



Physical Test Methods Sub-Group

Technical Report

2nd Collaborative Study on Crush Strength of Flavor Capsules for Filters

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1. INTRODUCTION

1.1 Purpose and Scope

In August 2020 the Physical Test Methods (PTM) Sub-Group published CRM 94 (Determination of Crush Strength of Flavour Capsules for Filters – Definitions and Measurement Principles) and for that purpose carried out a first collaborative study published as PTM-218-1-CTR.

In line with the objectives of the PTM Sub-Group a second collaborative study was carried out, to check if during the first two years of use the laboratories are still able to maintain the r&R values determined in the first study. The study shall also be evaluated in the form of z-scores to allow laboratories to assess their performance when measuring filter capsule crush strength. The study involved the measurement of the crush strength of three different filter capsules. All results will be presented in anonymized form.

1.2 Study Protocol

The test protocol used for this collaborative study is given in Appendix A and will be briefly summarized below.

The protocol contained information on the sample material, the preparation of samples and the procedure for carrying out the measurements. The study participants were required to provide data to identify their laboratory and report all measurement results obtained.

Three samples of flavor capsules were distributed to the laboratories and the laboratories were asked to perform 30 measurements on the capsules on each of 3 days to determine the crush strength, compressive strain and modulus of elasticity as specified in the CRM 94. Thus, each laboratory had to make 90 measurements. The data were collected in an Excel-sheet and sent to the study coordinator for further processing and evaluation.

The distribution of sample materials, the protocol and the data collection sheet started in September 2022 and laboratories were asked to report the results until end of December 2022.

1.3 Products and Measurements

The capsules were supplied by three companies from China (A: Shandong Tobacco Industry, B: Guizhou Tobacco Industry, C: Nantong Filter Factory), all the capsules are commercial products. The main characteristics of the capsules are listed in Table 1.

Table 1 – Characteristics of the capsules

Sample No.	Diameter /mm	Crush Strength /N
A	2.8	15.0
B	2.8	10.0
C	3.5	10.0

1.4 Study Participants

In total 19 sample sets were distributed to 16 laboratories, as listed in Table 2. A code was assigned to each laboratory and the order of laboratories in Table 2 does not agree with the order of the laboratories in other tables. Three laboratories did not provide results within the deadline. ITC Limited provided two sets of results obtained from different laboratories. In total 15 data sets were received for statistical analysis.

Table 2 – List of participants

Participant Name	Country
China National Tobacco Quality Supervision & Test Center	China
Guizhou Tobacco Industry, CNTC	China
Hunan Tobacco Industry, CNTC	China
Henan Tobacco Industry, CNTC	China
Anhui Tobacco Industry, CNTC	China
Fujian Tobacco Industry, CNTC	China
Hubei Tobacco Industry, CNTC	China
Sichuan Tobacco Industry, CNTC	China
Zhejiang Tobacco Industry, CNTC	China
Mudanjiang Filter Factory	China
Nantong Filter Factory	China
British American Tobacco - Brazil (TSS AmSSA)	Brazil
ITC Limited	India
GODFREY PHILLIPS INDIA LTD.	India
British American Tobacco	United Kingdom

2. STATISTICAL EVALUATION

2.1 Raw Data Treatment

In total 15 data sets were received, and all sets were used for statistical analysis. The mean values (MV), the standard deviation (StD) and the number of replicate measurements (N) for each laboratory are reported for the crush strength in Table 3, for the crush strain in Table 4 and for the modulus of elasticity in Table 5. The full data set containing all individual measured values is given in tabulated form in Appendix B and in graphical form in Appendix C.

Table 3 – Summary data for crush strength per laboratory, outliers included

	Crush Strength								
Sample	A			B			C		
Lab ID	MV	StD	N	MV	StD	N	MV	StD	N
	N	N		N	N		N	N	
1	15.9	0.23	3	10.6	0.31	3	10.5	0.30	3
2	15.4	0.67	3	11.8	0.42	3	11.4	0.20	3
3	15.5	0.25	3	11.7	0.17	3	11.3	0.15	3
4	17.8	0.61	3	11.3	0.25	3	10.5	0.10	3
5	15.1	0.12	3	10.2	0.46	3	10.5	0.99	3
6	15.6	0.12	3	8.9	0.06	3	9.7	0.25	3
7	14.3	0.15	3	11.4	0.85	3	12.3	0.49	3
8	17.8	0.44	3	10.9	0.20	3	10.4	0.21	3
9	16.0	0.29	3	10.6	0.38	3	10.6	2.24	3
10	15.2	0.15	3	10.8	0.25	3	10.4	0.26	3
11	17.2	0.44	3	9.8	0.46	3	9.4	0.21	3
12	14.6	0.26	3	11.1	0.12	3	12.4	0.45	3
13	15.4	0.40	3	9.5	0.57	3	10.3	0.59	3
14	15.2	0.38	3	9.3	0.40	3	8.8	0.21	3
15	14.9	0.23	3	11.6	0.06	3	11.9	0.38	3

Table 4 – Summary data for crush strain per laboratory, outliers included

	Crush Strain								
Sample	A			B			C		
Lab ID	MV	StD	N	MV	StD	N	MV	StD	N
1	0.61	0.095	3	0.34	0.062	3	0.41	0.114	3
2	0.56	0.010	3	0.36	0.015	3	0.41	0.015	3
3	0.55	0.012	3	0.35	0.017	3	0.39	0.010	3
4	0.51	0.006	3	0.26	0.015	3	0.29	0.017	3
5	0.52	0.000	3	0.31	0.012	3	0.37	0.047	3
6	0.49	0.006	3	0.24	0.006	3	0.28	0.015	3
7	0.52	0.000	3	0.35	0.030	3	0.42	0.021	3
8	0.48	0.006	3	0.24	0.006	3	0.29	0.010	3
9	0.54	0.025	3	0.32	0.031	3	0.36	0.110	3
10	0.53	0.010	3	0.34	0.021	3	0.42	0.010	3

	Crush Strain								
Sample	A			B			C		
Lab ID	MV	StD	N	MV	StD	N	MV	StD	N
11	0.47	0.015	3	0.22	0.038	3	0.24	0.042	3
12	0.52	0.000	3	0.35	0.006	3	0.44	0.015	3
13	0.54	0.010	3	0.28	0.017	3	0.36	0.032	3
14	0.49	0.017	3	0.25	0.059	3	0.24	0.032	3
15	0.55	0.006	3	0.42	0.010	3	0.47	0.017	3

Table 5 – Summary data for modulus of elasticity per laboratory, outliers included

	Modulus of Elasticity								
Sample	A			B			C		
Lab ID	MV	StD	N	MV	StD	N	MV	StD	N
	N	N		N	N		N	N	
1	26.5	4.52	3	31.9	5.38	3	23.2	1.62	3
2	27.4	0.87	3	32.6	0.52	3	28.0	0.90	3
3	28.3	0.65	3	33.4	1.14	3	28.5	0.76	3
4	33.3	1.56	3	41.3	0.98	3	35.7	2.04	3
5	28.8	0.12	3	33.6	0.46	3	27.8	1.01	3
6	32.0	0.46	3	37.5	0.40	3	35.0	1.01	3
7	26.5	0.26	3	31.7	0.75	3	27.7	0.30	3
8	36.7	0.99	3	44.9	0.61	3	36.3	1.27	3
9	29.5	0.85	3	34.1	2.67	3	29.9	2.73	3
10	28.6	0.69	3	32.2	1.57	3	24.6	0.76	3
11	31.8	1.42	3	37.6	5.18	3	32.3	5.42	3
12	27.9	0.44	3	31.3	0.25	3	27.7	0.15	3
13	28.4	1.19	3	34.3	1.55	3	28.6	0.95	3
14	30.7	1.11	3	37.7	6.01	3	36.4	4.37	3
15	26.7	0.59	3	27.3	0.40	3	25.1	0.26	3

2.2 Outlier Analysis and Removal

Repeatability and reproducibility data were determined following ISO 5725-2, whereby outlier testing according to Cochran’s test and Grubbs’ test was used. First for each laboratory the maximum and the minimum of the 30 individual measurements was checked for being an outlier according to Grubbs’ test (“within-laboratory Grubbs’ test”). Any outliers that were detected were removed from the data set, but the other replicates remained for further calculations.

Secondly the standard deviation of each laboratory’s results was compared to the total standard deviation by Cochran’s test to detect any laboratories that had an unusually high standard deviation. If an outlier was detected, this data set was removed from further analysis.

In a third step Grubbs’ test (“between-laboratory Grubbs’ test”) was used to check if the mean value of a laboratory was exceptionally high or low compared to the other laboratories. All outliers were removed. These two outlier tests were repeated as often as was necessary until no further outliers appeared. After elimination of outliers global statistics, in particular mean values and standard deviations, were calculated and the repeatability and reproducibility statistics were determined.

For crush strength the value obtained by laboratories 5 and 9 for sample C qualified as the outliers based on Cochran’s test.

For crush strain the values obtained by laboratory 1 for samples A and C qualified as outliers based on Cochran’s test.

For the modulus of elasticity, the values obtained by laboratory 1 for sample A and by laboratory 11 for sample C qualified as outliers based on Cochran’s test.

No outliers were excluded based on between-laboratory Grubbs’ test, so that in total 6 individual data points had to be excluded from the analysis of repeatability and reproducibility.

2.3 Robust Mean Values and Standard Deviations

After removal of outliers robust mean values and between-laboratory standard deviations were calculated using ISO 5725-2. The results are given in Table 6.

Table 6 – Robust mean values (MV), between-laboratory standard deviations (SDb) and within-laboratory standard deviations (SDw) of crush strength and crush strain and modulus of elasticity

Sample ID	Crush Strength				Crush Strain				Modulus of Elasticity			
	MV	SDb	SDw	N	MV	SDb	SDw	N	MV	SDb	SDw	N
	N	N	N						N	N	N	
A	15.8	1.07	0.36	15	0.52	0.027	0.010	15	29.8	2.82	0.88	15
B	10.6	0.90	0.39	15	0.31	0.056	0.029	15	34.8	4.26	2.68	15
C	10.7	1.05	0.41	15	0.36	0.072	0.047	15	29.1	4.16	1.26	15

2.4 Evaluation of Repeatability and Reproducibility

Based on the robust mean value and the between-laboratory and within-laboratory standard deviations, repeatability and reproducibility statistics were calculated according to ISO 5725-2. The results are given in Tables 8a-c. The tables show the standard deviation (SD), the limit and the coefficient of variation (CoV) relative to the global mean value for repeatability and reproducibility.

Table 8a – Repeatability and reproducibility statistics for crush strength

	Crush Strength					
	Repeatability			Reproducibility		
ID	StD	Limit	CoV	StD	Limit	CoV
	N	N	%	N	N	%
A	0.36	1.00	2.27	1.13	3.16	7.15
B	0.39	1.09	3.65	0.98	2.75	9.23
C	0.41	1.13	3.79	1.13	3.15	10.53

Table 8b – Repeatability and reproducibility statistics for crush strain

	Crush Strain					
	Repeatability			Reproducibility		
ID	StD	Limit	CoV	StD	Limit	CoV
			%			%
A	0.010	0.027	1.84	0.029	0.081	5.52
B	0.029	0.080	9.29	0.063	0.177	20.45
C	0.047	0.132	13.10	0.086	0.241	24.05

Table 8c – Repeatability and reproducibility statistics for modulus of elasticity

	Modulus of Elasticity					
	Repeatability			Reproducibility		
ID	StD	Limit	CoV	StD	Limit	CoV
	N	N	%	N	N	%
A	0.88	2.46	2.95	2.96	8.28	9.91
B	2.68	7.51	7.72	5.04	14.10	14.49
C	1.26	3.52	4.32	4.34	12.16	14.93

2.5 Evaluation of Laboratory Performance (z-Scores)

Based on the robust mean value and the between-laboratory standard deviation the z-scores were calculated as described in ISO 13528:2015. For the calculation of z-scores the data sets were used as reported without any outlier elimination. In the tables, fields marked in orange are z-scores with $2 < |z| < 3$ and red fields are those with $3 \leq |z|$.

Table 9 – Z-Scores for all laboratories on the measurement of crush strength, crush strain and modulus of elasticity

ID	Crush strength			Crush strain			Modulus of elasticity		
	A	B	C	A	B	C	A	B	C
1	0.63	-0.20	0.00	2.70	0.28	0.43	-0.85	-0.41	-1.19
2	-0.16	1.00	1.21	1.20	0.57	0.43	-0.48	-0.24	-0.11
3	0.00	0.90	1.08	0.90	0.43	0.22	-0.18	-0.07	0.00
4	3.81	0.50	0.00	0.00	-0.85	-0.86	1.66	1.85	1.62
5	-0.63	-0.60	0.00	0.00	-0.14	0.00	0.00	0.00	-0.16
6	0.16	-1.90	-1.21	-0.90	-1.14	-1.08	1.18	0.94	1.48
7	-1.75	0.60	2.43	0.00	0.43	0.54	-0.85	-0.46	-0.18
8	3.65	0.10	-0.13	-1.20	-1.14	-0.86	2.92	2.72	1.75
9	0.95	-0.20	0.13	0.90	0.00	-0.11	0.30	0.17	0.31
10	-0.16	0.00	-0.13	0.30	0.28	0.54	-0.04	-0.39	-0.88
11	2.86	-1.00	-1.48	-1.20	-1.42	-1.40	1.18	0.96	0.85
12	-1.43	0.30	2.56	0.00	0.43	0.76	-0.33	-0.55	-0.18
13	0.16	-1.30	-0.27	0.60	-0.57	-0.11	0.00	0.17	0.02
14	-0.48	-1.50	-2.29	-0.90	-0.99	-1.40	0.70	0.99	1.78
15	-0.95	0.80	1.89	0.90	1.42	1.08	-0.78	-1.52	-0.76

3. DATA INTERPRETATION

3.1 Repeatability and Reproducibility

The number of outliers observed in this collaborative study is rather low, which shows that laboratories are in general able to reliably perform the measurement of crush strength parameters as described in CRM 94. For the crush strength, the coefficient of variation for repeatability is between 2.27 % and 3.79 %. The coefficient of variation for reproducibility is between 7.15 % and 10.53 %. For the crush strain, the coefficient of variation for repeatability is between 1.84 % and 13.10 %. The coefficient of variation for reproducibility is between 5.52 % and 24.05 %. For the modulus of elasticity, the coefficient of variation for repeatability is between 2.95 % and 7.72 %. The coefficient of variation for reproducibility is between 9.91 % and 14.93 %.

It must be noted that the testing according to the CRM is destructive, thus the repeatability and reproducibility statistics contain the sample-to-sample variability, which is a substantial contribution to the overall variability of the method. Based on the results the method described in CRM 94 continues to be suitable for measuring crush strength parameters of flavor capsules.

3.2 Laboratory Performance

As described in ISO 13528:2015, in normal circumstances about 95 % of all z-scores will be in the range between -2 and 2. Occasionally, absolute z-scores equal to or greater than 2 may be expected at a rate of about 5 %, while absolute z-scores equal to or greater than 3 will occur only at a rate of about 0.3 %.

Thus for absolute z-scores between 2 and 3 it is up to the laboratory to decide if these exceptional values are of importance and require any corrective action or review of the laboratory procedures. For absolute z-scores of 3 or higher it is strongly recommended that the laboratory investigates the reasons for the deviation and derives appropriate actions from these investigations.

In this study, for crush strength 4 of 45 determinations, i.e. 8.9 %, resulted in absolute z-scores of 2 or higher and 2 of 45 determinations, i.e. 4.4 %, in absolute z-scores of 3 or higher. For crush strain 1 of 45 determinations, i.e. 2.2 %, resulted in an absolute z-score of 2 or higher and no result in absolute z-scores of 3 or higher. For the modulus of elasticity 2 of 45 determinations, i.e. 4.4 %, resulted in absolute z-scores of 2 or higher and no result in absolute z-scores of 3 or higher.

For the crush strength, it can be seen in Table 9 that laboratories 4 and 8 obtained z-scores with absolute values greater than 3. It is recommended those laboratories investigate the reasons for these deviations.

3.3 Comparison with Historical Data

One of the purposes of this study is to assess laboratory performance so that over time a steady improvement can be achieved. The following historical assessment by comparing data from the 1st Collaborative Study on Crush Strength of Flavor Capsules for Filters (2020) is an attempt to investigate, if such an improvement can be observed. Tables 10a and 10b show the average coefficient of variation for repeatability and reproducibility of 2020 and 2022.

For the crush strength, the repeatability and reproducibility coefficient of variation decreased significantly. This indicates that the test of crush strength can be carried out reliably within and between laboratories, which may be due to the laboratories becoming familiar with the method, but it may also be affected by the sample materials themselves. For crush strain, the repeatability coefficient of variation decreased by about 50 %, the reproducibility coefficient of variation however did not change much. For the modulus of elasticity, the repeatability and reproducibility coefficient of variation improved only a little.

Table 10a – Historical development of repeatability coefficient of variation

Parameter	Repeatability Coefficient of Variation	
	%	
	2020	2022
Crush strength	18.88	3.24
Crush strain	14.69	8.08
Modulus of elasticity	7.94	5.00

Table 10b – Historical development of reproducibility coefficient of variation

Parameter	Reproducibility Coefficient of Variation	
	%	
	2020	2022
Crush strength	20.31	8.97
Crush strain	17.78	16.67
Modulus of elasticity	13.34	13.11

4. REFERENCES

- CORESTA Recommended Method No. 94, Determination of Crush Strength of Flavor Capsules for Filters - Definitions and Measurement Principles.
- ISO/IEC 17043:2010, Conformity assessment – General requirements for proficiency testing.
- ISO 13528:2015, Statistical methods for use in proficiency testing by interlaboratory comparison.
- ISO 5725-2:1994, Accuracy (trueness and precision) of measurement methods and results - Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method.
- PTM-218-1-CTR: Collaborative Study on Crush Strength of Flavour Capsules for Filters, August 2020.

5. APPENDICES

APPENDIX A – Protocol

The following protocol was used in this collaborative study based on the details described in the CRM 94 :

Prior to each measurement flavor capsules shall be conditioned in an atmosphere as specified in ISO 3402 / CRM 21 (temperature (22 ± 1) °C, relative humidity (60 ± 3) %) for not less than 48 h. If this is impossible, make a note in the comments column. You will find 3 separate samples called "Sample A", "Sample B" and "Sample C".

Prior to a set of measurements, all instruments have to be checked and calibrated according to the CRM 94. Calibration and instrument settings shall be as used in your laboratory. Set the test speed to (20 ± 5) mm/min.

Conduct measurements in the standard laboratory atmosphere as specified in ISO 3402 / CRM 21 (temperature (22 ± 1) °C, relative humidity (60 ± 5) %). If this is impossible, make a note in the comments column.

