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Jackfruit Texture Analysis

Texture testing of jackfruit samples is essential for assessing firmness, hardness, and internal structural integrity, which are crucial for product development and quality control. By identifying appropriate probes and parameters, manufacturers can ensure consistency in texture, especially for products that involve fibrous, varied samples like jackfruit.

Background:

- Jackfruit samples vary in hardness and sponginess, with four sample types (JF225, SF175, Ball, and Flat).
- Texture testing focuses on measuring hardness and hardness work done, which reflects the energy required to break down internal bonds within the sample.
- Sample size, shape, and surface texture influence test consistency.

Figure 1
Brookfield CTX Texture Analyzer fitted with 10kg loadcell & acrylic knife blade

Equipment:

- Instrument: Brookfield CTX Texture Analyzer with 10 kg load cell (Fig. 1)
- Probes and Fixtures:
    - Warner-Bratzler Flat Blade (TA-SBA-1), 30 mm cone probe (TA2/1000), 6 mm and 50.8 mm flat cylinder probes, 25.4 mm and 12.7 mm ball probes (TA43, TA18), Craft Knife Adapter (TA-CKA), and Ottawa Cell Fixture (TA-OC)
    - Software: Texture Pro

Figure 2
Samples received for testing

Settings:

- Test Type: Compression
- Speeds and Distances:
    - Flat Sample: 10 mm distance with 20 g trigger load at 1 mm/s
    - Ball Sample: 20 mm distance with 50 g trigger load at 1 mm/s
    - JF225 and SF175 Samples: 8 mm distance with 50 g trigger load at 1 mm/s

Procedure:

1. Store samples in the freezer and thaw at room temperature (22°C) for 15-20 hours before testing.
2. Inspect and select samples with similar size and geometry.
3. Attach the appropriate probe to the load cell and set up the fixture base table.
4. Place the sample on the fixture base plate, ensuring consistent sample orientation across tests.
5. Lower the probe to 10-15 mm above the sample and adjust alignment.
6. Begin the compression test according to the specified settings for each sample type.
7. Use a fresh sample for each test to ensure accurate results.

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Observations:

- Figure 3.1-2, 4, 5, 6: Hardness and hardness work done graphs for various samples.
    - Flat Sample: Requires 13.29 g force for compression.
    - Ball Sample: Requires 6,042 g force with a larger probe.
    - JF225 and SF175: SF175 shows greater hardness (2,917 g force) compared to JF225 (1,678 g force) under identical conditions.

Results:

- Hardness: SF175 is harder than JF225 based on force measurements under similar conditions.
- Work Done: SF175 has a higher hardness work done (101.6 mJ) compared to JF225 (60.17 mJ), indicating more energy required to deform and break down SF175.

Discussion:

- Consistent sample preparation and equipment setup are vital for reproducible results, given the variability in jackfruit sample sizes and textures. The CTX Texture Analyzer with various probes effectively quantifies jackfruit's firmness and structural resistance, supporting product development needs for fibrous food items.

