TEXTURE APPLICATION NOTE :

HARD, ROUND TABLET CRUSH TEST

Tablet Hardness Testing by Crushing Using a CTX Texture Analyzer and a 36 mm Diameter Flat Cylindrical Probe

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TEST OBJECTIVE

To compare hardness, Hardness Work Done, and fracturability of a hard, round tablet using compression with a 36 mm diameter flat cylindrical probe (TA-AACC36) and a CTX Texture Analyzer.

BACKGROUND

Samples used for this test are hard, round tablets (Fig. 1). Measurement of tablet sample hardness can be used to correlate with a tablet's rate of dissolution and friability.

Tablets were stored at room temperature overnight at 21°C. A CTX Texture Analyzer (Fig. 2) with a 50 kg load cell was used with a 36 mm diameter flat cylindrical probe (Fig. 3) to perform the compression test.

This test compresses the hard tablet to a set distance and measures the force required to crush it.

The hard tablet is placed between the TA-AACC36 probe and the Fixture Base Table (TA-BT-KIT). As the probe is lowered onto the sample, it will compress the tablet with enough force to crush it. The result will provide the data on the hardness of the tablet.

Figure 1 - Hard, Round Tablet

Figure 2 -
CTX with a 500 kg Load Cell (XCTX)

Figure 3 -
36 mm Diameter
Flat Cylindrical Probe (TA-AACC36)

METHOD

Equipment:

CTX with a 50 kg Load Cell (XCTX)
Fixture Base Table (TA-BT-KIT)
36 mm Diameter Flat Cylindrical Probe (TA-AACC36)
TexturePro Software (SWL-02-111)

Settings:

Test Type:	Compression
Target Type:	Distance
Target Deformation:	2 mm
Trigger Load:	30 g
Pre-Test Speed:	2 mm/s
Test Speed:	1 mm/s

PROCEDURE

1. Attach the TA-AACC36 probe to the CTX Texture Analyzer.
2. Insert two table bolts into the slots on the analyzer base.
3. Place the Fixture Base Table on the CTX, and slightly screw on the bolt nuts.
4. Adjust the table so that the probe is at the center of the table.
5. Once the alignment is complete, secure the base table by tightening the bolt nuts.
6. Place the sample on the table. Align the sample under the probe at the center. The sample should be placed on its side so that it stands on its rim (Fig. 4).
7. Position the probe to about 1 mm above the sample.
8. Set the test parameters using the TexturePro software.
9. Commence test.
10. Repeat steps 1-9 for all samples.

Figure 4

OBSERVATION

When a trigger load of 30 g is detected at the sample surface, the probe compresses the tablet (Fig. 5) at a test speed of 1 mm/s over a specified distance of 2 mm. Once the 2 mm distance is met, the probe returns to the starting position. The Load vs. Time graph (Fig. 6) indicates the positive Peak Load (firmness) and fracturability. The Load vs. Distance graph (Fig. 7) indicates the work done on the sample and the distance when the tablet broke.

The hard, round tablet samples were tested five times, and these tests were averaged together. The graphs below report the data.