Each sample shall be tested by performing 30 individual measurements on each of 3 days of measurement.

APPENDIX B – Individual Raw Data

Appendix B.1-1: Crush strength, Sample A, the outliers (Grubbs' test) are marked in yellow

Crush Strength															
Sample A															
Day 1															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	17.0	16.9	15.0	19.7	15.3	13.1	15.5	16.3	15.0	13.4	13.9	15.9	16.5	13.8	13.3
2	16.8	17.2	16.2	19.4	17.1	18.5	15.1	17.3	13.1	13.9	16.1	14.3	15.7	15.2	14.6
3	15.4	16.8	14.3	12.8	15.4	14.5	16.3	20.6	17.3	15.6	15.5	15.4	16.1	14.4	13.8
4	17.8	14.3	16.8	17.6	14.9	16.3	13.6	14.8	17.1	13.8	14.9	15.3	15.7	12.5	16.4
5	17.4	16.1	16.5	19.9	15.9	13.3	8.4	15.6	16.4	16.3	17.7	14.9	16.0	18.7	13.6
6	16.6	16.3	17.2	16.9	12.9	16.9	14.9	20.4	15.7	15.8	14.8	15.3	14.3	17.5	16.2
7	14.9	17.1	14.3	16.7	14.4	15.8	16.6	20.0	16.7	15.8	20.2	13.1	16.1	14.8	14.0
8	14.7	17.2	16.1	17.5	14.3	17.2	8.3	19.3	17.9	13.0	16.9	15.0	15.6	12.3	14.7
9	13.8	16.0	16.3	16.5	12.5	15.5	16.8	15.1	17.4	17.2	15.6	15.6	16.0	14.8	15.1
10	16.9	17.6	16.2	13.6	15.9	12.7	15.6	15.1	17.5	14.1	16.1	15.8	15.9	17.4	16.0
11	16.1	15.4	13.6	20.1	12.8	16.6	14.0	18.2	16.8	16.5	15.2	15.1	16.3	14.2	16.5
12	14.7	17.5	16.4	18.0	12.8	15.3	13.9	11.6	17.1	12.3	19.2	13.6	16.3	14.6	15.6
13	13.6	15.5	15.1	17.4	15.8	15.6	13.9	17.9	17.1	13.0	21.1	15.2	15.7	17.6	16.3
14	17.3	16.6	16.0	15.9	16.3	19.0	13.0	17.8	16.8	15.4	14.3	13.5	15.7	19.5	15.6
15	15.4	14.5	14.4	9.7	16.2	11.3	15.8	16.8	16.1	15.8	17.7	14.9	15.2	14.4	15.8
16	15.5	16.4	15.9	8.3	15.8	18.7	15.3	12.9	15.7	16.6	19.4	15.2	15.0	15.8	14.4
17	17.7	15.8	13.6	17.1	16.3	16.4	15.8	14.5	15.9	14.6	15.3	15.6	15.8	14.6	13.5
18	17.3	16.1	15.8	19.4	15.5	13.6	12.1	17.9	15.9	17.0	18.8	15.3	13.2	16.2	14.6
19	18.0	16.5	14.7	20.0	14.8	14.2	11.9	16.6	15.7	16.5	14.1	15.0	16.5	14.3	14.8
20	14.9	17.2	17.3	17.0	16.2	15.2	8.7	17.2	15.8	11.4	16.3	15.7	14.4	15.8	16.7
21	16.8	16.6	15.4	16.4	13.2	15.3	16.5	19.2	17.2	16.5	17.7	14.4	14.7	19.4	15.2
22	13.1	13.9	15.5	19.6	15.9	14.4	15.8	15.1	14.4	16.5	18.8	14.5	16.1	14.3	16.1
23	15.4	13.0	17.2	19.8	15.4	13.7	16.9	20.8	16.2	12.2	15.2	12.8	10.6	14.9	15.8
24	16.9	17.3	12.7	19.4	17.0	14.5	14.0	18.6	16.3	18.7	17.2	15.9	14.0	17.3	14.8
25	16.7	16.4	14.8	19.9	16.2	15.6	16.8	22.0	17.2	16.8	19.1	14.2	14.9	15.7	14.8
26	16.1	16.4	15.3	19.8	16.1	16.4	14.8	17.3	17.6	14.7	16.4	14.2	16.0	13.0	16.3
27	17.1	13.7	15.0	18.4	13.7	14.9	16.7	21.9	15.1	14.3	13.6	16.0	16.0	14.8	15.4
28	15.0	12.2	16.1	18.9	15.6	16.3	13.2	18.6	10.8	15.6	16.8	13.9	14.1	16.4	14.2
29	14.1	17.5	16.3	20.4	15.5	16.9	16.2	15.8	17.7	15.2	18.4	15.9	15.1	16.3	15.3
30	17.5	15.0	15.0	17.7	15.5	18.1	15.3	14.8	17.7	15.1	20.4	14.7	15.2	18.0	16.0

Crush Strength															
Sample A															
Day 2															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	15.7	14.4	15.0	17.3	16.1	14.7	12.8	19.4	18.3	15.5	14.7	15.1	15.3	13.5	14.8
2	16.4	17.4	15.7	20.4	11.8	14.6	9.2	17.8	15.8	17.5	14.3	13.7	17.7	14.1	15.2
3	17.7	14.8	14.8	17.4	15.4	17.2	13.5	14.6	12.8	17.5	15.8	14.2	10.1	13.5	16.2
4	17.5	15.9	13.5	14.4	16.0	10.2	15.0	20.3	15.9	16.2	17.6	14.6	14.1	14.6	13.9
5	15.3	13.7	14.6	19.0	16.1	13.1	15.8	18.8	15.9	16.2	17.3	15.8	16.7	15.4	14.0
6	13.6	16.1	15.6	18.6	14.8	16.7	15.1	17.3	18.5	16.0	14.5	15.3	15.4	14.3	13.6
7	17.0	14.1	16.5	14.7	16.1	19.4	14.7	17.6	15.8	13.7	17.0	14.3	13.3	13.4	15.1
8	13.6	17.1	12.4	18.0	15.5	19.0	12.0	21.1	11.3	14.5	17.4	14.4	15.8	16.8	14.7
9	15.8	17.5	16.2	16.2	15.0	15.8	15.0	19.8	14.3	16.1	18.6	15.3	13.8	17.2	15.6
10	13.1	13.3	13.2	16.7	14.6	16.0	15.1	16.7	12.1	17.4	20.0	14.7	16.9	12.6	14.7
11	16.8	14.1	15.7	20.6	13.9	8.1	15.0	19.1	13.7	16.0	15.8	15.3	8.4	17.4	16.8
12	14.4	17.6	14.6	19.4	15.6	14.4	16.8	17.0	19.5	13.6	11.0	15.2	15.2	14.7	14.9
13	18.5	16.5	12.4	15.8	16.2	16.3	15.2	21.9	13.0	13.6	21.2	13.3	15.2	14.8	15.0
14	16.3	17.5	15.9	17.0	15.0	17.3	15.0	15.0	18.9	17.0	14.7	12.5	16.2	14.4	15.6
15	17.1	13.9	16.7	19.7	13.7	18.1	15.4	21.2	13.5	13.4	18.2	15.8	15.7	16.6	14.6
16	19.3	15.9	14.1	14.1	14.0	14.3	13.8	15.6	18.2	14.9	12.2	14.0	15.9	14.1	15.1
17	14.4	14.9	17.0	16.2	15.8	17.8	15.5	19.2	18.6	13.0	20.9	13.0	11.8	13.5	14.4
18	17.6	17.8	14.8	18.0	14.9	17.4	13.8	15.1	15.4	14.5	18.0	16.3	14.4	13.1	14.6
19	14.0	17.0	14.7	20.9	15.8	19.2	16.1	16.6	10.0	17.2	20.2	14.5	14.1	16.0	14.2
20	13.6	14.4	16.9	9.5	16.0	19.6	15.0	19.1	8.8	14.3	19.7	14.9	14.9	17.2	14.2
21	14.9	16.5	14.4	20.2	15.8	16.1	9.0	19.2	14.9	14.4	18.7	13.7	16.8	14.6	14.6
22	14.0	15.3	15.0	14.3	15.7	16.9	12.8	17.8	17.7	17.8	18.0	13.2	16.3	14.6	14.2
23	18.5	12.7	14.4	14.6	13.6	14.3	14.4	17.4	16.2	16.1	20.3	15.2	16.4	11.0	14.8
24	13.9	16.1	17.8	19.8	15.8	14.6	15.7	20.8	15.8	14.0	16.2	15.6	15.8	12.9	14.2
25	14.9	16.8	15.7	17.0	12.4	13.2	15.6	16.2	19.8	17.3	20.3	14.9	16.6	16.1	15.0
26	15.8	15.5	15.8	13.9	14.9	14.0	11.9	15.5	16.2	13.3	20.1	15.2	17.1	14.7	13.8
27	17.7	13.9	17.0	20.0	16.2	17.8	15.8	13.2	18.8	6.8	20.4	12.7	15.7	16.0	14.4
28	16.9	12.7	16.4	17.2	14.0	13.9	12.2	18.6	18.1	18.6	17.1	14.0	14.8	17.8	14.2
29	17.3	17.6	17.3	18.9	15.6	15.8	16.6	19.7	18.0	17.9	20.9	14.9	14.0	16.1	15.7
30	18.7	17.1	16.4	22.2	13.8	15.6	16.0	18.3	15.9	12.8	20.2	14.8	17.2	15.4	16.1

Crush Strength															
Sample A															
Day 3															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	16.3	18.6	15.1	14.5	16.8	8.7	14.1	19.1	14.7	16.1	15.6	13.5	10.5	18.0	14.9
2	17.1	15.2	13.7	17.4	14.7	9.4	12.3	18.6	15.9	16.2	17.3	16.0	15.9	16.7	15.1
3	16.1	15.7	16.8	15.9	16.6	14.6	14.3	17.4	14.7	7.8	19.6	15.3	16.4	14.4	13.7
4	16.2	13.1	13.6	19.1	13.4	14.0	13.6	19.5	14.9	16.6	21.4	16.6	12.8	12.4	15.2
5	14.1	17.9	14.7	16.5	15.8	18.6	12.4	16.8	16.4	15.2	7.1	14.9	16.5	15.4	13.5
6	17.0	16.6	17.1	15.5	13.6	15.3	13.8	19.2	12.6	15.3	15.4	12.6	17.1	10.9	14.4
7	16.9	16.3	14.9	20.2	15.2	18.4	15.0	19.7	14.1	16.8	16.2	15.4	14.0	15.0	14.8
8	13.8	14.2	17.4	19.3	15.0	14.7	13.4	17.0	15.1	15.7	17.5	13.0	17.2	16.7	15.5
9	14.9	16.5	17.2	20.8	14.5	18.3	14.2	19.2	19.2	11.6	18.6	14.3	16.1	16.5	14.1
10	16.8	13.3	14.2	29.8	16.5	16.4	15.1	20.0	17.5	16.4	18.9	13.4	17.5	15.2	13.5
11	16.6	17.2	17.8	18.0	14.7	17.1	15.6	20.1	15.2	13.1	19.2	14.6	17.3	15.3	13.3
12	16.7	14.1	17.0	20.6	15.9	17.5	12.9	19.4	16.9	15.7	15.7	13.8	18.2	13.7	14.2
13	17.5	12.4	16.4	20.1	14.4	12.2	13.3	18.5	14.5	15.9	16.0	13.4	12.1	15.5	14.7
14	14.9	14.5	15.7	19.3	15.3	17.9	16.5	19.5	18.4	13.4	21.3	14.3	16.2	16.1	15.7
15	12.8	15.4	15.9	19.1	16.1	16.7	13.1	18.2	13.4	13.3	10.9	13.2	15.9	16.2	15.5
16	15.6	17.0	16.3	18.0	13.1	15.1	14.1	17.2	16.7	17.5	16.4	11.2	15.9	19.0	15.0
17	16.8	14.3	18.1	20.7	15.5	17.7	9.7	17.9	17.3	16.7	16.6	14.6	16.0	12.5	13.9
18	15.6	12.7	16.2	12.0	15.3	17.3	13.9	15.5	18.0	15.9	19.8	15.6	15.9	14.2	15.1
19	12.5	12.8	16.0	18.4	13.5	14.2	14.7	16.8	16.4	17.0	16.2	13.2	17.5	16.5	15.2
20	14.5	13.7	16.9	19.8	16.4	17.7	15.9	18.2	17.5	12.4	20.1	13.7	13.9	17.4	15.0
21	14.4	14.3	14.1	15.3	15.5	12.6	12.5	19.0	17.2	16.7	17.5	14.5	15.3	15.8	15.0
22	16.8	14.6	13.8	18.3	14.0	6.4	16.1	15.2	18.4	15.5	18.3	13.2	16.0	17.2	14.2
23	14.5	13.2	17.0	18.4	15.7	14.7	14.8	19.0	13.6	13.0	18.6	15.1	17.5	13.1	16.4
24	15.0	13.7	14.0	19.2	15.0	17.6	16.0	17.3	13.8	16.3	15.3	15.4	15.6	14.0	15.9
25	17.4	13.0	16.9	16.5	16.2	14.4	14.5	16.2	17.8	16.5	15.9	13.8	14.5	12.4	15.0
26	15.2	12.5	16.6	17.2	13.2	17.1	15.8	17.0	16.3	17.8	19.2	15.5	16.3	16.3	15.1
27	17.7	12.3	14.2	18.5	15.0	16.8	12.5	17.4	19.0	17.7	19.8	15.8	18.1	10.7	14.6
28	14.8	16.0	14.4	19.9	16.0	19.2	15.6	18.9	18.5	16.5	15.2	13.8	16.4	10.0	14.3
29	16.8	15.0	15.5	19.2	13.8	16.4	14.3	21.6	15.1	16.5	12.5	16.1	16.2	14.9	15.0
30	12.8	15.1	17.5	16.8	13.9	18.7	13.5	14.9	18.1	17.2	17.2	15.9	16.9	18.0	15.1

Appendix B.1-2: Crush strength, Sample B, the outliers (Grubbs' test) are marked in yellow

Crush Strength															
Sample B															
Day 1															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	10.4	12.9	9.4	6.6	6.4	10.3	11.7	5.1	8.9	9.3	9.3	10.4	14.1	10.0	10.5
2	8.1	15.8	11.7	11.2	8.6	10.5	8.9	11.5	10.0	10.3	8.6	12.1	13.2	9.6	8.3
3	11.8	11.6	15.0	10.5	9.7	12.2	10.8	11.5	5.6	13.1	10.6	7.9	12.0	10.3	12.1
4	9.8	14.1	14.2	12.3	9.5	8.2	10.6	10.1	10.9	7.5	8.0	4.2	10.0	11.1	10.4
5	12.9	12.9	9.5	13.1	9.7	3.2	10.1	14.0	19.5	12.7	10.7	6.4	9.3	9.0	10.6
6	10.1	11.3	12.0	11.0	12.2	6.7	10.2	11.5	9.1	10.2	10.2	13.0	6.7	6.4	9.8
7	8.8	12.9	10.2	7.8	6.8	7.5	10.8	9.6	11.2	14.3	12.2	12.8	9.5	12.2	10.9
8	12.2	12.6	9.3	10.4	12.4	7.9	12.2	10.1	11.7	11.6	9.1	10.1	4.3	12.9	12.8
9	10.8	14.5	11.1	14.0	8.8	8.5	10.1	10.1	10.7	8.6	13.2	12.1	13.5	6.6	12.8
10	9.6	11.2	15.5	7.5	6.4	6.6	13.9	9.2	9.4	8.3	8.6	14.2	9.5	8.0	11.6
11	9.6	10.2	9.6	9.3	8.0	10.8	11.9	16.4	10.0	9.5	7.9	9.2	10.6	9.0	14.7
12	12.0	11.4	8.4	13.3	7.7	8.4	8.1	11.7	11.2	11.8	7.9	9.0	10.4	11.8	11.7
13	9.1	10.8	11.0	11.8	12.3	13.4	5.8	15.7	10.3	8.9	10.1	10.8	12.6	13.3	13.6
14	11.2	10.0	8.8	7.9	10.4	5.1	10.4	16.3	4.2	12.6	10.8	11.4	13.3	11.4	11.2
15	13.9	13.8	8.5	10.0	6.6	11.7	9.3	10.8	12.0	11.1	9.3	16.9	11.6	7.6	12.4
16	9.3	9.8	12.2	9.3	8.1	10.9	10.0	9.1	14.8	12.2	8.6	12.6	7.4	8.8	12.4
17	10.2	12.3	14.3	14.1	13.0	9.7	9.1	11.4	11.4	9.0	9.1	11.6	9.1	7.1	10.7
18	10.2	11.4	9.9	9.2	8.7	8.9	10.1	11.7	13.7	12.6	7.9	9.6	9.4	10.1	12.8
19	11.6	12.9	12.6	14.1	11.5	9.9	9.8	12.4	12.7	8.4	10.7	12.7	10.3	8.6	12.0
20	8.8	11.3	15.5	13.9	11.2	5.2	10.9	12.1	11.9	12.6	8.2	12.6	2.7	7.9	9.7
21	11.2	14.1	17.7	15.6	14.8	7.2	13.4	8.8	11.3	8.4	5.4	12.2	12.8	7.8	10.4
22	9.8	13.8	11.3	5.7	10.6	10.0	13.3	3.6	14.5	8.7	9.1	15.6	6.9	10.7	10.4
23	10.2	10.3	12.4	13.0	8.6	14.8	10.0	10.9	8.2	7.5	4.1	9.1	5.7	11.5	11.8
24	8.0	14.4	12.5	9.6	9.1	5.4	12.2	10.2	9.3	10.0	13.1	10.3	7.9	11.6	12.1
25	12.4	11.6	10.3	12.8	9.3	8.9	11.9	14.2	10.6	12.7	9.0	8.8	9.0	7.4	12.4
26	13.5	10.1	11.9	10.4	10.6	9.4	10.7	12.9	10.6	12.8	10.2	8.2	10.5	11.0	11.8
27	11.7	11.9	11.8	10.4	11.5	10.3	12.0	10.2	7.5	11.9	9.6	13.3	8.0	10.1	10.3
28	9.9	12.2	13.5	4.2	11.6	10.0	8.0	12.9	9.1	10.3	9.1	9.0	15.1	8.0	13.1
29	8.6	15.2	11.9	17.4	13.3	10.5	10.3	10.7	14.0	12.8	10.9	11.2	11.3	8.2	12.9
30	8.7	11.4	12.2	13.5	9.0	7.2	10.2	8.2	9.1	14.0	7.3	12.1	11.4	11.8	10.4