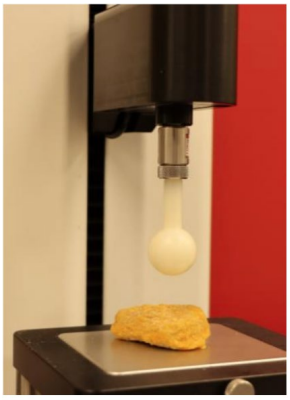


Figure 3
25.4mm ϕ ball probe (TA43) for testing Flat Sample

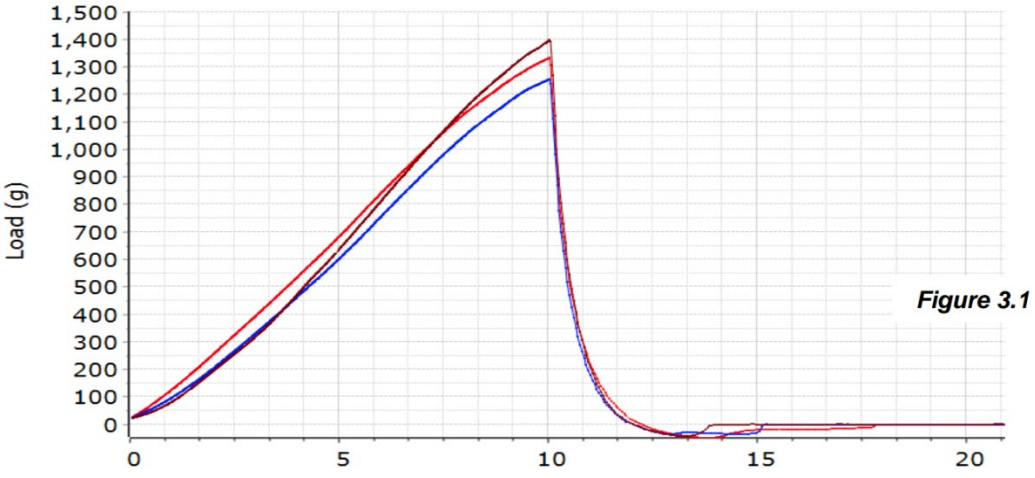
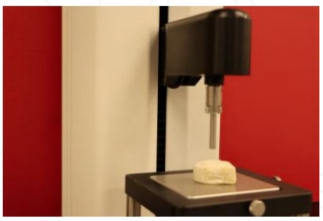
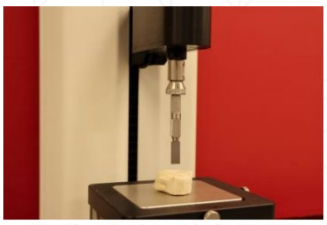
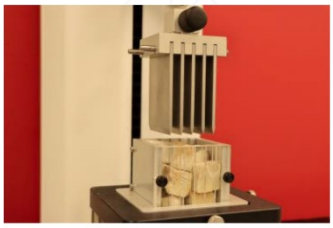


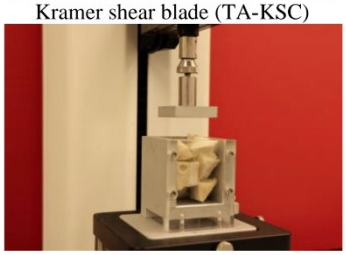
Figure 3.1

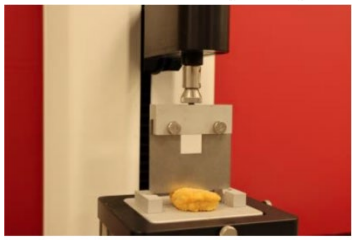

60° 30mm ϕ Cone probe (TA2/1000)

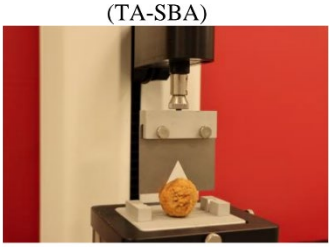

6mm ϕ Flat cylinder probe (TA41)


Small scale shear blade (TA52)


Kramer shear blade (TA-KSC)


112cc Ottawa cell (TA-OC)


Warner-Bratzler Flat Blade (TA-SBA)


Warner-Bratzler V Blade (TA-SBA)

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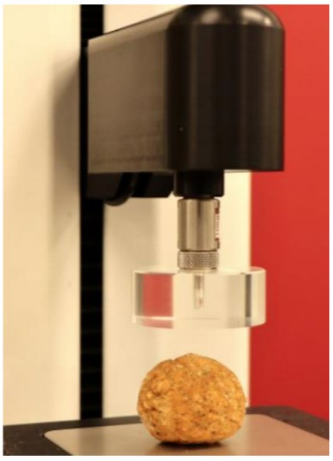
#	Sample Product Name	Batch Name	Results Sample	Hardness Cycle 1 g	Hardness Work Cycle 1 mJ
1	Annie	JackF Flat	3	1333.40	67.46
2	Annie	JackF Flat	2	1255.50	61.07
3	Annie	JackF Flat	1	1398.00	65.29
		Minimum		1256	61.07
		Maximum		1398	67.46
		Average		1329	64.61
		Standard Deviation		71.40	3.25

Figure 3.2



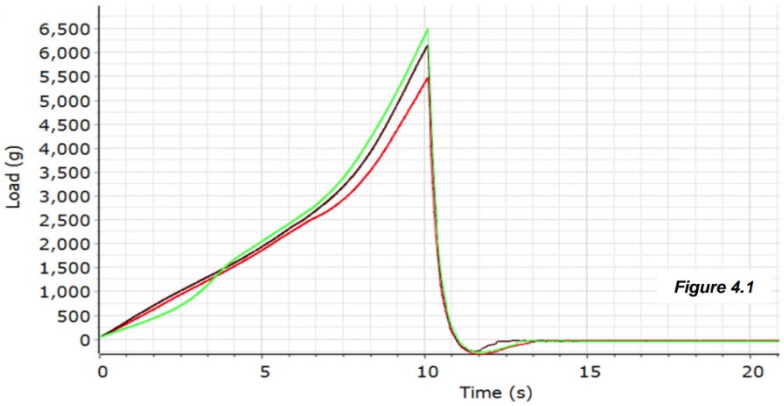


Figure 4.1

Figure 4

50.8mm ϕ flat cylinder probe (TA25/1000), Ball Sample

#	Sample Product Name	Batch Name	Results Sample	Hardness Cycle 1 g	Hardness Work Cycle 1 mJ
1	Annie	JackF Ball	5	5470.10	411.20
2	Annie	JackF Ball	2	6157.00	446.40
3	Annie	JackF Ball	1	6499.90	455.14
		Minimum		5470	411.2
		Maximum		6500	455.1
		Average		6042	437.6
		Standard Deviation		524.4	23.26

