time (S) correlates with flour strength. Flours with long stability times are generally more suited for artisan or variety bread production and often require longer mixing times.

The stability time of the dough is the interval of time for which it remains at maximum consistency and is very important relative to the type of fermentation and mechanical stress which a dough can withstand.

The Stability Time (S) or mixing tolerance is an important index of flour stability.

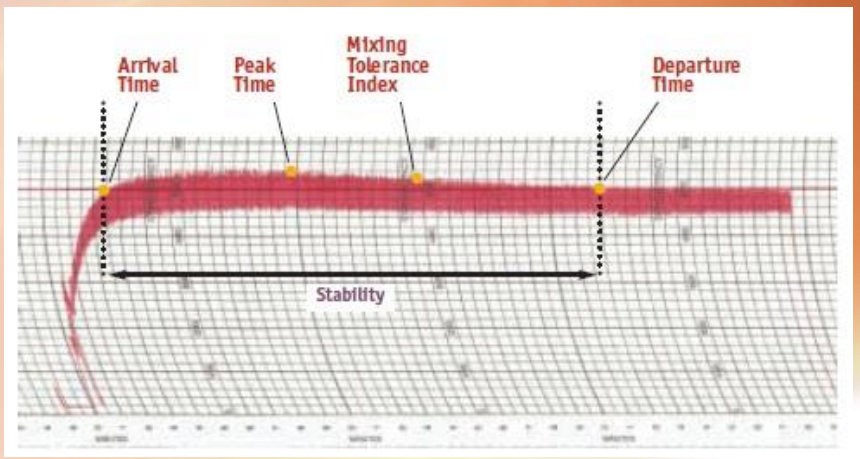
Improve flour stability – tests in bread



Very good quality flours break down at between 0 and 30 Brabender Units (BU) and have a Stability Time (S), of greater than 10 minutes. Poor quality flours break down between 70 and 130 BU's and have a Stability Time of not less than 3 minutes.

A baker can formulate end products by using the Farinograph's results to determine the following:

Water absorption, dough viscosity, including peak water to gluten ratio prior to gluten breakdown, peak mixing time to arrive at desired water/gluten ratio, the stability of flour under mixing and the tolerance of a flour's gluten



Ilustrations:

Upper right - weak gluten flour. Lower right - strong gluten flour.

Sugar beet fibre and stability

Swedish Cereal Laboratories made several measurements with sugar beet fibres (SBF, fine particle size) and wheat fibre (WF) in flour. Farinograph results showed increased WHC (water holding capacity) for both fibres used, but slightly higher for SBF. Stability was increased with BF while WF showed weak results. Development time was similar for both fibres. Efficiency (FU) – at low addition rate (1%) results were similar to the control for both, but at 2% addition, sugar beet fibre showed lower efficiency while WF remained unchanged.

Other studies indicate that addition of sugar beet fibre improved stability values. This is because the mix of soluble / insoluble fibre interacts with the gluten matrix forming a stable dough.

Test in table: Laukova et al 2018, Comparing Celery root fibre with Sugar beet fibre at very high additions

		Water absorption (%)	Dough development time (min)	Dough stability (min)	Mechanic tolerance index (BU)
WF		54.20 ± 0.11	2.55 ± 0.09	9.58 ± 0.14	61.00 ± 1.00
CRP	5%	60.06 ± 0.09*	4.12 ± 0.13*	11.13 ± 0.13*	50.50 ± 0.87*
	7.5%	64.03 ± 0.05*	5.03 ± 0.06*	13.40 ± 0.25*	50.67 ± 1.15*
	10%	66.14 ± 0.57*	7.22 ± 0.26*	14.67 ± 0.29*	31.33 ± 1.15*
	20%	76.53 ± 0.13*	12.50 ± 0.09*	21.50 ± 0.15*	11.00 ± 0.00*
SBP	5%	60.16 ± 0.19*	3.42 ± 0.10	12.06 ± 0.11*	60.00 ± 2.00
	7.5%	65.72 ± 0.14*	8.75 ± 0.25*	13.75 ± 0.15*	29.33 ± 1.15*
	10%	70.10 ± 1.43*	11.17 ± 0.29*	15.40 ± 0.09*	10.00 ± 0.00*
	20%	76.21 ± 1.02*	14.50 ± 0.09*	24.20 ± 0.09*	0.00 ± 0.00*

BU – Brabender unit; CRP – celery root powder; SBP – sugar beet pulp powder; WF – semi-coarse wheat flour; *significantly different from the control sample according to Student's t-test ($P < 0.05$)

Study: Bakery test done in Denmark

Standard Toast Bread

	Reference		2% sugar beet fibre	
	[%]	[g]	[%]	[g]
Wheat flour	100.0%	2,000	100.0%	1,960
Sugar beet fibre		0		40
Salt	1.8%	36	1.8%	36
Sugar	1.0%	20	1.0%	20
Yeast (fresh)	4.0%	80	4.0%	80
Bread improver	1.0%	20	1.0%	20
Water	59.6%	1,192	62.9%	1,258
Total		3,348		3,414

Standard commercial Danish wheat flour

Moisture content	14 – 15.5 %
Amylogram gelatinization temp.	80.5 – 84.5 °C
Wet gluten	27.5 – 30.5 %
Protein	11.9 – 13. 1 %
Falling number	260 – 330 sec.
Ascorbic acid	

Extensograph

	Energy	Extensibility	Max Resistance	Max Resistance/ Extensibility
	cm^2	mm	BU	BU/ mm
	45 min			
Reference	110	166	515	3.1
2% Sugar beet fibres	119	160	558	3.5
	90 min			
Reference	133	129	780	6.1
2% Sugar beet fibres	124	125	758	6.1

Method: Brabender Extensograph, ICC Standard 114/1

Farinograph - Results

	Water absorption (corrected to 14% moisture content)	Development time	Stability	Degree of softening (12 min. after max)
	%	min	min	FU
Reference	59.6	2.5	4.7	42
2% Sugar beet fibres	62.9	2.3	13.5	25

Analysis performed by Svenska Cereallaboratoriet AB

Method: Brabender Farinograph E, ICC Standard 115/1

Conclusions

- Sugar beet fibre improved the stability time – mainly due to the mix of soluble/insoluble fibre where the soluble part is efficient to interact with the flour gluten matrix.
- Addition of sugar beet fibre at lower levels strengthened the structure of the dough and improved its quality.
- Wheat fibre did not add Stability Time – probably comparable with other insoluble fibres.
- Both fibres improved water absorption, sugar beet fibre by 5.5%, wheat fibre by 2.7%.
- Sugar beet fibre improved extensograph max. resistance value.
- Wheat fibre did not change extensograph value.