	Crush Strength														
	Sample B														
	Day 2														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	10.8	12.9	10.5	12.6	7.4	10.0	16.8	8.3	15.7	7.5	4.8	11.1	9.8	8.9	12.9
2	9.6	9.6	12.1	15.9	13.2	8.8	10.5	10.0	7.9	14.5	8.0	11.6	9.9	7.8	12.1
3	11.8	11.8	15.5	12.4	8.6	10.8	8.9	11.4	3.0	7.8	8.7	7.9	8.6	10.1	11.2
4	10.0	11.6	10.9	13.6	8.7	8.6	10.0	13.0	6.7	13.3	9.8	12.0	4.6	9.1	10.6
5	9.9	12.2	10.6	7.9	12.3	4.2	13.1	9.8	7.9	16.2	10.5	11.0	9.8	10.6	10.7
6	12.1	13.4	11.2	11.0	10.6	12.2	8.9	7.8	8.1	7.2	9.7	9.9	5.7	6.8	12.8
7	11.1	11.3	15.9	11.9	14.2	10.1	18.8	18.8	8.6	12.3	11.3	9.2	2.7	10.0	11.6
8	11.8	11.3	11.4	6.2	6.3	9.0	11.6	12.7	10.9	12.4	10.1	11.3	8.4	8.2	9.5
9	11.1	12.6	10.5	11.3	11.8	9.9	9.9	11.2	13.1	11.3	11.0	9.7	11.1	10.0	12.0
10	9.4	10.2	9.5	13.5	10.3	9.6	10.5	4.8	6.1	10.9	12.2	13.3	9.4	9.6	9.8
11	8.4	15.4	9.4	11.6	8.4	7.0	10.2	14.7	11.9	10.8	11.9	15.4	9.5	9.0	11.6
12	9.0	13.6	14.1	6.8	12.1	9.6	8.2	15.3	11.9	11.1	9.9	11.2	11.9	10.9	10.0
13	9.3	9.9	13.3	11.6	11.4	15.0	14.7	10.0	13.5	9.6	10.1	12.5	9.6	9.6	10.7
14	10.5	9.5	12.0	15.2	15.1	4.3	14.2	6.2	8.2	7.8	7.7	9.3	9.8	10.4	9.9
15	8.2	14.0	13.1	8.7	4.0	9.7	9.8	7.9	13.1	8.1	11.4	8.5	12.2	7.9	13.5
16	10.7	11.7	11.6	10.1	11.6	14.4	11.8	11.6	8.1	9.4	11.6	14.4	1.9	8.7	13.5
17	9.0	13.8	11.0	9.6	10.2	8.4	13.7	8.7	7.5	13.7	11.6	8.9	11.3	8.6	12.8
18	11.7	13.0	11.0	14.1	13.2	3.1	14.3	11.4	12.0	10.6	11.7	12.2	8.8	9.0	11.5
19	10.3	11.7	13.9	10.2	11.9	4.8	10.4	12.5	9.6	9.6	11.4	10.1	11.4	8.7	10.3
20	8.2	9.6	11.3	13.6	6.4	10.1	12.6	12.0	12.7	9.9	10.0	11.4	11.3	10.6	11.9
21	9.3	9.5	10.8	8.8	6.4	10.1	13.5	12.6	9.5	9.0	8.1	11.8	7.9	7.1	13.5
22	9.5	11.8	11.1	11.2	8.8	4.8	10.7	11.6	8.3	12.2	10.0	10.9	14.0	10.2	8.4
23	10.9	13.5	12.3	12.9	11.1	6.8	13.2	11.0	12.6	10.2	10.6	8.9	6.3	8.9	11.8
24	10.5	9.6	10.1	9.2	5.5	11.0	9.7	9.0	12.4	9.0	9.4	12.4	7.4	8.5	11.8
25	11.4	10.8	9.7	10.4	12.6	7.5	15.3	8.2	7.6	11.8	4.8	12.8	14.8	10.0	12.9
26	9.7	9.8	14.4	10.0	8.8	10.3	19.3	11.0	15.1	9.3	11.9	12.2	9.5	7.9	11.8
27	10.8	11.7	12.2	12.6	10.5	9.1	13.0	12.2	9.5	20.8	13.5	11.3	2.6	8.3	10.9
28	11.8	13.7	11.9	14.5	9.4	11.2	12.4	13.5	9.5	10.2	11.6	6.9	13.8	5.7	10.4
29	12.3	11.2	11.6	16.9	7.9	5.9	11.0	10.6	13.7	16.5	9.9	11.8	4.3	7.1	12.9
30	8.8	10.8	9.7	11.7	9.1	12.1	12.3	3.0	9.8	7.8	4.6	10.0	9.0	8.7	12.1

Crush Strength															
Sample B															
Day 3															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	10.4	10.4	11.6	12.7	10.8	5.0	12.6	10.6	17.1	13.9	11.9	12.3	7.9	9.7	12.9
2	11.1	12.6	14.8	12.7	10.3	11.9	15.1	12.2	9.8	8.8	10.2	7.9	11.7	7.5	12.4
3	10.4	10.8	13.8	9.0	8.1	9.3	16.5	7.6	8.6	8.8	9.0	13.9	11.7	13.0	12.1
4	7.8	13.3	12.3	7.3	10.7	10.3	11.4	11.8	14.3	12.7	7.7	8.7	9.7	11.1	12.6
5	11.2	12.1	10.5	8.4	12.7	11.4	9.3	12.4	7.3	9.3	9.5	15.0	11.2	8.3	10.7
6	8.3	12.1	9.7	11.7	9.4	10.2	10.6	9.8	8.9	8.7	11.7	12.9	8.3	10.2	11.2
7	14.4	9.6	9.8	8.0	9.2	9.7	12.3	13.4	8.9	8.3	8.8	9.3	7.7	11.1	10.8
8	18.5	11.0	12.7	10.8	7.4	11.9	7.8	10.8	10.8	7.4	11.9	7.9	9.0	10.8	10.6
9	10.7	14.2	9.9	12.3	9.1	8.5	16.3	14.0	10.0	10.5	9.3	10.1	12.7	7.5	12.0
10	11.2	11.5	13.5	11.5	14.0	10.6	7.4	8.3	11.1	12.6	8.1	10.9	5.6	9.5	11.8
11	11.7	12.8	10.5	9.7	13.6	8.1	14.9	12.6	12.7	10.0	11.2	15.1	7.1	11.5	11.6
12	11.4	11.3	9.4	15.4	8.0	7.8	7.9	6.8	10.8	13.9	7.5	8.9	7.8	9.4	12.2
13	8.7	12.1	9.9	14.6	11.1	9.3	9.8	10.9	7.4	12.9	7.0	11.2	8.4	7.9	10.7
14	11.2	9.8	12.4	5.1	9.8	7.2	14.6	14.6	11.0	10.2	10.9	8.5	9.9	10.9	9.5
15	11.0	10.5	15.2	15.9	8.1	5.0	10.4	11.5	9.0	11.5	10.1	9.7	11.1	8.9	12.8
16	7.9	14.2	13.7	9.2	9.8	8.4	10.3	6.4	8.8	11.2	9.3	9.5	7.5	6.9	9.6
17	9.8	11.2	9.8	9.0	15.2	8.6	11.5	10.2	11.2	6.8	10.9	16.3	10.9	9.0	12.4
18	10.8	11.4	11.0	10.3	12.9	6.9	5.7	11.2	13.6	13.3	12.2	11.4	10.7	9.0	11.4
19	14.6	10.8	9.4	8.8	13.4	8.4	4.3	16.9	11.2	10.6	11.7	8.9	9.6	8.1	10.4
20	13.4	10.9	11.7	11.1	13.1	9.9	9.5	4.3	9.6	8.5	8.5	13.9	14.4	7.6	11.8
21	13.0	10.5	10.5	11.9	12.1	8.8	9.5	11.9	9.1	9.2	9.9	14.9	10.0	9.4	12.8
22	8.9	14.0	10.6	13.3	8.1	5.4	12.9	11.9	12.8	8.3	9.9	10.9	7.2	8.7	12.4
23	11.9	11.2	10.4	13.7	8.7	9.2	15.8	18.7	11.1	10.6	11.3	10.7	9.6	9.2	10.8
24	13.4	10.2	13.6	10.6	6.2	5.6	10.0	8.2	13.7	13.2	13.0	8.9	9.6	12.2	11.5
25	7.6	10.0	11.3	13.4	11.4	6.4	11.6	7.3	11.3	13.8	8.0	11.2	8.9	8.2	9.3
26	7.9	10.9	10.1	11.2	9.6	12.3	11.3	9.7	9.6	8.6	12.4	10.8	11.3	9.0	11.8
27	9.6	12.2	11.4	15.7	11.9	13.3	12.6	9.7	10.4	9.5	13.1	11.7	11.1	9.4	12.9
28	10.1	11.9	10.4	12.3	10.7	7.3	12.1	10.3	10.8	11.4	10.3	10.9	10.9	8.1	13.3
29	10.5	9.9	14.0	6.9	12.4	10.2	14.5	11.1	14.3	7.4	10.6	11.5	9.1	7.7	10.4
30	9.6	11.4	10.2	16.8	13.8	9.1	10.9	11.7	12.0	12.9	9.9	12.8	8.6	9.1	12.4

Appendix B.1-3: Crush strength, Sample C, the outliers (Grubbs' test) are marked in yellow

Crush Strength															
Sample C															
Day 1															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	9.7	11.2	10.1	12.6	12.6	9.2	16.2	12.8	12.3	15.0	9.0	14.0	13.1	11.3	10.7
2	7.5	13.7	12.5	10.0	11.6	6.3	12.3	10.3	17.1	10.0	10.6	17.4	10.3	10.5	10.2
3	11.8	10.7	9.6	11.8	10.5	12.7	12.1	12.4	17.7	13.0	9.0	11.0	9.2	9.9	13.2
4	9.2	12.1	12.2	10.5	13.4	7.8	14.0	10.4	11.0	11.2	8.4	12.7	12.4	8.6	10.7
5	9.2	12.4	10.1	11.8	12.4	12.1	13.5	15.7	11.8	12.6	10.2	15.0	11.5	10.7	12.6
6	14.0	11.4	14.7	10.4	7.8	9.2	14.6	10.6	13.9	10.9	10.5	13.2	9.8	8.1	12.9
7	10.8	10.9	9.1	9.8	13.3	8.3	11.6	12.8	16.0	7.9	9.0	13.2	9.2	8.8	13.1
8	12.6	9.8	9.5	11.1	10.7	8.4	9.8	9.8	8.9	9.7	10.0	16.5	9.5	6.6	11.3
9	7.4	9.7	12.7	10.8	10.5	8.4	14.8	12.8	16.4	11.5	7.8	9.5	12.1	13.1	13.0
10	12.0	13.3	11.3	9.2	12.3	11.9	8.7	9.4	12.8	10.9	8.0	14.3	11.8	9.0	11.8
11	12.6	12.9	10.5	11.7	8.6	10.8	16.8	8.5	11.8	12.1	10.4	12.8	8.3	8.8	12.6
12	13.0	13.8	10.1	13.0	9.3	10.8	11.0	11.0	9.4	13.1	8.2	16.2	10.4	9.0	10.9
13	9.2	12.4	13.9	11.5	11.8	10.4	8.3	9.0	10.1	12.2	11.5	10.3	10.2	8.7	12.7
14	12.1	9.0	10.8	12.2	11.0	8.1	11.6	11.4	15.8	10.7	9.9	12.9	6.8	9.7	13.1
15	7.9	9.0	10.9	9.9	10.5	8.5	8.3	11.2	14.4	12.3	9.7	12.0	12.1	7.1	11.7
16	9.0	9.3	12.6	9.2	9.2	10.2	7.7	9.9	15.6	8.9	8.1	11.1	12.9	9.5	13.0
17	12.9	9.8	11.5	11.7	9.5	10.1	10.0	9.8	10.6	13.1	9.5	9.5	12.4	7.2	8.8
18	10.3	12.8	11.6	8.1	10.5	8.7	16.4	9.8	11.0	9.0	10.5	17.0	11.9	8.5	13.9
19	11.3	9.6	11.2	10.5	12.1	8.9	10.3	9.2	15.4	11.3	8.5	14.4	10.6	10.6	13.1
20	12.7	12.7	10.4	10.5	10.9	9.1	9.1	7.5	10.4	6.9	10.5	12.3	10.4	6.5	12.6
21	9.9	16.5	15.5	9.3	11.5	7.6	11.5	11.5	14.3	8.6	8.8	9.4	8.9	6.9	13.2
22	8.1	11.6	9.3	8.1	9.3	11.5	13.2	9.9	15.0	8.1	11.8	11.8	7.9	9.4	10.9
23	9.2	10.1	9.3	11.2	13.3	8.4	12.2	11.5	15.0	8.9	11.8	14.9	13.3	8.8	13.4
24	8.6	11.1	10.6	9.5	14.4	11.8	10.0	7.5	17.7	9.2	8.1	13.1	8.4	7.0	10.6
25	9.2	15.3	9.5	11.4	12.1	10.8	11.4	11.3	15.3	11.4	7.5	12.3	10.0	9.8	13.2
26	9.5	14.1	14.4	11.3	14.0	8.2	14.1	9.0	6.7	7.8	10.0	13.8	9.6	10.7	12.6
27	7.5	11.9	11.3	10.5	11.4	8.2	10.3	11.1	15.3	11.0	8.9	12.0	10.5	7.0	13.0
28	8.9	11.2	9.2	9.2	11.1	6.4	12.3	9.7	10.3	7.8	10.4	8.8	12.5	7.6	10.9
29	11.4	9.8	10.5	11.4	10.4	9.6	8.1	12.6	10.1	10.8	9.7	12.5	7.9	7.3	10.2
30	7.3	10.9	10.1	9.8	11.3	9.2	9.8	7.6	13.8	11.0	8.8	12.1	9.8	10.1	12.6

	Crush Strength														
	Sample C														
	Day 2														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	10.7	9.5	10.9	11.8	11.0	17.2	14.3	10.8	10.4	10.2	8.3	9.4	10.1	10.6	11.3
2	13.5	11.7	12.7	9.1	9.0	7.4	12.6	10.5	8.2	10.7	10.0	12.8	10.1	8.2	11.8
3	9.1	11.5	11.7	7.8	10.0	8.7	10.8	11.1	12.8	7.8	9.4	13.0	10.5	6.7	10.2
4	11.6	8.6	11.2	10.1	14.9	7.1	10.4	9.4	9.6	10.1	8.0	14.6	7.2	10.1	9.4
5	11.5	14.5	10.6	11.5	12.8	11.7	8.4	12.0	9.9	9.4	9.0	15.6	8.5	7.4	10.2
6	8.0	8.5	12.3	11.7	9.0	10.0	11.2	8.4	8.7	13.3	8.3	13.6	9.2	7.3	12.1
7	8.9	14.4	14.0	11.2	11.6	8.0	12.3	12.2	8.6	12.2	11.1	12.0	11.4	7.3	11.4
8	11.8	11.5	9.6	3.4	10.9	14.0	15.8	9.8	9.3	8.1	12.0	16.1	15.6	10.3	12.3
9	9.5	13.1	12.6	12.5	8.8	10.3	14.4	11.5	9.6	7.0	9.0	10.7	12.6	9.9	9.4
10	10.9	11.2	10.5	9.3	12.6	9.9	11.7	8.8	7.5	10.4	8.0	9.8	12.2	9.7	13.0
11	11.2	13.4	9.3	12.4	12.4	5.3	9.3	9.1	8.5	11.3	10.2	8.4	11.5	7.3	12.2
12	8.5	9.4	9.2	9.8	11.4	7.8	15.4	8.4	12.1	8.0	9.9	12.6	9.6	9.0	12.2
13	11.7	11.9	12.4	9.6	11.2	10.4	9.9	9.1	9.6	8.2	11.1	9.1	10.0	9.9	12.1
14	10.9	14.4	11.1	14.4	12.7	10.7	14.0	7.1	8.8	9.8	9.4	11.5	10.1	7.6	11.8
15	11.3	13.8	11.0	12.5	10.6	8.7	11.9	8.9	9.8	9.7	8.5	13.7	10.5	7.3	10.6
16	8.6	11.4	11.0	11.7	11.7	9.5	12.7	14.1	6.1	13.7	10.1	11.3	12.3	8.3	12.2
17	13.6	10.2	12.9	10.1	16.3	11.1	16.4	9.4	11.1	10.7	11.9	18.7	14.3	8.6	11.7
18	8.1	9.4	9.6	10.0	8.8	9.6	10.2	10.0	11.7	9.0	8.9	13.5	9.9	8.8	11.8
19	8.5	9.3	13.2	6.3	8.0	10.7	11.4	9.4	8.7	8.1	10.7	10.2	10.6	8.6	10.2
20	10.9	11.1	12.3	10.9	10.1	8.6	16.6	12.5	7.9	10.5	10.6	12.8	7.4	9.6	12.1
21	9.8	12.6	13.5	7.6	9.4	12.8	13.5	12.1	8.7	9.4	9.0	9.9	11.2	9.3	12.6
22	9.4	12.5	12.2	10.8	11.7	11.7	10.8	8.3	7.6	8.1	9.2	9.7	12.6	9.4	13.0
23	8.4	9.9	11.8	11.5	8.6	9.1	15.0	8.4	7.4	8.9	10.4	8.3	9.8	7.7	11.4
24	14.7	11.2	11.9	11.2	14.9	10.8	17.7	9.3	8.5	12.5	9.6	16.8	13.2	9.0	12.2
25	8.8	9.8	10.4	10.5	11.5	8.4	9.9	11.8	9.1	12.7	8.5	16.8	11.1	8.3	8.1
26	11.0	11.0	10.8	10.7	10.0	9.5	10.5	10.6	8.7	10.5	11.0	11.7	8.6	7.9	11.4
27	10.7	12.9	12.5	11.2	6.5	8.9	7.1	10.3	8.2	10.3	8.4	13.1	15.1	7.5	10.3
28	9.4	10.0	9.5	15.3	10.3	9.9	13.2	9.7	10.1	10.3	8.6	10.6	11.0	9.0	12.3
29	12.5	12.2	13.0	12.4	10.9	9.8	16.2	8.8	8.8	11.7	10.3	12.9	4.7	9.2	12.3
30	11.6	12.2	11.3	8.4	13.0	9.6	15.4	14.1	7.6	10.4	7.8	13.2	8.1	7.0	13.0