Figure 4.2

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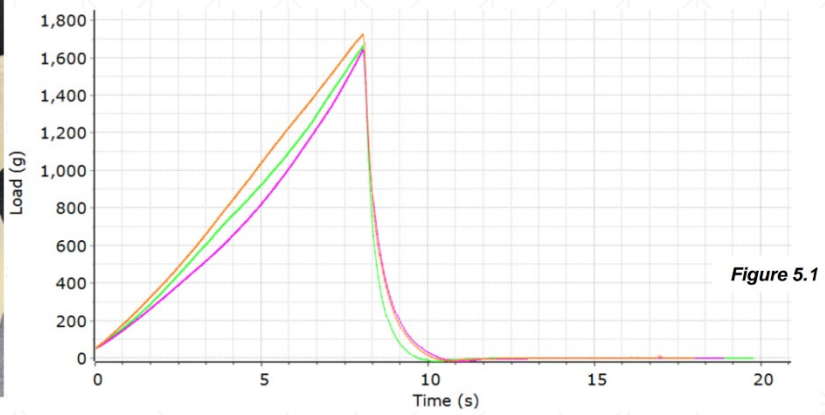
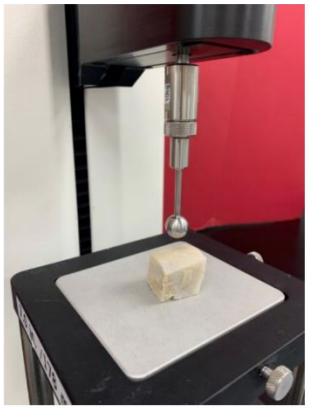


Figure 5.1

Figure 5
12.7mm ϕ ball probe (TA43) for testing JF225 Sample

Figure 5.2

#	Sample		Results	Hardness Cycle 1	Hardness Work Cycle 1
	Product Name	Batch Name	Sample	g	mJ
1	Annie	JackF JF225	5	1663.70	59.73
2	Annie	JackF JF225	4	1644.90	55.18
3	Annie	JackF JF225	3	1726.30	65.59
		Minimum		1645	55.18
		Maximum		1726	65.59
		Average		1678	60.17
		Standard Deviation		42.60	5.22



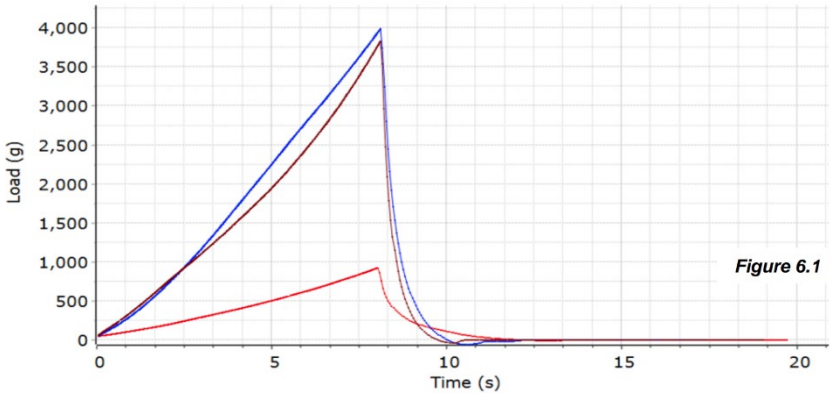


Figure 6.1

Figure 6
12.7mm ϕ ball probe (TA43) for testing SF175 Sample

Figure 6.2

#	Sample		Results	Hardness Cycle 1	Hardness Work Cycle 1
	Product Name	Batch Name	Sample	g	mJ
1	Annie	JackF SF175	3	927.80	33.37
2	Annie	JackF SF175	2	3991.50	141.57
3	Annie	JackF SF175	1	3830.80	129.73
		Minimum		927.8	33.37
		Maximum		3992	141.6
		Average		2917	101.6
		Standard Deviation		1724	59.35