Figure 5

Figure 6
Load vs. Time Graph

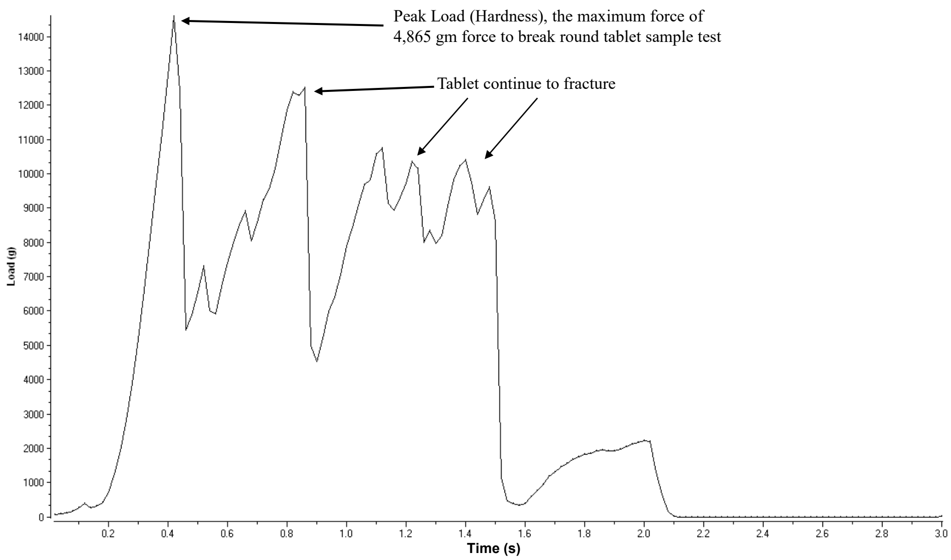
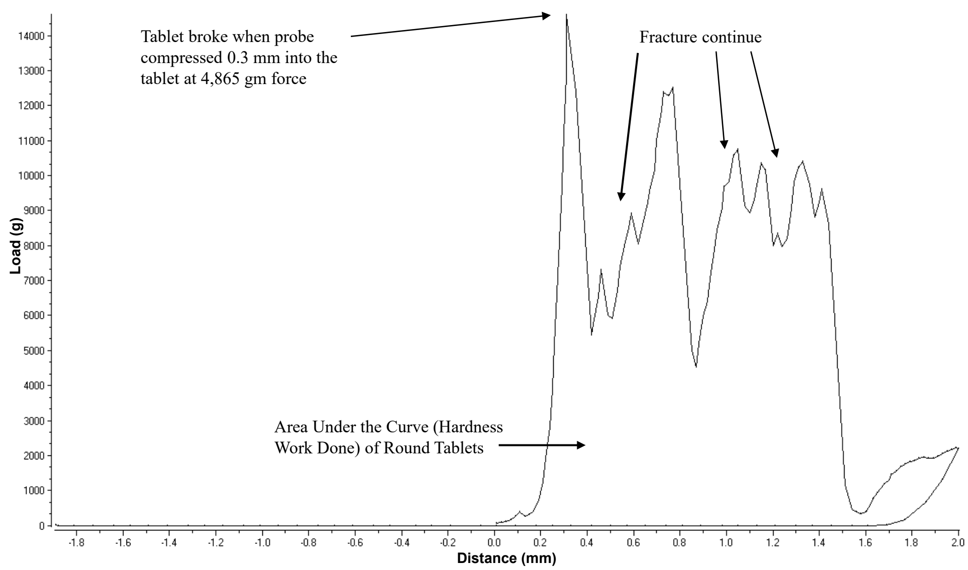


Figure 7
Load vs. Distance Graph



DISCUSSION

The maximum force value is the Peak Load. It is a measure of sample tablet hardness. The higher the value, the harder the sample. The higher the Peak Load, the more work required to break down the sample. Hardness Work Done characterizes the necessary work done to fracture the sample by measuring the amount of force needed to compress the sample to a set distance.

Fracturability measures the brittleness of the sample by recording the load value at the first fracture. Refer to the highest peak in the graph before showing decreases in the load. The quantity of fractures provides a strong indication of sample crunchiness by measuring the number of fractures during the first compression stroke. Only one compression stroke was used in this test.

DATA REPORT

TexturePro Software is used to program and control the CTX Texture Analyzer during the experimental tests. It automatically calculates the Peak Load values and the Hardness Work Done. Multiple samples can be run if desired, and calculated values for standard deviation can be reported.

#	Sample Description Product Name	Batch Name	Result Sample	Hardness Cycle 1 g	Hardness Work Cycle 1 mJ	Quantity of Fractures	Fracturability g
1	Acetaminophen	Round Tablet	1	14865.00	85.00	5.00	14865.00
2	Acetaminophen	Round Tablet	2	15265.00	18.50	1.00	13525.00
3	Acetaminophen	Round Tablet	3	15345.00	83.10	3.00	13600.00
4	Acetaminophen	Round Tablet	4	13295.00	29.80	2.00	13295.00
5	Acetaminophen	Round Tablet	5	14585.00	115.20	9.00	12880.00
Calculation Setting Fracture Sensitivity: 1% of Load			Minimum	13295.00	18.50	1.00	12880.00
			Maximum	15345.00	115.20	9.00	14865.00
			Average	14671.00	66.30	4.00	13633.00
			Standard Deviation	828.00	40.70	3.00	744.00

Figure 8 - Results of the tests performed on the hard, round tablet samples.

CONCLUSION

The test results can be used to determine the ideal hardness of hard tablets. The test procedure, sample preparation, and equipment setup must be adhered to for reproducible test results.

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