	Crush Strength														
	Sample C														
	Day 3														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	13.8	11.1	10.3	10.3	8.3	13.0	10.4	9.5	8.5	9.3	6.7	11.5	10.9	9.7	13.0
2	10.2	13.3	11.5	8.8	11.3	11.1	11.2	14.4	11.3	8.1	10.3	8.4	12.8	11.0	13.4
3	10.1	13.3	9.4	11.9	8.1	8.5	12.0	10.3	10.9	9.9	7.8	16.7	10.0	7.7	10.2
4	7.8	11.7	10.6	10.2	11.8	10.7	17.9	13.2	10.0	12.7	8.4	14.7	10.3	8.7	13.4
5	7.8	11.3	9.1	11.6	8.7	7.9	14.5	8.3	7.1	8.5	10.6	11.2	11.1	7.7	13.0
6	8.0	9.4	10.2	9.4	11.0	11.6	13.3	12.5	9.9	9.6	8.7	12.7	13.1	8.9	13.1
7	8.1	11.6	9.1	10.9	14.0	9.6	11.3	10.0	8.8	9.6	8.1	11.3	7.6	8.1	10.6
8	11.5	9.8	9.4	12.0	5.9	10.5	11.0	11.3	12.6	11.7	8.0	10.9	11.1	10.0	12.6
9	12.6	10.1	10.7	11.8	8.6	12.1	12.9	8.7	10.3	12.1	9.9	12.6	11.1	8.0	13.1
10	9.7	9.4	13.7	9.9	8.8	9.0	7.5	9.6	7.6	11.0	10.6	12.2	8.4	7.2	13.7
11	16.5	12.5	9.7	10.0	9.4	7.0	14.6	11.5	11.8	12.3	9.8	9.7	8.6	8.5	10.9
12	8.7	9.6	11.3	9.3	11.7	12.5	13.2	12.1	9.1	10.9	9.6	13.0	7.0	9.0	11.7
13	17.8	9.6	9.6	10.9	8.4	6.9	12.2	11.2	7.4	10.7	8.3	8.7	9.4	8.4	10.6
14	9.3	13.5	10.8	11.5	13.7	9.8	8.0	12.7	8.3	13.5	9.8	11.1	11.1	7.5	11.3
15	9.8	10.7	13.9	10.1	9.4	10.0	20.3	9.6	7.7	8.5	10.2	15.0	9.1	10.0	13.4
16	9.2	9.8	13.4	10.6	9.1	9.6	9.5	10.8	11.8	10.6	8.6	10.0	10.7	8.5	11.8
17	11.2	10.0	12.6	8.9	8.2	7.4	16.0	13.3	9.3	10.5	9.7	12.5	16.6	9.9	12.6
18	9.8	11.3	9.7	8.1	11.1	10.3	15.3	12.1	9.4	9.5	10.0	10.8	7.9	8.9	11.4
19	9.4	15.4	15.0	11.2	7.2	9.8	16.6	11.3	9.6	8.3	8.7	16.2	8.5	9.6	12.3
20	12.3	12.5	10.3	9.0	7.5	9.2	11.3	12.0	8.0	9.8	11.7	12.5	1.6	9.5	13.0
21	8.9	10.4	15.3	12.1	11.4	9.5	9.8	7.6	11.3	10.3	9.3	12.6	7.6	8.7	13.0
22	15.2	11.3	14.0	12.8	6.3	7.4	16.2	9.0	11.9	15.3	7.8	11.6	11.1	8.9	13.7
23	12.6	10.9	11.7	12.4	9.4	9.6	12.0	7.8	8.7	12.5	9.2	10.7	9.9	9.8	13.7
24	11.1	11.8	10.8	9.9	10.2	8.6	8.9	8.8	8.7	9.5	12.6	13.5	4.0	7.6	10.4
25	8.6	10.8	10.3	10.2	8.5	10.7	14.0	10.6	7.1	11.6	8.3	15.2	10.7	10.5	12.6
26	9.3	10.2	13.3	7.7	8.4	10.1	9.1	9.9	11.8	14.2	8.2	11.7	9.1	9.1	10.9
27	9.3	11.3	10.4	11.7	7.1	11.0	14.2	11.8	10.4	9.4	8.8	10.5	7.7	7.9	9.0
28	12.4	10.3	13.3	9.6	8.2	8.8	9.9	8.8	9.3	9.1	9.8	11.5	9.5	10.6	12.7
29	10.8	10.5	10.1	7.8	8.7	8.0	12.9	9.2	9.0	5.6	9.9	10.2	10.6	9.5	13.1
30	11.0	12.9	9.3	12.6	11.2	10.8	10.5	11.6	9.5	9.1	8.1	11.9	11.1	8.7	12.7

Appendix B.2-1: Crush strain, Sample A, the outliers (Grubbs' test) are marked in yellow

	Crush Strain														
	Sample A														
	Day 1														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.75	0.57	0.55	0.56	0.51	0.47	0.63	0.48	0.57	0.51	0.46	0.54	0.58	0.48	0.54
2	0.75	0.58	0.55	0.53	0.52	0.52	0.51	0.49	0.54	0.54	0.49	0.54	0.56	0.51	0.50
3	0.72	0.59	0.53	0.46	0.51	0.50	0.52	0.51	0.59	0.54	0.49	0.53	0.56	0.49	0.55
4	0.74	0.56	0.55	0.51	0.52	0.50	0.51	0.47	0.58	0.53	0.47	0.51	0.56	0.47	0.56
5	0.73	0.57	0.56	0.54	0.54	0.47	0.43	0.47	0.58	0.56	0.51	0.49	0.56	0.53	0.56
6	0.73	0.57	0.56	0.50	0.50	0.50	0.55	0.52	0.57	0.55	0.47	0.52	0.55	0.52	0.56
7	0.70	0.56	0.54	0.50	0.52	0.49	0.50	0.51	0.58	0.54	0.52	0.49	0.57	0.49	0.54
8	0.70	0.57	0.56	0.51	0.50	0.49	0.41	0.50	0.58	0.54	0.49	0.51	0.56	0.45	0.56
9	0.68	0.57	0.55	0.51	0.50	0.47	0.52	0.48	0.58	0.54	0.48	0.59	0.57	0.49	0.55
10	0.73	0.58	0.57	0.49	0.53	0.45	0.53	0.47	0.58	0.52	0.49	0.53	0.56	0.51	0.55
11	0.71	0.56	0.54	0.55	0.50	0.50	0.59	0.48	0.59	0.55	0.49	0.52	0.56	0.49	0.56
12	0.69	0.60	0.58	0.51	0.49	0.48	0.51	0.42	0.58	0.54	0.51	0.50	0.57	0.49	0.56
13	0.69	0.54	0.54	0.51	0.54	0.48	0.50	0.50	0.57	0.54	0.52	0.52	0.55	0.53	0.56
14	0.73	0.58	0.55	0.51	0.53	0.51	0.47	0.48	0.58	0.52	0.46	0.49	0.56	0.53	0.56
15	0.70	0.55	0.54	0.42	0.54	0.43	0.52	0.49	0.57	0.52	0.49	0.52	0.55	0.50	0.56
16	0.69	0.58	0.58	0.52	0.52	0.52	0.57	0.44	0.57	0.55	0.52	0.55	0.56	0.51	0.55
17	0.72	0.58	0.54	0.50	0.52	0.50	0.51	0.46	0.56	0.53	0.48	0.54	0.57	0.49	0.54
18	0.72	0.56	0.56	0.53	0.54	0.47	0.48	0.49	0.57	0.56	0.52	0.51	0.53	0.51	0.56
19	0.73	0.59	0.56	0.53	0.51	0.50	0.48	0.46	0.57	0.55	0.46	0.52	0.56	0.50	0.55
20	0.68	0.58	0.57	0.52	0.53	0.48	0.43	0.49	0.56	0.51	0.49	0.53	0.53	0.50	0.56
21	0.69	0.57	0.56	0.50	0.50	0.48	0.63	0.50	0.56	0.54	0.49	0.50	0.55	0.54	0.55
22	0.64	0.54	0.57	0.53	0.54	0.49	0.52	0.46	0.54	0.55	0.50	0.51	0.56	0.49	0.55
23	0.69	0.54	0.58	0.53	0.54	0.50	0.52	0.50	0.57	0.52	0.48	0.52	0.49	0.50	0.56
24	0.70	0.57	0.51	0.53	0.53	0.48	0.50	0.50	0.56	0.59	0.49	0.53	0.53	0.52	0.55
25	0.71	0.58	0.55	0.53	0.54	0.50	0.54	0.50	0.57	0.55	0.50	0.50	0.54	0.50	0.55
26	0.69	0.57	0.55	0.54	0.53	0.52	0.54	0.48	0.57	0.53	0.47	0.50	0.56	0.47	0.55
27	0.70	0.54	0.54	0.51	0.51	0.48	0.51	0.51	0.55	0.53	0.45	0.52	0.55	0.50	0.54
28	0.68	0.56	0.59	0.52	0.52	0.50	0.48	0.51	0.50	0.55	0.49	0.51	0.54	0.52	0.53
29	0.66	0.59	0.55	0.53	0.52	0.50	0.51	0.48	0.57	0.55	0.50	0.51	0.54	0.52	0.55
30	0.70	0.54	0.56	0.52	0.54	0.51	0.52	0.47	0.58	0.54	0.53	0.55	0.55	0.53	0.55

	Crush Strain														
	Sample A														
	Day 2														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.54	0.54	0.54	0.50	0.52	0.47	0.60	0.52	0.55	0.55	0.46	0.51	0.54	0.48	0.54
2	0.53	0.58	0.56	0.53	0.49	0.47	0.44	0.50	0.53	0.54	0.44	0.53	0.56	0.49	0.55
3	0.48	0.55	0.54	0.50	0.52	0.50	0.50	0.46	0.50	0.55	0.46	0.53	0.48	0.49	0.55
4	0.53	0.55	0.53	0.48	0.52	0.42	0.52	0.50	0.53	0.54	0.47	0.52	0.53	0.51	0.55
5	0.51	0.54	0.52	0.54	0.55	0.48	0.54	0.51	0.54	0.52	0.47	0.52	0.55	0.52	0.55
6	0.49	0.56	0.54	0.53	0.52	0.49	0.50	0.48	0.55	0.55	0.46	0.52	0.55	0.49	0.54
7	0.53	0.55	0.54	0.48	0.52	0.53	0.51	0.48	0.53	0.51	0.48	0.50	0.53	0.48	0.55
8	0.49	0.58	0.50	0.52	0.51	0.51	0.49	0.52	0.49	0.52	0.49	0.51	0.55	0.53	0.56
9	0.50	0.57	0.54	0.49	0.52	0.48	0.52	0.50	0.51	0.52	0.50	0.55	0.52	0.52	0.56
10	0.51	0.53	0.51	0.52	0.51	0.49	0.64	0.48	0.49	0.56	0.50	0.52	0.56	0.48	0.55
11	0.52	0.54	0.54	0.53	0.50	0.39	0.51	0.50	0.51	0.53	0.46	0.54	0.45	0.53	0.56
12	0.50	0.57	0.52	0.53	0.51	0.48	0.53	0.47	0.56	0.53	0.40	0.51	0.54	0.50	0.55
13	0.53	0.56	0.53	0.51	0.54	0.49	0.51	0.52	0.49	0.52	0.51	0.50	0.55	0.51	0.55
14	0.51	0.56	0.54	0.51	0.52	0.50	0.54	0.46	0.55	0.52	0.44	0.49	0.55	0.50	0.55
15	0.52	0.54	0.54	0.53	0.52	0.50	0.50	0.51	0.50	0.52	0.48	0.54	0.55	0.52	0.55
16	0.53	0.56	0.52	0.48	0.50	0.49	0.51	0.47	0.56	0.51	0.40	0.54	0.55	0.48	0.56
17	0.50	0.55	0.56	0.51	0.52	0.52	0.53	0.48	0.55	0.51	0.50	0.51	0.50	0.49	0.56
18	0.51	0.57	0.55	0.52	0.52	0.53	0.51	0.45	0.52	0.51	0.47	0.54	0.55	0.48	0.55
19	0.50	0.57	0.53	0.54	0.51	0.52	0.63	0.47	0.42	0.52	0.50	0.52	0.52	0.51	0.55
20	0.49	0.55	0.56	0.40	0.52	0.52	0.51	0.48	0.42	0.52	0.49	0.52	0.54	0.54	0.55
21	0.50	0.58	0.53	0.54	0.52	0.49	0.43	0.50	0.53	0.51	0.48	0.50	0.55	0.50	0.55
22	0.48	0.56	0.53	0.49	0.53	0.51	0.49	0.48	0.54	0.52	0.47	0.50	0.55	0.51	0.55
23	0.52	0.52	0.54	0.50	0.53	0.49	0.53	0.47	0.53	0.52	0.48	0.56	0.55	0.46	0.56
24	0.48	0.57	0.56	0.54	0.54	0.50	0.52	0.50	0.53	0.51	0.45	0.53	0.54	0.48	0.55
25	0.49	0.57	0.54	0.51	0.49	0.46	0.52	0.47	0.56	0.53	0.49	0.52	0.55	0.51	0.55
26	0.49	0.55	0.54	0.47	0.51	0.47	0.49	0.45	0.52	0.50	0.50	0.51	0.55	0.50	0.56
27	0.53	0.55	0.55	0.56	0.53	0.51	0.52	0.42	0.56	0.36	0.49	0.48	0.55	0.51	0.56
28	0.50	0.52	0.55	0.51	0.52	0.48	0.59	0.49	0.55	0.53	0.47	0.52	0.55	0.53	0.55
29	0.51	0.57	0.54	0.52	0.51	0.50	0.52	0.48	0.55	0.51	0.50	0.52	0.52	0.53	0.57
30	0.53	0.56	0.54	0.54	0.51	0.50	0.54	0.46	0.53	0.54	0.50	0.56	0.55	0.50	0.56

	Crush Strain														
	Sample A														
	Day 3														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.65	0.57	0.53	0.48	0.51	0.21	0.61	0.50	0.53	0.54	0.47	0.51	0.48	0.50	0.54
2	0.66	0.55	0.52	0.51	0.51	0.40	0.48	0.49	0.52	0.52	0.47	0.57	0.54	0.49	0.56
3	0.64	0.55	0.55	0.50	0.54	0.52	0.51	0.49	0.52	0.45	0.50	0.53	0.54	0.47	0.55
4	0.64	0.53	0.53	0.52	0.49	0.48	0.50	0.50	0.52	0.52	0.51	0.53	0.52	0.43	0.56
5	0.61	0.57	0.54	0.50	0.54	0.51	0.49	0.49	0.55	0.52	0.30	0.50	0.54	0.48	0.55
6	0.64	0.57	0.56	0.48	0.51	0.51	0.54	0.50	0.51	0.54	0.45	0.48	0.54	0.40	0.56
7	0.65	0.54	0.53	0.53	0.51	0.52	0.50	0.49	0.52	0.54	0.46	0.51	0.52	0.48	0.55
8	0.61	0.54	0.56	0.53	0.50	0.48	0.49	0.48	0.53	0.52	0.47	0.49	0.56	0.49	0.56
9	0.61	0.55	0.56	0.54	0.52	0.51	0.50	0.49	0.57	0.48	0.48	0.55	0.53	0.48	0.56
10	0.63	0.53	0.54	0.51	0.52	0.50	0.52	0.50	0.55	0.52	0.49	0.52	0.55	0.48	0.55
11	0.64	0.57	0.55	0.53	0.51	0.50	0.63	0.49	0.53	0.53	0.48	0.53	0.55	0.48	0.56
12	0.62	0.55	0.55	0.54	0.53	0.50	0.49	0.51	0.54	0.54	0.46	0.50	0.54	0.46	0.54
13	0.63	0.55	0.54	0.53	0.52	0.45	0.50	0.49	0.53	0.54	0.47	0.51	0.49	0.49	0.57
14	0.61	0.56	0.55	0.52	0.53	0.50	0.53	0.49	0.55	0.51	0.51	0.51	0.54	0.48	0.57
15	0.59	0.54	0.55	0.52	0.54	0.50	0.50	0.49	0.50	0.52	0.39	0.50	0.54	0.49	0.57
16	0.61	0.55	0.56	0.52	0.50	0.48	0.55	0.47	0.54	0.53	0.47	0.50	0.53	0.52	0.57
17	0.62	0.53	0.55	0.54	0.52	0.51	0.43	0.49	0.54	0.52	0.47	0.52	0.50	0.44	0.54
18	0.61	0.55	0.53	0.45	0.52	0.50	0.48	0.46	0.56	0.54	0.49	0.53	0.52	0.46	0.58
19	0.58	0.56	0.55	0.51	0.49	0.47	0.52	0.47	0.55	0.53	0.46	0.49	0.55	0.50	0.56
20	0.60	0.57	0.56	0.53	0.52	0.51	0.53	0.48	0.55	0.51	0.49	0.51	0.50	0.50	0.56
21	0.60	0.55	0.53	0.50	0.52	0.45	0.59	0.50	0.54	0.55	0.48	0.51	0.52	0.48	0.56
22	0.62	0.55	0.52	0.52	0.51	0.32	0.54	0.45	0.56	0.52	0.49	0.50	0.54	0.50	0.54
23	0.59	0.55	0.55	0.51	0.54	0.47	0.50	0.49	0.50	0.52	0.48	0.55	0.54	0.45	0.57
24	0.60	0.56	0.53	0.52	0.52	0.51	0.53	0.48	0.52	0.53	0.44	0.53	0.52	0.45	0.57
25	0.63	0.57	0.54	0.50	0.53	0.49	0.52	0.46	0.55	0.54	0.45	0.52	0.51	0.44	0.56
26	0.60	0.55	0.54	0.52	0.49	0.50	0.56	0.47	0.53	0.54	0.48	0.52	0.53	0.49	0.56
27	0.62	0.51	0.52	0.51	0.52	0.49	0.48	0.46	0.57	0.52	0.49	0.53	0.55	0.39	0.54
28	0.60	0.56	0.53	0.52	0.51	0.51	0.52	0.50	0.56	0.54	0.45	0.51	0.53	0.41	0.55
29	0.61	0.56	0.52	0.52	0.50	0.49	0.49	0.50	0.53	0.53	0.40	0.54	0.54	0.48	0.56
30	0.57	0.57	0.54	0.50	0.50	0.51	0.50	0.44	0.55	0.54	0.47	0.55	0.54	0.51	0.56

Appendix B.2-2: Crush strain, Sample B, the outliers (Grubbs' test) are marked in yellow

