Bread Crumb Properties – Double Cycle Compression

TVT Texture Analyzer
The TVT Texture Analyzer (Figure 1) offers rapid and objective analysis for all kinds of products. The following parameters can be characterized for your product category.

- Firmness
- Springiness
- Resilience
- Cohesiveness

Both international standard methods as well as customer tailor-made profiles are available.

Figure 1: TVT Texture Analyzer

Scope
- Determination of bread crumb firmness and springiness by double cycle compression.

Method Description
The recording of the measurement data commences once the probe reaches the pre-set trigger force. The probe will then compress the sample to a pre-defined percentage of the samples height. After the first compression, the probe returns to its starting position before the second compression begins. A pre-set wait time decides when the second compression starts. After the double compression, the probe returns to its starting position.

Calibration
Make sure the instrument is correct calibrated before the measurements. How to perform the calibration can be found in the User’s Manual.

Load cell (recommended) 5 - 10kg

Probe
P-CY25S, Cylinder probe 25 mm diameter, stainless steel
Part number: 6730.25 (Figure 2)

Figure 2: P-CY25S
Profile settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Cycle Compression</td>
<td></td>
</tr>
<tr>
<td>Sample height [mm]</td>
<td>50.0</td>
</tr>
<tr>
<td>Starting distance from sample [mm]</td>
<td>5.0</td>
</tr>
<tr>
<td>Number of cycles</td>
<td>2</td>
</tr>
<tr>
<td>Compression [%]</td>
<td>20.00</td>
</tr>
<tr>
<td>Pause [s]</td>
<td>15</td>
</tr>
<tr>
<td>Adhesiveness</td>
<td>Marked</td>
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<tr>
<td>Initial speed [mm/s]</td>
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</tr>
<tr>
<td>Test speed [mm/s]</td>
<td>1.0</td>
</tr>
<tr>
<td>Retract speed [mm/s]</td>
<td>1.0</td>
</tr>
<tr>
<td>Trigger force [g]</td>
<td>5</td>
</tr>
<tr>
<td>Data rate [pps]</td>
<td>200</td>
</tr>
</tbody>
</table>

Sample preparation
Slice the bread loaves in 50 mm thick slices or compress several bread slices (thickness of 50 mm in total) at the same time. Avoid taking the 3 slices nearest the end of the loaf, since they are normally harder than the rest. Place the sample on the measuring table and center it below the probe, Figure 3. Make sure no larger irregularities are in the measuring area. Work quickly, since contact with air dries out the bread and increases the firmness. If a sample is irregular avoid using it in the test. This test could be done with or without the bread crust. Avoid getting the probe too close to the edges since it will have an effect on the measuring results.

![Sample set-up](image.jpg)

Figure 3: Sample set-up

Curve Description
In Figure 4 a typical Force-Distance compression cycle curve is illustrated. The two peaks are representing the force required during the two compressions in the cycle. Force A and Force B represents maximum force for first and second compression respectively. Force A is defined as the firmness. Springiness is a type of
recovery measurement of the sample and gives information to what extent the sample springs back after the deformation during the first compression. The springiness is here measured as the compression distance for the second peak (y) divided with the compression distance for the first peak (x) (Figure 4).

\[
\frac{\text{Distance } y}{\text{Distance } x} \times 100 = \%\text{Springiness}
\]

Resilience is the area from the withdraw (a) divided with the compression area (a).

\[
\frac{\text{Area } a_2}{\text{Area } a_1} = \text{Resilience}
\]

Cohesiveness is the total area of the second peak (B) divided with the total area of the first peak (A).

\[
\frac{\text{Area } B}{\text{Area } A} = \text{Cohesiveness}
\]

The pre-set pause between the two compressions is important for some products, where a too long wait time will allow the sample to spring back more than it would do under its normal conditions.

![Figure 4: Double cycle compression of bread crumb.](image)

**Data Analysis**
The force required to compress the sample to a certain strain of the sample height is here defined as firmness and can be measured in the units [g] or [N]. Springiness is given as a percentage [%] value. Except raw data (force, time and distance) the program also directly provides calculated results such as mean value and standard deviation.