Crush Strain															
Sample B															
Day 1															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.41	0.44	0.33	0.16	0.18	0.25	0.43	0.13	0.25	0.30	0.21	0.34	0.42	0.36	0.41
2	0.29	0.51	0.38	0.26	0.25	0.31	0.26	0.28	0.33	0.35	0.22	0.46	0.39	0.28	0.30
3	0.49	0.37	0.49	0.23	0.29	0.36	0.31	0.24	0.19	0.46	0.25	0.27	0.35	0.34	0.44
4	0.43	0.45	0.40	0.27	0.29	0.20	0.32	0.22	0.33	0.27	0.20	0.15	0.30	0.37	0.41
5	0.49	0.39	0.30	0.30	0.32	0.13	0.30	0.38	0.59	0.43	0.42	0.19	0.28	0.30	0.40
6	0.40	0.41	0.39	0.23	0.38	0.20	0.28	0.28	0.29	0.36	0.25	0.37	0.20	0.20	0.40
7	0.33	0.43	0.29	0.19	0.18	0.24	0.31	0.19	0.38	0.46	0.50	0.40	0.26	0.44	0.40
8	0.44	0.41	0.33	0.23	0.41	0.23	0.32	0.23	0.35	0.36	0.21	0.32	0.14	0.41	0.45
9	0.42	0.44	0.36	0.36	0.23	0.23	0.28	0.23	0.37	0.24	0.26	0.41	0.38	0.22	0.47
10	0.42	0.31	0.50	0.19	0.16	0.18	0.51	0.19	0.29	0.26	0.19	0.46	0.27	0.23	0.42
11	0.30	0.28	0.26	0.21	0.26	0.27	0.34	0.39	0.32	0.29	0.40	0.26	0.33	0.31	0.44
12	0.44	0.37	0.26	0.27	0.22	0.21	0.20	0.28	0.37	0.39	0.39	0.25	0.29	0.40	0.41
13	0.32	0.28	0.35	0.29	0.38	0.37	0.14	0.40	0.34	0.28	0.44	0.33	0.40	0.43	0.46
14	0.37	0.31	0.25	0.18	0.32	0.17	0.34	0.41	0.13	0.44	0.54	0.35	0.42	0.43	0.40
15	0.55	0.39	0.24	0.22	0.21	0.28	0.27	0.24	0.35	0.36	0.17	0.49	0.32	0.24	0.45
16	0.32	0.30	0.41	0.21	0.23	0.29	0.24	0.20	0.49	0.37	0.19	0.44	0.20	0.27	0.44
17	0.39	0.46	0.46	0.34	0.39	0.23	0.24	0.26	0.39	0.26	0.19	0.40	0.29	0.22	0.41
18	0.43	0.34	0.25	0.20	0.26	0.22	0.30	0.26	0.46	0.42	0.16	0.32	0.31	0.33	0.44
19	0.38	0.42	0.36	0.32	0.38	0.23	0.29	0.29	0.39	0.23	0.23	0.40	0.30	0.29	0.42
20	0.29	0.35	0.45	0.28	0.34	0.15	0.40	0.28	0.41	0.46	0.41	0.37	0.10	0.25	0.33
21	0.49	0.43	0.49	0.34	0.45	0.18	0.41	0.18	0.38	0.27	0.13	0.41	0.41	0.25	0.42
22	0.37	0.43	0.32	0.14	0.35	0.26	0.40	0.10	0.49	0.29	0.18	0.45	0.19	0.37	0.41
23	0.36	0.32	0.36	0.29	0.26	0.33	0.32	0.24	0.23	0.24	0.09	0.31	0.19	0.36	0.46
24	0.29	0.43	0.35	0.24	0.27	0.15	0.39	0.19	0.30	0.33	0.27	0.32	0.23	0.37	0.42
25	0.45	0.36	0.30	0.31	0.28	0.25	0.40	0.30	0.38	0.43	0.21	0.29	0.24	0.20	0.45
26	0.50	0.29	0.36	0.24	0.31	0.24	0.31	0.32	0.36	0.44	0.21	0.21	0.32	0.36	0.43
27	0.45	0.32	0.35	0.27	0.35	0.25	0.36	0.20	0.25	0.41	0.18	0.43	0.23	0.38	0.37
28	0.36	0.34	0.37	0.12	0.33	0.23	0.21	0.29	0.29	0.35	0.17	0.26	0.42	0.25	0.45
29	0.26	0.47	0.38	0.38	0.40	0.29	0.29	0.23	0.44	0.44	0.25	0.39	0.32	0.26	0.45
30	0.31	0.34	0.36	0.28	0.23	0.18	0.26	0.17	0.31	0.48	0.14	0.45	0.36	0.38	0.35

	Crush Strain														
	Sample B														
	Day 2														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.32	0.43	0.34	0.31	0.22	0.23	0.61	0.20	0.48	0.24	0.11	0.40	0.34	0.21	0.48
2	0.29	0.25	0.38	0.37	0.42	0.24	0.33	0.22	0.26	0.45	0.17	0.41	0.28	0.18	0.44
3	0.32	0.41	0.48	0.27	0.24	0.29	0.25	0.28	0.15	0.24	0.20	0.24	0.26	0.26	0.40
4	0.27	0.36	0.33	0.27	0.24	0.21	0.28	0.31	0.19	0.44	0.19	0.37	0.14	0.20	0.40
5	0.24	0.42	0.34	0.21	0.41	0.12	0.40	0.20	0.22	0.49	0.22	0.33	0.33	0.27	0.38
6	0.34	0.42	0.35	0.28	0.32	0.31	0.34	0.16	0.23	0.20	0.18	0.26	0.15	0.16	0.47
7	0.28	0.36	0.49	0.28	0.46	0.25	0.51	0.47	0.21	0.42	0.23	0.29	0.11	0.21	0.42
8	0.32	0.37	0.35	0.14	0.15	0.22	0.35	0.29	0.29	0.41	0.20	0.38	0.28	0.21	0.35
9	0.28	0.40	0.35	0.24	0.36	0.24	0.31	0.25	0.44	0.39	0.22	0.34	0.34	0.25	0.44
10	0.21	0.39	0.28	0.29	0.31	0.24	0.32	0.10	0.17	0.36	0.24	0.44	0.27	0.22	0.37
11	0.23	0.55	0.29	0.26	0.24	0.20	0.36	0.38	0.31	0.31	0.23	0.49	0.28	0.23	0.42
12	0.24	0.44	0.41	0.20	0.37	0.23	0.23	0.36	0.34	0.38	0.20	0.33	0.42	0.29	0.37
13	0.23	0.29	0.42	0.24	0.34	0.42	0.44	0.20	0.37	0.28	0.18	0.37	0.28	0.20	0.41
14	0.29	0.29	0.38	0.38	0.48	0.14	0.43	0.13	0.20	0.25	0.17	0.32	0.30	0.23	0.35
15	0.20	0.44	0.38	0.19	0.11	0.27	0.31	0.19	0.34	0.25	0.22	0.31	0.37	0.18	0.47
16	0.27	0.34	0.37	0.22	0.34	0.41	0.44	0.24	0.20	0.25	0.21	0.47	0.06	0.21	0.45
17	0.24	0.42	0.34	0.21	0.28	0.23	0.41	0.22	0.21	0.39	0.23	0.31	0.32	0.20	0.44
18	0.33	0.40	0.32	0.33	0.45	0.11	0.47	0.21	0.32	0.27	0.21	0.37	0.26	0.26	0.38
19	0.29	0.39	0.42	0.23	0.36	0.16	0.33	0.28	0.27	0.24	0.21	0.29	0.32	0.22	0.39
20	0.22	0.27	0.30	0.29	0.16	0.25	0.37	0.25	0.37	0.26	0.18	0.34	0.32	0.27	0.42
21	0.22	0.26	0.32	0.21	0.17	0.25	0.53	0.28	0.25	0.26	0.15	0.41	0.22	0.17	0.45
22	0.21	0.34	0.37	0.26	0.25	0.17	0.33	0.23	0.28	0.30	0.20	0.37	0.43	0.22	0.27
23	0.34	0.42	0.36	0.29	0.35	0.18	0.38	0.23	0.37	0.29	0.19	0.28	0.17	0.18	0.46
24	0.27	0.27	0.29	0.22	0.14	0.26	0.27	0.18	0.35	0.21	0.19	0.39	0.19	0.18	0.43
25	0.30	0.31	0.32	0.24	0.39	0.18	0.45	0.16	0.20	0.43	0.10	0.41	0.46	0.24	0.45
26	0.26	0.29	0.40	0.22	0.24	0.28	0.57	0.21	0.40	0.32	0.24	0.37	0.28	0.21	0.43
27	0.27	0.32	0.42	0.29	0.34	0.27	0.36	0.26	0.28	0.55	0.28	0.36	0.10	0.20	0.37
28	0.31	0.39	0.35	0.35	0.25	0.30	0.35	0.32	0.26	0.35	0.21	0.19	0.43	0.14	0.35
29	0.37	0.33	0.31	0.39	0.20	0.15	0.29	0.24	0.38	0.53	0.18	0.40	0.12	0.18	0.45
30	0.28	0.33	0.30	0.25	0.29	0.35	0.40	0.08	0.32	0.21	0.10	0.31	0.26	0.19	0.47

	Crush Strain														
	Sample B														
	Day 3														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.33	0.33	0.37	0.28	0.29	0.14	0.43	0.23	0.50	0.42	0.25	0.38	0.22	0.24	0.44
2	0.35	0.39	0.44	0.30	0.31	0.28	0.44	0.28	0.27	0.27	0.23	0.24	0.37	0.20	0.44
3	0.30	0.34	0.40	0.23	0.24	0.24	0.50	0.16	0.23	0.25	0.19	0.57	0.34	0.31	0.44
4	0.24	0.48	0.37	0.21	0.32	0.25	0.34	0.27	0.39	0.39	0.17	0.28	0.24	0.31	0.45
5	0.36	0.35	0.30	0.24	0.41	0.32	0.29	0.27	0.21	0.24	0.19	0.49	0.39	0.21	0.41
6	0.33	0.40	0.26	0.34	0.28	0.29	0.35	0.23	0.24	0.25	0.23	0.40	0.22	0.28	0.42
7	0.49	0.26	0.25	0.17	0.26	0.25	0.37	0.29	0.24	0.24	0.17	0.30	0.18	0.29	0.39
8	0.70	0.37	0.38	0.26	0.20	0.32	0.20	0.23	0.27	0.22	0.24	0.20	0.23	0.29	0.40
9	0.36	0.42	0.29	0.28	0.28	0.23	0.47	0.32	0.27	0.33	0.19	0.33	0.32	0.17	0.47
10	0.39	0.33	0.39	0.27	0.39	0.26	0.31	0.19	0.32	0.37	0.16	0.39	0.18	0.23	0.46
11	0.43	0.44	0.33	0.23	0.40	0.21	0.43	0.31	0.38	0.24	0.22	0.46	0.20	0.26	0.42
12	0.42	0.35	0.26	0.37	0.21	0.21	0.20	0.15	0.27	0.43	0.14	0.30	0.20	0.24	0.42
13	0.28	0.41	0.25	0.33	0.33	0.27	0.24	0.22	0.20	0.44	0.14	0.40	0.24	0.20	0.41
14	0.39	0.27	0.39	0.13	0.28	0.20	0.47	0.35	0.31	0.32	0.22	0.30	0.28	0.27	0.36
15	0.37	0.36	0.42	0.40	0.25	0.15	0.35	0.26	0.24	0.39	0.19	0.27	0.30	0.20	0.44
16	0.23	0.43	0.38	0.20	0.28	0.22	0.29	0.17	0.23	0.41	0.21	0.30	0.22	0.18	0.36
17	0.32	0.33	0.28	0.21	0.48	0.21	0.34	0.22	0.30	0.22	0.19	0.50	0.30	0.21	0.44
18	0.34	0.34	0.31	0.25	0.45	0.18	0.15	0.26	0.36	0.41	0.21	0.43	0.30	0.21	0.45
19	0.50	0.31	0.30	0.20	0.39	0.20	0.12	0.41	0.35	0.31	0.23	0.24	0.28	0.20	0.42
20	0.46	0.29	0.37	0.26	0.40	0.24	0.39	0.09	0.28	0.27	0.18	0.37	0.42	0.23	0.46
21	0.42	0.32	0.33	0.24	0.37	0.25	0.26	0.25	0.26	0.26	0.20	0.49	0.26	0.23	0.44
22	0.29	0.41	0.23	0.31	0.26	0.15	0.39	0.28	0.36	0.25	0.17	0.31	0.17	0.20	0.45
23	0.39	0.30	0.31	0.41	0.25	0.27	0.48	0.43	0.29	0.35	0.23	0.34	0.29	0.23	0.42
24	0.46	0.24	0.35	0.27	0.17	0.15	0.29	0.17	0.41	0.41	0.24	0.32	0.26	0.30	0.41
25	0.21	0.26	0.37	0.38	0.33	0.18	0.40	0.15	0.31	0.44	0.15	0.33	0.26	0.21	0.38
26	0.23	0.36	0.28	0.30	0.27	0.39	0.36	0.19	0.26	0.26	0.22	0.30	0.33	0.26	0.43
27	0.26	0.38	0.37	0.38	0.35	0.31	0.36	0.23	0.29	0.29	0.24	0.34	0.34	0.22	0.45
28	0.32	0.39	0.30	0.26	0.34	0.19	0.37	0.22	0.29	0.36	0.20	0.37	0.32	0.21	0.46
29	0.33	0.30	0.37	0.19	0.40	0.23	0.48	0.24	0.47	0.21	0.22	0.35	0.25	0.22	0.41
30	0.31	0.29	0.27	0.41	0.43	0.23	0.43	0.26	0.33	0.38	0.17	0.42	0.25	0.25	0.45

Appendix B.2-3: Crush strain, Sample C, the outliers (Grubbs' test) are marked in yellow

Crush Strain															
Sample C															
Day 1															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.42	0.44	0.34	0.36	0.45	0.26	0.58	0.39	0.50	0.51	0.27	0.45	0.44	0.36	0.47
2	0.40	0.49	0.44	0.29	0.45	0.18	0.38	0.32	0.55	0.43	0.34	0.55	0.39	0.37	0.44
3	0.36	0.38	0.32	0.34	0.40	0.33	0.42	0.38	0.55	0.48	0.27	0.44	0.36	0.32	0.49
4	0.52	0.44	0.43	0.30	0.46	0.23	0.46	0.31	0.46	0.45	0.25	0.46	0.43	0.27	0.47
5	0.42	0.45	0.39	0.36	0.46	0.32	0.43	0.44	0.48	0.50	0.31	0.49	0.42	0.35	0.50
6	0.40	0.42	0.48	0.30	0.33	0.25	0.49	0.33	0.49	0.47	0.31	0.46	0.38	0.25	0.50
7	0.55	0.41	0.36	0.30	0.45	0.22	0.39	0.36	0.53	0.37	0.25	0.45	0.37	0.30	0.50
8	0.45	0.35	0.34	0.33	0.43	0.23	0.36	0.29	0.41	0.42	0.31	0.51	0.36	0.19	0.48
9	0.55	0.35	0.44	0.30	0.42	0.24	0.47	0.40	0.54	0.44	0.22	0.43	0.44	0.42	0.48
10	0.28	0.46	0.36	0.28	0.43	0.34	0.31	0.29	0.50	0.42	0.23	0.49	0.41	0.27	0.47
11	0.52	0.46	0.41	0.33	0.32	0.30	0.61	0.24	0.48	0.49	0.29	0.44	0.31	0.27	0.50
12	0.50	0.46	0.40	0.38	0.39	0.30	0.38	0.32	0.44	0.49	0.24	0.49	0.39	0.29	0.48
13	0.52	0.45	0.45	0.37	0.43	0.32	0.25	0.25	0.44	0.49	0.34	0.39	0.38	0.25	0.51
14	0.38	0.34	0.40	0.35	0.40	0.23	0.41	0.32	0.54	0.45	0.28	0.47	0.25	0.31	0.49
15	0.50	0.34	0.41	0.30	0.42	0.25	0.31	0.32	0.49	0.47	0.28	0.46	0.42	0.25	0.47
16	0.36	0.35	0.45	0.28	0.34	0.30	0.29	0.30	0.52	0.34	0.23	0.47	0.45	0.30	0.48
17	0.35	0.34	0.45	0.32	0.39	0.29	0.36	0.31	0.45	0.47	0.27	0.37	0.39	0.23	0.42
18	0.52	0.44	0.41	0.24	0.39	0.24	0.48	0.27	0.47	0.42	0.30	0.51	0.42	0.28	0.50
19	0.42	0.33	0.40	0.31	0.43	0.26	0.39	0.26	0.53	0.46	0.23	0.48	0.39	0.34	0.50
20	0.48	0.43	0.38	0.30	0.40	0.25	0.34	0.19	0.45	0.27	0.31	0.44	0.36	0.21	0.49
21	0.51	0.52	0.48	0.25	0.41	0.24	0.47	0.33	0.50	0.37	0.23	0.38	0.33	0.24	0.49
22	0.38	0.42	0.34	0.21	0.34	0.29	0.44	0.28	0.52	0.35	0.31	0.53	0.27	0.31	0.48
23	0.33	0.37	0.31	0.33	0.45	0.26	0.41	0.32	0.52	0.36	0.34	0.51	0.46	0.27	0.49
24	0.33	0.40	0.36	0.27	0.48	0.31	0.36	0.19	0.55	0.45	0.22	0.48	0.30	0.22	0.46
25	0.37	0.49	0.34	0.33	0.43	0.32	0.40	0.28	0.51	0.46	0.21	0.46	0.35	0.32	0.49
26	0.37	0.48	0.48	0.31	0.46	0.22	0.49	0.25	0.30	0.34	0.26	0.46	0.36	0.35	0.50
27	0.43	0.43	0.39	0.29	0.43	0.24	0.34	0.30	0.52	0.44	0.24	0.43	0.36	0.23	0.48
28	0.26	0.42	0.31	0.24	0.41	0.19	0.41	0.26	0.44	0.33	0.28	0.34	0.41	0.24	0.48
29	0.37	0.33	0.39	0.31	0.39	0.26	0.28	0.34	0.43	0.44	0.27	0.53	0.28	0.22	0.44
30	0.45	0.38	0.37	0.26	0.39	0.26	0.35	0.19	0.48	0.48	0.23	0.47	0.36	0.33	0.50

	Crush Strain														
	Sample C														
	Day 2														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.47	0.34	0.40	0.31	0.40	0.53	0.57	0.32	0.32	0.45	0.23	0.37	0.36	0.29	0.48
2	0.55	0.46	0.45	0.26	0.33	0.21	0.46	0.33	0.27	0.44	0.28	0.48	0.37	0.20	0.47
3	0.44	0.40	0.42	0.22	0.37	0.24	0.41	0.32	0.38	0.34	0.26	0.47	0.38	0.18	0.45
4	0.50	0.32	0.43	0.29	0.48	0.19	0.38	0.30	0.28	0.43	0.22	0.49	0.25	0.24	0.40
5	0.49	0.49	0.39	0.31	0.43	0.33	0.31	0.39	0.33	0.42	0.23	0.47	0.32	0.20	0.45
6	0.37	0.33	0.40	0.31	0.35	0.28	0.45	0.23	0.28	0.48	0.22	0.49	0.34	0.20	0.46
7	0.41	0.51	0.48	0.31	0.43	0.22	0.45	0.37	0.27	0.46	0.30	0.47	0.42	0.19	0.45
8	0.51	0.44	0.37	0.11	0.41	0.38	0.50	0.30	0.33	0.36	0.32	0.51	0.50	0.27	0.47
9	0.41	0.47	0.45	0.35	0.35	0.28	0.46	0.33	0.33	0.26	0.25	0.42	0.44	0.26	0.40
10	0.47	0.42	0.38	0.25	0.42	0.28	0.44	0.25	0.22	0.41	0.22	0.37	0.42	0.25	0.45
11	0.45	0.48	0.33	0.32	0.43	0.17	0.42	0.26	0.30	0.43	0.26	0.33	0.44	0.20	0.46
12	0.36	0.38	0.32	0.25	0.41	0.23	0.47	0.23	0.36	0.30	0.26	0.45	0.35	0.24	0.46
13	0.49	0.43	0.43	0.27	0.39	0.28	0.37	0.26	0.35	0.32	0.28	0.37	0.38	0.25	0.46
14	0.43	0.49	0.37	0.37	0.43	0.29	0.48	0.21	0.29	0.40	0.25	0.47	0.39	0.20	0.46
15	0.50	0.51	0.38	0.33	0.39	0.27	0.48	0.24	0.32	0.43	0.21	0.47	0.39	0.19	0.46
16	0.36	0.42	0.40	0.30	0.44	0.28	0.47	0.39	0.18	0.50	0.26	0.40	0.43	0.21	0.46
17	0.55	0.38	0.44	0.28	0.50	0.29	0.48	0.27	0.33	0.45	0.31	0.52	0.48	0.22	0.47
18	0.36	0.36	0.32	0.27	0.35	0.25	0.37	0.27	0.39	0.33	0.22	0.47	0.37	0.23	0.46
19	0.38	0.37	0.43	0.17	0.29	0.29	0.40	0.27	0.27	0.38	0.27	0.36	0.38	0.22	0.45
20	0.47	0.41	0.43	0.27	0.36	0.24	0.50	0.34	0.23	0.45	0.26	0.47	0.27	0.24	0.46
21	0.43	0.44	0.47	0.19	0.34	0.36	0.54	0.33	0.30	0.44	0.22	0.42	0.41	0.23	0.45
22	0.43	0.43	0.41	0.27	0.43	0.33	0.38	0.22	0.24	0.41	0.24	0.35	0.44	0.24	0.46
23	0.37	0.37	0.41	0.28	0.29	0.28	0.47	0.21	0.23	0.42	0.27	0.33	0.36	0.20	0.45
24	0.57	0.42	0.41	0.27	0.49	0.28	0.50	0.25	0.27	0.48	0.23	0.50	0.43	0.22	0.46
25	0.39	0.34	0.39	0.28	0.43	0.25	0.39	0.33	0.29	0.47	0.21	0.50	0.41	0.23	0.34
26	0.47	0.41	0.40	0.29	0.37	0.26	0.43	0.27	0.26	0.42	0.27	0.43	0.30	0.20	0.45
27	0.47	0.44	0.45	0.29	0.24	0.25	0.22	0.27	0.25	0.42	0.21	0.47	0.47	0.21	0.43
28	0.50	0.39	0.34	0.38	0.36	0.27	0.46	0.23	0.30	0.46	0.20	0.40	0.41	0.25	0.47
29	0.63	0.44	0.44	0.32	0.40	0.29	0.50	0.24	0.26	0.46	0.27	0.47	0.16	0.26	0.47
30	0.51	0.45	0.38	0.21	0.46	0.27	0.50	0.38	0.25	0.44	0.20	0.44	0.28	0.19	0.45

Crush Strain															
Sample C															
Day 3															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.60	0.40	0.39	0.24	0.27	0.34	0.44	0.26	0.26	0.39	0.14	0.44	0.36	0.24	0.51
2	0.51	0.45	0.42	0.23	0.38	0.32	0.38	0.36	0.32	0.31	0.22	0.35	0.44	0.27	0.49
3	0.48	0.46	0.33	0.36	0.28	0.23	0.40	0.30	0.34	0.38	0.17	0.51	0.32	0.19	0.44
4	0.41	0.42	0.35	0.29	0.42	0.33	0.51	0.39	0.30	0.46	0.18	0.47	0.36	0.23	0.53
5	0.37	0.41	0.30	0.32	0.28	0.24	0.48	0.23	0.25	0.35	0.22	0.41	0.38	0.20	0.48
6	0.40	0.29	0.36	0.24	0.41	0.32	0.48	0.31	0.36	0.39	0.18	0.44	0.44	0.23	0.50
7	0.38	0.44	0.35	0.31	0.43	0.30	0.42	0.25	0.29	0.39	0.17	0.40	0.25	0.20	0.46
8	0.57	0.38	0.32	0.34	0.17	0.30	0.41	0.30	0.42	0.43	0.18	0.40	0.37	0.25	0.50
9	0.59	0.36	0.36	0.33	0.34	0.38	0.44	0.23	0.32	0.44	0.20	0.50	0.39	0.20	0.50
10	0.48	0.32	0.44	0.29	0.31	0.29	0.27	0.26	0.28	0.43	0.23	0.43	0.30	0.19	0.51
11	0.67	0.42	0.33	0.24	0.33	0.20	0.56	0.32	0.37	0.45	0.21	0.38	0.30	0.21	0.48
12	0.43	0.36	0.38	0.22	0.41	0.37	0.43	0.32	0.31	0.40	0.20	0.45	0.22	0.24	0.47
13	0.70	0.33	0.35	0.31	0.30	0.21	0.45	0.30	0.24	0.43	0.17	0.33	0.32	0.22	0.46
14	0.44	0.45	0.37	0.32	0.45	0.30	0.28	0.35	0.27	0.49	0.18	0.42	0.37	0.19	0.48
15	0.44	0.39	0.44	0.25	0.31	0.28	0.52	0.27	0.27	0.33	0.20	0.49	0.32	0.25	0.46
16	0.43	0.34	0.45	0.25	0.33	0.27	0.38	0.28	0.39	0.43	0.17	0.43	0.38	0.22	0.46
17	0.48	0.33	0.42	0.20	0.29	0.22	0.48	0.37	0.33	0.42	0.19	0.43	0.49	0.26	0.45
18	0.46	0.37	0.33	0.22	0.41	0.29	0.47	0.32	0.27	0.39	0.20	0.42	0.27	0.22	0.45
19	0.46	0.47	0.47	0.31	0.23	0.29	0.48	0.29	0.32	0.37	0.18	0.48	0.30	0.25	0.47
20	0.49	0.39	0.36	0.23	0.24	0.41	0.41	0.32	0.24	0.39	0.24	0.42	0.07	0.24	0.45
21	0.47	0.37	0.46	0.31	0.38	0.28	0.43	0.19	0.38	0.41	0.20	0.45	0.27	0.22	0.46
22	0.64	0.40	0.45	0.32	0.21	0.24	0.48	0.22	0.35	0.53	0.16	0.41	0.37	0.22	0.51
23	0.59	0.36	0.37	0.31	0.32	0.27	0.42	0.22	0.30	0.49	0.19	0.43	0.33	0.26	0.54
24	0.50	0.41	0.38	0.23	0.35	0.25	0.30	0.22	0.28	0.41	0.24	0.45	0.15	0.20	0.49
25	0.38	0.39	0.34	0.26	0.29	0.31	0.46	0.28	0.24	0.43	0.16	0.48	0.36	0.27	0.49
26	0.41	0.32	0.44	0.20	0.31	0.29	0.36	0.23	0.38	0.50	0.17	0.43	0.27	0.23	0.46
27	0.43	0.35	0.37	0.33	0.25	0.31	0.45	0.33	0.30	0.37	0.17	0.40	0.22	0.20	0.36
28	0.56	0.37	0.44	0.24	0.27	0.28	0.35	0.24	0.33	0.36	0.20	0.41	0.32	0.26	0.51
29	0.48	0.36	0.33	0.20	0.31	0.23	0.43	0.24	0.26	0.22	0.20	0.37	0.35	0.23	0.50
30	0.50	0.47	0.33	0.31	0.39	0.30	0.38	0.30	0.30	0.37	0.16	0.44	0.36	0.21	0.51

Appendix B.3-1: Modulus of elasticity, Sample A, the outliers (Grubbs' test) are marked in yellow

Modulus of elasticity															
Sample A															
Day 1															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	22.6	29.3	26.9	33.9	29.5	27.9	23.8	33.9	26.2	26.2	25.6	29.4	28.6	28.4	24.3
2	22.5	29.8	29.1	35.4	32.4	35.8	28.5	34.9	24.3	25.4	28.9	26.3	27.7	29.5	29.0
3	21.5	28.5	26.9	26.8	29.7	28.9	30.3	40.5	29.3	28.7	27.7	28.9	28.5	29.3	24.9
4	23.9	25.5	30.2	32.9	28.2	32.4	25.8	31.5	29.3	25.8	27.4	29.6	28.0	26.7	29.1
5	23.7	28.4	29.0	35.6	29.5	28.4	18.5	33.5	28.1	29.0	30.6	30.1	28.2	35.1	26.3
6	22.7	28.4	30.4	32.5	25.5	34.2	26.1	39.3	27.4	28.4	27.4	29.0	25.9	33.9	28.7
7	21.3	30.7	26.1	31.9	27.6	32.4	32.1	39.4	28.8	29.1	35.5	26.8	28.0	29.9	25.5
8	20.9	29.8	28.5	33.1	28.4	35.0	18.8	38.4	30.8	24.0	30.2	29.3	27.6	27.2	26.2
9	20.2	27.9	29.4	31.2	24.9	33.2	31.1	31.8	30.2	31.5	28.5	26.3	28.0	30.1	27.4
10	23.2	30.1	28.4	26.4	29.9	28.4	28.6	32.0	30.0	26.7	28.6	29.6	28.1	34.1	28.7
11	22.6	27.3	24.8	35.0	25.5	33.0	22.9	37.5	28.5	29.6	27.3	28.8	29.3	29.1	29.1
12	21.2	29.2	28.2	33.8	25.8	32.0	26.2	27.5	29.3	22.6	34.0	26.7	28.6	29.8	27.7
13	19.9	28.3	27.5	32.6	29.3	32.6	26.7	35.6	29.8	23.9	36.5	28.9	28.7	33.3	28.8
14	23.8	28.4	29.1	30.1	30.6	36.9	26.6	36.6	29.0	29.5	26.7	27.5	28.2	37.0	27.8
15	22.2	26.2	26.4	21.9	29.7	26.0	29.2	34.3	28.3	29.8	31.9	28.4	27.6	28.8	28.3
16	22.5	28.2	27.1	15.3	30.3	36.3	25.9	29.6	27.7	30.1	33.7	27.5	27.0	30.9	26.0
17	24.6	27.3	24.8	32.5	31.3	32.9	29.7	31.4	28.4	27.3	27.8	28.8	27.8	30.0	24.7
18	24.0	28.7	27.8	35.1	28.8	29.0	24.3	36.7	27.9	30.2	32.6	29.5	24.8	31.4	26.0
19	24.7	27.9	26.2	36.2	29.0	28.2	23.8	35.8	27.5	29.8	26.2	28.9	29.2	28.7	26.6
20	21.9	29.4	30.3	31.1	30.5	31.6	19.0	35.5	28.4	22.2	29.5	29.4	26.9	31.8	29.4
21	24.2	29.1	27.4	31.4	26.3	31.9	25.6	38.3	30.6	30.7	31.8	28.4	26.6	36.0	27.3
22	20.4	25.5	27.3	35.3	29.6	29.3	29.3	32.5	26.6	29.7	33.4	28.3	28.8	29.2	29.0
23	22.4	24.1	29.3	35.8	28.5	27.6	31.2	41.3	28.6	23.3	27.8	24.4	21.6	29.8	27.9
24	24.2	30.0	24.8	35.4	31.9	30.2	27.2	37.2	29.0	31.7	31.1	29.8	26.3	33.0	26.6
25	23.6	28.3	26.6	36.1	30.1	31.3	30.3	44.0	30.2	30.1	34.4	28.3	27.7	31.3	27.0
26	23.3	28.6	27.5	35.5	30.2	31.8	26.3	35.8	30.9	27.5	30.4	28.5	28.7	27.8	29.5
27	24.4	25.2	27.3	34.7	26.7	30.8	31.8	42.6	27.6	26.9	26.0	30.4	29.1	29.8	28.2
28	21.9	21.6	26.9	34.6	29.7	32.3	26.7	36.2	21.5	28.4	30.1	27.1	26.2	31.6	26.7
29	21.4	29.8	29.5	36.6	29.5	33.5	30.4	32.9	30.9	27.5	32.8	30.8	28.0	31.0	27.6
30	25.2	27.8	26.9	32.5	28.6	35.4	28.5	31.5	30.7	28.1	35.0	26.7	27.8	34.0	29.0

Modulus of elasticity															
Sample A															
Day 2															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	29.2	26.7	27.7	32.9	31.0	30.9	20.7	37.4	33.3	28.1	27.7	29.4	28.1	28.0	27.3
2	31.2	29.8	28.0	36.7	23.7	31.1	19.9	35.4	30.0	32.0	28.3	25.6	31.6	28.7	27.4
3	37.0	26.9	27.1	33.4	29.1	34.6	26.0	31.7	25.6	31.8	30.2	26.6	21.2	27.6	29.0
4	32.8	28.5	25.0	28.7	30.3	24.2	28.0	40.1	29.8	30.1	33.3	27.7	26.5	28.7	25.3
5	29.9	25.3	27.8	33.8	29.0	27.2	28.1	37.0	29.5	31.1	32.7	30.2	30.3	29.8	25.3
6	27.9	28.4	28.8	33.7	28.3	33.9	29.0	35.8	33.6	29.1	27.3	28.9	28.0	29.2	24.8
7	32.4	25.5	30.6	29.3	30.5	36.6	28.0	36.4	29.9	26.4	31.6	28.3	25.1	27.8	27.2
8	28.0	29.2	24.7	33.2	30.1	36.8	23.6	40.8	23.0	27.3	31.6	28.2	29.0	31.8	26.0
9	31.3	30.3	29.7	31.4	28.7	32.8	27.8	39.5	28.0	30.6	33.4	27.9	26.4	33.2	27.7
10	26.0	24.9	25.6	30.9	28.5	32.9	22.9	35.0	24.6	30.9	36.3	27.8	30.2	26.3	26.6
11	32.6	25.8	28.7	37.0	27.4	21.0	28.1	38.6	27.0	30.0	29.9	28.3	18.7	32.6	29.5
12	29.2	30.5	28.1	35.1	30.4	29.9	30.9	36.5	35.1	25.5	22.4	29.6	28.0	29.0	27.0
13	35.2	29.0	23.4	29.5	30.1	33.1	28.6	42.1	26.2	26.1	37.4	26.2	27.9	28.9	27.1
14	32.1	31.1	29.4	31.8	28.5	34.4	26.7	32.2	34.2	32.4	28.7	25.3	29.3	29.2	28.0
15	32.8	25.6	30.8	35.4	25.9	36.3	30.0	41.3	26.9	25.5	34.0	28.9	28.7	31.6	26.2
16	36.8	28.4	26.9	27.9	28.0	29.4	26.1	33.6	32.6	28.8	25.6	25.7	28.7	29.1	26.6
17	29.1	26.6	30.1	30.7	30.3	34.0	28.4	39.9	33.7	25.0	37.9	25.4	23.6	27.8	25.6
18	34.4	30.8	26.9	33.4	28.1	33.1	26.3	33.5	29.3	28.4	34.0	30.0	26.5	27.5	26.6
19	28.0	29.7	27.6	37.2	30.8	37.2	24.5	35.1	24.1	32.5	36.5	27.9	26.9	31.5	25.6
20	27.9	25.9	29.8	22.7	30.6	37.6	28.1	39.4	20.8	27.4	36.6	28.4	27.6	32.1	25.5
21	29.8	28.2	27.2	35.9	30.0	32.9	19.6	38.5	28.3	28.1	35.0	27.4	30.5	29.4	26.2
22	28.9	27.0	28.1	28.3	29.4	32.9	25.4	37.4	32.5	33.7	34.1	26.1	29.8	28.6	25.8
23	35.4	24.5	26.4	28.2	25.5	29.2	26.1	36.8	30.7	30.5	38.4	26.7	29.9	23.9	26.2
24	28.9	28.3	31.7	35.0	29.3	29.2	28.9	41.3	29.9	27.4	31.3	29.1	29.0	27.0	25.6
25	30.6	29.0	28.8	32.0	25.2	28.6	29.0	34.7	35.3	32.6	37.0	28.2	30.1	31.4	26.9
26	32.2	27.9	29.0	28.3	29.2	29.6	23.2	34.8	30.8	26.6	36.2	29.8	31.2	29.5	24.6
27	33.7	25.4	30.5	34.2	30.4	34.9	29.1	31.5	33.4	18.5	37.6	26.2	28.6	31.3	25.6
28	33.8	24.3	29.7	32.2	26.8	29.1	19.9	37.8	32.7	34.9	32.3	26.8	27.2	33.3	25.4
29	34.0	30.4	31.6	34.8	30.1	31.7	30.6	40.7	32.7	34.9	37.7	28.5	26.8	30.6	27.3
30	35.4	30.3	30.2	39.4	27.0	31.1	28.7	40.0	30.2	23.6	36.8	26.2	31.0	30.8	28.4

Modulus of elasticity															
Sample A															
Day 3															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	25.1	32.2	28.2	29.5	32.6	41.6	22.2	38.1	27.6	29.7	28.8	26.3	22.1	35.7	27.2
2	26.1	27.4	26.0	33.2	28.4	23.5	24.5	37.7	30.3	30.9	32.5	28.1	29.5	34.1	26.9
3	25.0	28.1	30.4	31.0	30.7	28.3	27.1	35.4	28.0	17.3	35.4	28.8	30.2	31.0	24.7
4	25.3	24.5	25.5	35.8	27.1	29.3	26.4	39.0	28.8	31.6	38.3	31.0	24.6	28.9	26.8
5	23.3	31.1	27.0	32.2	29.3	36.6	24.2	33.9	29.9	28.7	17.4	29.3	30.4	32.2	24.3
6	26.5	28.7	30.6	31.4	26.3	29.9	24.9	38.1	24.7	28.0	30.1	26.0	31.4	27.2	25.7
7	25.9	29.7	27.8	37.4	29.8	35.7	29.0	39.8	26.9	31.2	31.0	29.9	26.8	31.2	28.0
8	22.6	26.2	30.8	35.6	29.8	30.7	26.2	35.6	28.5	30.1	33.2	26.2	30.9	33.7	27.4
9	24.3	29.7	30.7	37.5	27.8	35.6	27.4	38.9	33.6	24.1	34.4	25.9	30.3	34.2	25.1
10	26.4	24.9	26.3	57.8	31.5	32.8	27.9	39.8	31.9	31.1	34.9	25.5	31.9	31.7	24.3
11	26.0	30.3	32.3	33.4	28.9	34.3	24.0	40.9	28.7	24.7	36.2	27.5	31.7	31.6	23.8
12	26.9	25.6	30.6	37.2	29.8	34.8	25.5	38.3	31.4	28.9	29.9	27.6	33.5	29.7	25.9
13	27.8	22.3	30.1	37.4	27.6	27.4	25.6	37.4	27.6	29.3	29.7	26.3	24.8	31.6	25.5
14	24.2	26.0	28.6	36.1	28.5	35.4	30.0	39.8	33.2	26.0	37.9	27.6	30.0	33.2	27.5
15	21.5	28.3	28.5	35.8	29.9	33.2	25.3	37.3	26.7	25.3	23.2	26.3	29.5	33.1	27.1
16	25.4	30.5	28.9	33.8	26.0	31.4	24.8	36.5	30.9	32.9	30.9	22.1	30.0	36.7	26.1
17	27.0	27.0	32.5	37.7	29.3	34.8	21.2	36.7	31.8	32.0	31.2	27.9	31.7	28.3	25.4
18	25.6	22.8	30.6	26.3	29.0	34.4	27.9	34.0	32.2	29.0	36.6	29.4	30.3	31.2	26.0
19	21.6	22.6	28.8	35.1	27.4	29.9	27.3	35.9	29.7	31.9	30.8	26.9	31.9	33.3	26.8
20	24.1	23.7	30.3	36.7	31.0	35.0	29.2	37.7	32.0	24.3	37.1	26.5	27.7	35.1	26.7
21	23.8	26.0	26.5	30.2	29.8	27.8	20.3	37.6	31.6	29.9	32.3	28.3	29.3	32.9	26.8
22	27.3	26.3	26.4	34.2	27.2	20.3	28.8	33.8	33.0	29.4	33.7	26.4	29.9	34.1	25.9
23	24.6	23.8	30.8	35.5	28.9	31.1	28.4	39.1	27.0	24.7	34.5	27.3	32.2	29.3	28.8
24	25.2	24.6	26.1	35.8	28.5	34.3	29.2	36.2	26.7	30.6	30.3	28.8	30.2	30.9	27.7
25	27.6	22.7	30.9	32.4	30.5	29.3	26.9	35.4	32.6	30.2	31.0	26.2	28.5	28.0	26.7
26	25.2	22.5	30.4	32.6	26.8	34.4	27.5	35.9	30.5	33.0	35.9	29.7	30.5	33.1	26.9
27	28.6	23.9	26.8	35.3	28.8	34.6	25.3	37.4	33.5	33.5	36.4	29.6	32.8	27.5	26.2
28	24.9	28.2	27.1	37.3	30.8	37.2	29.2	38.0	33.1	30.3	29.3	27.0	30.9	24.4	25.6
29	27.6	26.5	29.6	36.3	27.6	33.5	28.0	42.8	28.6	30.9	26.1	29.6	30.0	31.3	26.6
30	22.3	26.4	32.0	32.8	27.5	36.4	25.7	33.7	32.8	31.6	32.5	28.7	31.2	35.2	27.0

Appendix B.3-2: Modulus of elasticity, Sample B, the outliers (Grubbs' test) are marked in yellow

	Modulus of elasticity														
	Sample B														
	Day 1														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	25.1	29.2	28.0	40.2	35.0	40.4	26.1	38.0	36.0	31.1	35.1	30.2	33.5	27.7	25.3
2	27.7	30.9	30.8	41.4	33.7	33.4	32.4	41.5	30.0	29.5	30.7	26.1	33.5	34.3	27.6
3	24.0	31.3	30.7	43.9	32.8	33.4	32.9	47.8	30.4	28.2	35.1	29.1	34.0	30.6	27.1
4	22.8	30.8	35.2	43.0	32.1	40.3	31.4	45.5	33.6	27.6	30.5	27.9	33.3	30.4	25.3
5	26.3	32.5	31.2	42.0	30.1	23.9	32.4	36.4	33.2	29.3	20.7	32.9	33.0	29.6	26.2
6	25.4	27.5	30.8	45.6	32.2	33.9	34.5	41.7	31.3	27.8	32.9	34.9	33.2	32.7	24.1
7	27.0	29.5	34.6	40.2	37.6	30.7	33.5	50.7	29.8	30.9	20.4	31.6	36.5	27.9	27.3
8	28.0	30.1	28.0	42.5	29.6	34.4	36.2	43.9	33.5	31.6	33.4	31.6	31.5	31.2	27.9
9	26.0	32.8	30.3	37.9	38.0	37.4	33.9	43.5	28.9	35.1	42.5	29.5	36.0	30.2	27.1
10	22.7	35.6	30.6	37.8	38.3	36.3	26.1	47.8	32.6	31.2	35.1	30.7	35.0	34.4	27.0
11	31.6	36.0	37.1	42.5	30.6	40.3	33.6	42.2	31.6	32.5	14.8	34.3	31.9	28.7	31.7
12	27.5	30.8	31.8	47.8	35.0	39.0	37.3	42.5	30.2	30.2	15.2	35.0	36.1	29.2	28.1
13	28.6	38.5	30.8	38.7	32.1	36.3	37.9	39.3	30.4	32.0	18.3	32.2	31.8	30.8	29.3
14	29.9	31.6	35.1	43.1	32.4	29.5	29.2	39.5	31.5	28.4	16.3	32.4	31.8	26.8	27.6
15	25.2	35.3	34.9	44.6	30.1	41.4	32.0	44.7	34.4	30.3	41.9	34.2	36.3	31.6	27.5
16	29.0	32.0	29.6	42.3	34.4	37.4	39.8	44.6	30.3	33.0	35.6	28.5	37.5	32.3	27.9
17	26.0	26.6	30.6	39.8	32.8	41.9	35.2	44.5	29.2	34.5	36.9	28.7	31.0	33.2	26.0
18	23.9	32.9	38.3	43.1	33.0	40.4	31.7	44.4	30.0	30.0	36.0	30.0	30.4	30.3	28.7
19	30.4	30.4	34.5	41.9	30.0	42.5	32.7	42.8	32.0	36.3	38.5	31.6	34.9	29.8	28.7
20	30.3	32.1	34.6	48.1	32.9	35.0	25.7	42.3	28.8	27.1	15.5	33.8	27.1	32.1	28.7
21	22.7	32.4	35.7	44.1	32.5	40.2	31.5	49.7	29.6	31.1	26.0	29.7	31.3	31.6	24.4
22	26.4	31.5	34.5	39.9	30.4	38.4	31.7	34.6	29.8	29.7	39.5	34.2	36.2	29.3	25.3
23	28.7	31.3	34.1	43.4	32.7	44.4	29.5	46.0	35.9	30.8	24.9	29.3	30.5	31.8	25.3
24	27.3	33.4	35.3	38.6	33.1	36.2	29.7	53.3	30.9	29.9	41.3	31.4	33.9	31.5	28.5
25	27.6	32.0	34.2	40.0	33.3	35.5	28.8	47.2	28.0	29.4	33.9	30.2	38.4	36.6	27.7
26	27.0	34.5	33.2	42.2	34.3	39.1	33.5	40.5	29.8	29.0	38.7	39.1	33.1	30.8	27.6
27	25.9	36.7	33.3	37.5	32.2	40.4	31.7	51.2	29.6	28.5	42.4	30.8	35.4	26.6	27.5
28	27.6	35.7	35.9	34.2	35.1	43.3	36.0	44.4	31.9	28.9	43.2	34.0	36.2	32.2	29.1
29	33.5	32.1	30.7	44.2	32.7	36.1	33.5	46.7	31.4	28.9	36.4	28.6	35.0	32.1	28.6
30	27.7	33.5	33.1	45.6	38.2	39.2	37.3	47.1	29.5	29.0	37.6	26.6	31.7	30.8	28.9

	Modulus of elasticity														
	Sample B														
	Day 2														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	33.6	29.5	30.6	38.4	32.8	42.9	26.8	41.7	32.4	31.6	26.7	27.1	28.5	42.7	26.6
2	33.5	37.4	31.3	41.6	31.3	35.9	29.8	45.5	31.0	31.9	34.4	27.7	35.0	42.8	27.0
3	37.2	28.3	32.3	43.7	34.9	37.1	33.9	40.6	20.2	32.2	34.2	32.0	32.5	39.0	27.5
4	36.5	31.9	32.8	47.7	35.8	40.6	34.1	41.4	34.8	29.7	42.1	32.5	33.4	45.2	26.2
5	41.3	29.0	30.9	35.4	29.9	35.3	31.7	47.9	35.5	33.0	39.3	32.9	29.6	39.9	28.0
6	35.1	31.8	31.7	37.7	32.7	39.5	24.7	47.1	35.8	35.0	43.8	37.0	37.6	42.3	27.1
7	39.5	31.2	32.5	40.7	30.6	41.0	36.1	40.4	41.7	29.0	40.0	31.1	25.3	47.4	27.0
8	36.8	30.4	32.4	43.0	42.0	40.3	32.0	43.5	37.2	30.2	41.2	29.9	30.2	39.6	27.1
9	39.7	31.2	29.6	45.3	32.8	41.5	30.4	43.9	29.8	28.5	41.3	28.6	33.0	40.8	26.9
10	44.0	25.8	33.4	44.3	33.1	39.4	31.1	46.2	35.6	30.0	42.1	30.2	35.5	43.4	26.3
11	36.8	27.9	31.7	42.1	34.7	34.9	26.9	39.1	38.9	34.9	43.5	31.3	34.6	39.8	27.0
12	37.1	30.7	34.2	32.2	32.4	41.0	34.1	42.4	35.3	29.3	38.8	33.8	28.5	37.7	27.0
13	40.6	34.3	31.6	45.8	33.7	35.9	32.5	50.0	36.4	33.7	44.5	33.4	34.3	48.6	26.0
14	36.7	33.0	31.0	38.8	31.1	31.0	32.1	47.6	41.2	30.9	34.0	28.3	33.3	44.4	27.7
15	40.8	31.8	34.6	43.6	34.2	35.7	30.3	40.8	38.2	31.6	43.2	26.6	33.2	44.5	28.5
16	39.2	34.0	30.7	44.1	34.1	34.9	25.9	47.8	40.5	37.1	46.6	30.4	29.3	42.4	29.9
17	37.7	32.2	32.1	43.6	36.9	36.0	31.9	39.8	35.2	35.4	41.2	28.7	34.9	42.5	28.7
18	35.7	32.0	33.9	40.6	28.8	28.3	29.3	53.0	37.4	38.8	46.7	32.9	34.3	35.4	29.6
19	35.2	29.7	32.5	43.0	32.4	30.7	29.5	44.3	35.7	39.6	44.0	34.2	36.1	39.0	26.3
20	37.7	34.8	37.1	45.1	39.4	39.9	32.8	47.3	34.2	38.2	43.8	33.0	35.0	39.0	28.2
21	42.0	36.0	33.3	40.0	37.3	41.2	24.5	44.4	38.8	34.3	41.4	28.2	36.7	41.7	29.8
22	44.3	34.7	29.9	42.0	35.2	28.1	30.4	49.7	29.7	41.0	41.2	29.3	32.8	45.8	30.7
23	32.4	31.7	34.1	42.8	31.8	38.0	33.6	48.2	33.6	35.3	44.7	31.6	37.4	49.4	25.3
24	38.4	34.9	34.6	39.9	37.5	42.9	34.3	49.7	35.3	41.4	40.2	31.3	39.7	46.6	27.6
25	38.6	34.8	30.0	41.0	31.7	40.8	32.7	52.3	38.2	27.1	27.9	30.6	32.3	42.4	28.7
26	37.3	33.2	36.1	43.8	36.2	37.3	33.2	52.0	37.9	28.3	41.9	32.5	33.6	37.9	27.6
27	40.6	36.5	28.8	42.3	30.5	33.2	35.2	47.4	33.8	37.6	41.8	31.2	26.9	41.9	29.3
28	38.4	34.8	34.3	39.6	37.1	37.9	34.0	41.7	36.2	28.9	46.5	36.1	32.1	41.1	28.9
29	33.4	33.8	37.1	41.8	39.8	38.7	36.2	45.1	35.9	31.1	43.6	28.9	36.2	39.6	28.7
30	31.9	32.2	32.3	46.0	31.0	34.2	29.1	39.9	30.7	36.6	26.8	31.9	34.3	46.2	25.8

	Modulus of elasticity														
	Sample B														
	Day 3														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	31.2	31.0	31.4	44.7	36.8	34.9	28.0	45.4	34.1	32.8	39.6	31.9	36.5	41.2	28.9
2	31.9	31.6	33.6	40.8	32.4	42.9	32.8	43.4	36.2	32.7	35.5	33.0	32.1	37.1	28.2
3	34.2	31.6	34.3	37.9	32.9	38.0	32.0	48.9	37.3	34.9	37.8	24.1	35.1	41.5	27.0
4	32.5	27.5	32.8	34.6	33.1	41.0	31.8	44.1	36.7	32.7	33.2	30.7	41.2	35.9	27.9
5	31.0	34.6	34.5	34.4	30.7	36.2	30.6	45.5	35.1	39.2	39.3	30.5	28.9	39.3	26.0
6	25.2	29.8	36.4	34.3	32.9	35.9	29.0	43.4	37.1	34.4	41.9	32.3	37.2	36.7	26.7
7	29.3	37.1	39.0	45.5	35.1	38.1	32.2	46.3	37.3	33.6	39.4	31.2	43.2	37.9	27.3
8	26.4	29.8	33.6	40.9	37.2	36.6	36.9	47.6	39.4	32.2	42.0	39.2	39.2	37.9	26.2
9	30.1	33.8	34.2	42.8	32.0	36.7	33.6	44.3	37.3	31.3	39.2	30.5	39.9	45.4	25.1
10	28.5	35.0	33.9	42.1	35.4	40.3	22.3	42.8	34.5	34.1	39.1	27.9	30.9	41.0	25.5
11	27.1	29.1	31.8	42.1	34.2	39.3	33.2	41.1	33.0	40.7	42.9	32.8	36.3	45.3	27.0
12	27.6	32.3	35.1	40.5	36.7	37.9	37.8	45.4	39.4	31.9	38.9	29.2	38.7	39.8	28.9
13	31.1	29.0	38.8	43.2	33.5	34.4	38.2	48.6	36.8	29.4	35.4	28.0	35.7	40.2	26.0
14	28.5	35.9	31.6	37.1	34.9	35.3	30.0	41.5	35.6	31.4	40.1	28.2	36.1	40.7	26.4
15	30.2	28.9	36.0	39.2	32.7	33.1	28.1	44.9	36.9	29.2	42.2	35.4	36.7	44.7	28.7
16	34.8	32.9	36.0	45.8	35.4	37.6	34.3	37.3	38.1	27.1	34.7	31.6	34.9	38.7	26.0
17	31.1	33.1	34.6	41.1	31.8	41.1	32.6	47.4	37.1	29.6	46.2	32.3	36.2	43.4	28.1
18	32.0	32.8	34.7	40.2	28.3	38.3	34.3	43.5	37.8	32.4	48.2	26.4	35.4	43.9	25.0
19	29.3	34.5	31.5	43.2	34.4	41.3	31.6	41.4	32.3	33.7	43.3	37.3	34.8	40.8	24.4
20	28.7	37.6	31.5	41.5	32.4	41.2	23.0	46.0	33.9	31.3	37.5	37.1	34.8	33.6	25.6
21	31.1	32.6	31.5	48.0	32.6	34.8	34.0	47.6	35.7	34.6	38.9	30.2	39.3	40.6	28.7
22	30.7	33.8	46.2	42.0	30.6	37.0	31.9	43.3	35.4	33.5	46.0	35.3	41.6	43.7	27.7
23	30.2	37.3	33.5	33.0	33.8	34.3	31.9	42.9	38.8	29.9	39.8	31.1	33.6	39.8	25.1
24	29.1	41.8	39.0	38.4	36.4	36.7	32.4	47.5	33.5	31.9	45.8	27.2	36.5	40.4	27.4
25	36.1	38.8	30.5	34.7	34.5	35.6	27.8	49.0	36.2	30.8	39.4	33.6	34.1	39.6	24.4
26	34.7	29.9	35.1	36.6	35.0	31.7	30.3	50.3	37.6	33.1	47.9	35.5	34.2	35.4	27.6
27	36.2	31.6	31.0	40.8	33.8	43.5	33.6	42.4	35.8	32.3	47.1	34.0	32.4	43.3	28.7
28	31.2	30.0	34.7	45.9	31.5	38.7	31.6	46.8	36.9	31.3	41.7	29.4	34.8	38.0	29.1
29	32.2	33.1	37.6	36.2	31.1	44.2	29.3	46.8	30.1	34.7	39.1	32.9	36.8	35.1	25.3
30	31.2	39.2	37.8	39.8	31.9	39.0	24.2	45.4	36.5	33.9	45.6	29.9	35.1	37.2	27.5

Appendix B.3-3: Modulus of elasticity, Sample C, the outliers (Grubbs' test) are marked in yellow

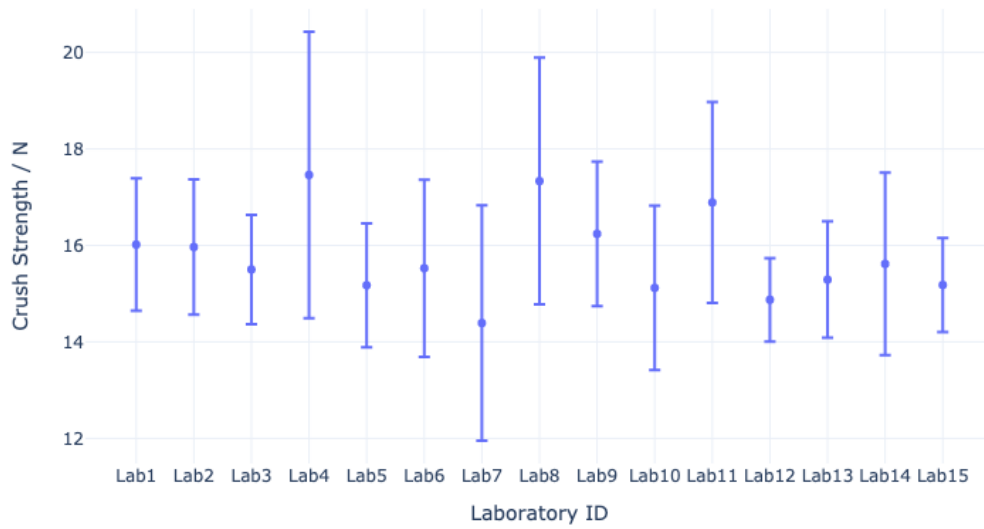
Modulus of elasticity															
Sample C															
Day 1															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	23.2	25.2	29.4	33.3	27.8	35.6	27.1	32.7	24.5	29.0	26.2	30.5	29.9	31.3	22.4
2	18.6	28.0	28.0	33.3	25.8	35.8	31.0	32.3	30.9	23.1	25.8	31.7	26.5	28.3	23.0
3	33.2	27.7	29.4	33.3	26.3	38.5	27.3	33.1	32.3	26.9	26.5	24.7	25.8	31.3	26.6
4	17.8	27.1	28.0	33.0	28.8	33.4	29.2	32.9	23.8	24.6	25.5	27.1	29.0	31.7	22.4
5	21.8	27.2	25.4	31.3	26.5	38.0	30.0	35.5	24.4	24.9	26.9	30.7	27.6	30.6	24.8
6	35.0	26.7	30.6	33.2	23.7	37.1	28.9	31.8	28.2	22.7	27.9	28.7	26.2	32.7	25.6
7	19.6	26.7	25.4	31.5	29.0	37.5	28.7	35.6	30.4	21.0	28.1	28.9	25.0	29.6	26.0
8	28.1	27.6	27.6	32.6	24.9	35.8	26.2	33.9	21.7	23.1	26.1	32.3	26.4	34.3	23.1
9	13.5	27.3	28.7	33.9	24.5	34.8	30.4	32.3	30.3	25.9	26.2	21.8	27.9	31.6	27.0
10	42.1	28.4	31.5	31.8	28.4	35.2	26.2	31.7	25.5	25.7	26.2	29.2	28.7	32.9	24.8
11	24.4	27.8	25.5	33.6	26.7	36.0	26.7	35.3	24.6	24.2	29.0	28.7	26.7	32.3	24.8
12	26.3	29.7	25.4	33.0	23.6	36.6	27.7	34.2	21.7	26.2	26.4	32.6	26.9	31.4	22.8
13	17.6	27.7	30.5	30.3	27.3	32.3	31.1	36.0	23.0	24.8	28.3	26.6	26.9	34.5	24.8
14	31.6	26.6	26.9	33.1	27.0	35.3	27.2	35.7	29.3	23.8	27.9	27.1	27.5	31.8	26.4
15	15.7	26.2	26.4	32.0	24.8	34.1	25.2	34.8	29.0	25.7	27.5	26.0	28.5	28.6	24.5
16	25.4	26.6	27.9	32.0	26.8	34.3	25.3	33.6	29.7	26.0	26.2	23.4	28.9	31.6	27.0
17	36.5	28.4	25.4	35.1	24.5	35.4	26.4	31.6	23.5	27.4	27.7	25.2	31.6	31.5	20.9
18	19.7	28.8	28.0	31.8	26.7	36.3	33.0	36.9	23.3	21.2	28.2	33.0	28.7	31.0	27.8
19	27.2	28.4	27.4	32.1	27.6	34.4	25.5	35.7	29.1	24.4	28.0	29.8	27.5	31.2	26.0
20	26.5	29.5	27.4	34.0	27.1	35.8	25.0	40.3	23.0	25.0	27.7	27.6	28.8	31.6	25.4
21	19.4	31.4	31.8	35.1	27.6	32.0	23.2	34.7	28.5	22.6	30.1	24.3	27.0	29.0	26.6
22	21.2	27.4	26.7	37.0	26.9	39.5	28.5	35.5	29.0	23.0	31.6	22.0	28.9	30.5	22.8
23	27.8	27.4	29.7	32.7	29.3	32.0	28.7	36.2	28.6	24.3	28.6	29.0	28.7	32.3	27.2
24	26.1	27.6	29.1	33.9	29.9	38.4	26.7	38.6	32.0	20.4	27.5	27.0	27.6	32.7	22.6
25	24.7	31.3	27.7	32.6	27.6	33.6	27.1	40.5	30.2	24.8	26.0	26.7	28.7	30.9	26.6
26	25.4	29.4	29.9	34.8	29.9	37.2	27.8	36.1	22.4	22.6	31.1	29.9	27.0	31.0	24.8
27	17.6	27.5	28.7	35.2	26.4	34.8	28.6	37.1	29.5	24.7	28.6	28.0	29.5	30.4	27.0
28	33.9	26.5	29.0	36.9	26.9	32.9	28.6	37.0	23.3	23.5	29.7	25.7	30.4	31.8	22.8
29	30.9	29.5	26.7	35.6	26.1	36.9	27.3	36.7	23.5	24.4	28.2	23.6	28.7	33.3	23.0
30	16.1	28.2	27.3	36.6	28.7	35.5	26.4	40.0	28.8	22.6	29.2	25.4	27.4	31.0	24.8

	Modulus of elasticity														
	Sample C														
	Day 2														
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	22.7	27.9	27.1	37.0	27.3	32.2	24.3	33.9	33.1	22.5	28.0	25.3	28.0	36.3	23.1
2	24.5	25.3	27.9	33.6	27.3	35.1	26.6	32.0	30.8	23.9	29.0	26.6	27.7	40.1	24.8
3	20.9	28.4	27.6	34.1	27.1	36.4	25.5	35.1	33.7	22.6	28.5	27.3	27.3	36.3	22.5
4	23.1	26.7	25.6	33.2	30.9	37.2	26.0	31.8	34.8	23.2	27.2	29.8	29.3	41.7	23.3
5	23.6	29.5	27.1	35.2	29.7	35.5	25.8	31.0	30.5	22.3	30.4	32.8	26.3	38.1	22.5
6	21.6	25.5	30.3	35.9	25.3	35.5	23.7	35.7	31.5	27.7	28.5	27.8	27.3	37.0	26.0
7	21.6	28.4	29.2	34.3	26.6	36.2	26.3	32.7	32.2	26.1	30.5	25.3	27.2	38.3	25.0
8	23.2	26.0	25.8	30.7	26.7	36.5	30.9	33.1	28.5	22.0	31.1	31.6	31.2	37.7	25.9
9	23.3	27.9	27.7	34.4	25.0	36.0	30.0	34.4	29.7	26.2	28.4	25.3	28.4	38.5	23.3
10	23.1	26.1	27.6	35.3	29.8	35.8	25.3	35.6	34.5	25.0	27.2	26.0	28.8	39.2	28.4
11	24.9	27.8	27.9	36.6	28.4	31.5	21.1	35.5	28.0	26.2	31.6	25.0	26.2	36.6	26.0
12	23.4	24.7	28.3	37.6	27.6	33.7	31.7	35.7	33.6	26.6	30.4	27.8	27.6	37.8	26.0
13	24.0	27.2	28.6	34.7	28.2	37.7	25.6	35.1	27.7	25.2	32.5	24.7	26.5	39.3	26.0
14	25.1	29.1	29.6	37.7	29.5	36.8	28.4	33.3	30.7	24.3	29.4	24.3	25.9	37.7	25.3
15	22.4	26.7	29.1	36.2	27.2	32.6	24.0	37.6	31.0	22.5	31.0	28.7	27.2	38.6	23.0
16	23.9	27.2	27.0	37.0	26.3	34.2	26.1	36.0	34.8	27.1	31.2	28.0	28.5	40.3	26.0
17	24.6	26.9	28.9	34.2	32.4	38.6	33.1	35.0	33.8	23.5	32.6	35.8	29.6	38.5	24.5
18	22.4	26.1	29.4	36.1	24.6	38.2	26.5	36.9	30.0	27.3	31.6	28.7	27.0	37.9	25.3
19	22.2	25.1	30.7	35.4	26.9	36.9	27.2	35.5	32.6	21.0	32.6	28.3	28.3	38.8	22.5
20	23.4	27.1	28.1	39.0	28.1	35.1	32.0	37.0	33.7	22.9	33.3	26.9	27.1	39.5	26.0
21	22.9	28.2	28.5	37.8	27.7	35.9	24.1	36.6	28.6	21.2	31.7	23.3	27.7	40.2	27.8
22	21.9	28.8	29.3	38.3	26.9	35.8	27.4	38.0	31.2	19.7	29.8	27.5	28.7	38.6	27.9
23	22.7	26.2	28.7	39.3	28.9	32.6	31.1	39.2	31.7	21.0	31.8	24.6	27.6	39.6	25.0
24	25.8	26.4	28.5	39.3	29.9	38.7	34.4	37.3	31.7	25.9	32.6	33.5	30.6	41.8	26.0
25	22.3	28.1	26.5	35.9	26.6	33.7	24.5	35.7	31.7	26.8	30.6	33.5	27.0	36.7	23.8
26	23.5	26.8	27.0	35.6	27.2	37.0	23.1	39.2	33.5	24.9	33.4	27.2	28.6	40.4	25.0
27	22.6	29.0	27.6	37.1	27.0	35.8	29.4	37.8	33.0	24.2	31.3	27.8	32.4	35.8	23.6
28	18.8	25.2	27.8	38.4	28.0	36.8	27.5	43.0	33.7	22.3	34.2	26.2	27.0	36.2	25.9
29	19.7	27.2	29.5	37.7	27.0	33.5	31.2	37.4	34.5	25.3	31.1	27.1	29.1	35.8	25.9
30	22.8	27.2	29.3	38.1	27.9	35.5	29.5	37.2	30.4	23.2	29.9	30.0	28.9	36.6	28.4

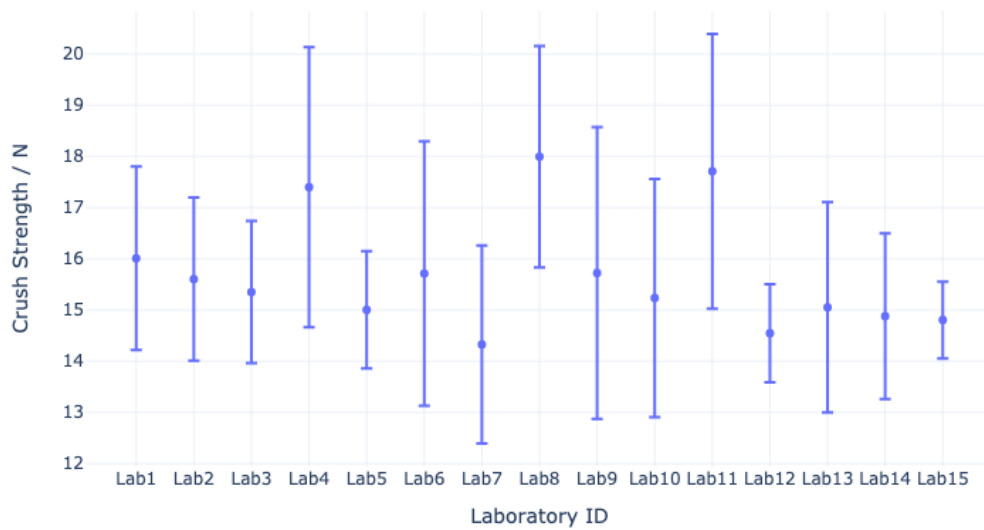
Modulus of elasticity															
Sample C															
Day 3															
Lab ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	23.1	27.9	26.4	41.8	30.5	38.0	22.3	36.5	33.3	23.6	33.5	26.0	30.0	41.0	25.2
2	20.2	29.1	27.3	37.5	29.4	34.3	28.3	40.1	35.4	26.0	37.1	24.1	28.8	40.9	27.2
3	21.1	28.9	28.7	32.3	29.0	36.4	28.5	34.5	32.3	25.9	34.4	32.3	31.9	40.9	23.0
4	19.3	27.7	29.9	34.1	28.0	32.6	34.3	34.1	33.5	27.6	35.5	30.7	28.4	38.6	25.2
5	20.8	27.1	30.1	35.2	30.9	33.2	29.3	36.8	29.1	24.2	39.4	27.3	29.2	39.6	27.0
6	19.9	32.2	27.9	38.7	26.5	36.6	26.4	40.5	27.8	24.2	38.0	28.5	30.1	38.3	26.0
7	21.5	26.4	26.0	34.6	32.1	31.7	25.7	40.7	30.7	24.0	36.0	28.3	30.1	39.6	23.0
8	20.3	25.4	29.4	34.9	34.7	35.4	26.0	38.0	30.0	27.1	34.1	27.2	29.8	39.8	24.8
9	21.2	28.1	29.7	34.8	24.8	32.0	28.1	37.8	32.1	27.1	39.6	24.9	28.7	40.9	26.0
10	20.2	28.9	31.2	33.4	28.4	31.6	26.0	36.2	27.1	25.3	38.0	28.0	28.5	37.6	26.8
11	24.5	29.5	28.7	40.0	27.9	34.3	25.1	36.6	31.9	27.1	37.8	25.4	29.0	41.4	22.8
12	20.1	26.4	29.9	40.7	28.1	33.9	29.4	37.5	29.8	27.0	38.9	28.7	31.2	37.8	24.5
13	25.3	28.6	27.2	34.3	28.1	32.1	26.1	37.3	31.3	24.6	37.8	26.3	29.1	38.3	22.6
14	21.0	29.7	29.2	34.8	29.9	33.1	26.5	36.0	30.8	27.3	42.3	25.9	29.8	39.4	23.1
15	22.1	27.2	31.6	39.7	29.7	35.4	38.4	35.4	28.4	25.4	40.7	30.6	28.5	39.9	28.6
16	21.3	28.3	29.7	41.2	27.1	36.1	23.5	38.8	30.0	24.2	39.7	23.3	28.0	38.0	25.3
17	23.7	30.2	29.4	42.7	27.7	34.4	32.1	35.8	28.7	24.9	39.9	29.2	34.2	37.7	27.8
18	21.4	30.1	28.9	36.1	26.8	35.7	31.3	37.2	35.2	23.9	39.5	25.4	29.2	41.2	25.0
19	20.6	32.7	32.0	35.7	30.2	34.3	33.3	38.6	29.6	22.3	37.9	33.4	28.7	38.7	25.9
20	24.9	31.5	28.8	37.5	30.8	22.4	26.2	38.2	33.4	25.0	40.0	29.6	22.9	39.7	28.4
21	19.2	27.9	33.4	38.6	29.4	33.9	21.6	39.1	29.9	25.0	36.6	27.7	28.4	39.0	27.9
22	23.8	27.9	30.8	38.9	29.8	31.4	32.9	40.8	34.1	28.8	36.6	28.3	30.1	39.7	26.8
23	21.5	29.7	31.2	39.0	29.3	35.2	27.3	35.7	28.9	25.6	38.7	24.7	30.1	38.4	25.2
24	22.3	28.5	28.1	42.0	28.9	34.1	27.7	40.1	30.9	23.1	43.9	29.5	26.5	37.9	21.0
25	22.4	27.7	29.9	37.7	29.3	34.1	29.4	37.5	30.1	26.7	40.0	31.6	30.0	39.4	25.4
26	22.4	31.9	29.8	38.1	27.1	34.6	23.7	42.2	31.2	28.4	35.7	26.8	33.5	39.0	23.4
27	21.6	32.0	28.0	34.6	28.4	35.0	30.5	36.2	34.9	25.1	40.5	26.1	34.8	38.7	24.4
28	22.3	27.9	29.8	38.5	29.8	31.8	26.7	36.7	28.1	24.8	38.8	27.6	29.6	41.4	24.8
29	22.3	29.0	30.2	37.4	27.6	34.3	28.6	38.4	34.5	25.4	40.7	27.4	30.0	41.3	26.0
30	22.0	27.4	28.1	39.7	28.4	35.6	26.1	38.5	31.9	24.5	37.8	27.1	31.3	42.2	24.8

APPENDIX C – Diagrams

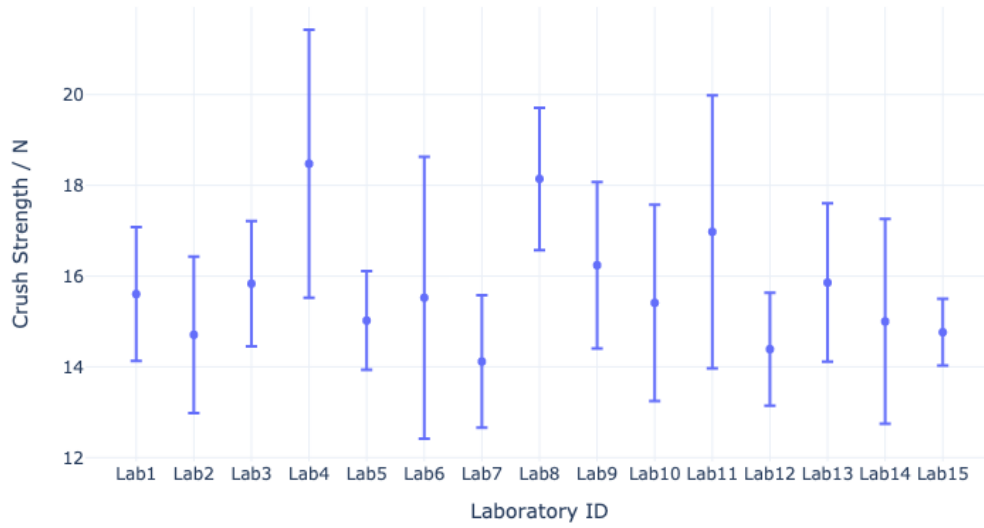
Crush Strength - Sample A - Day 1



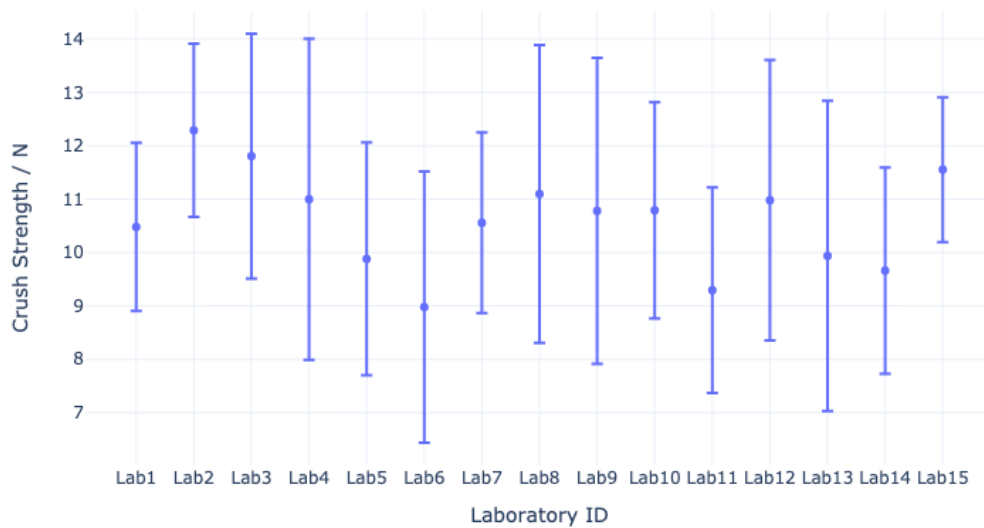
Crush Strength - Sample A - Day 2



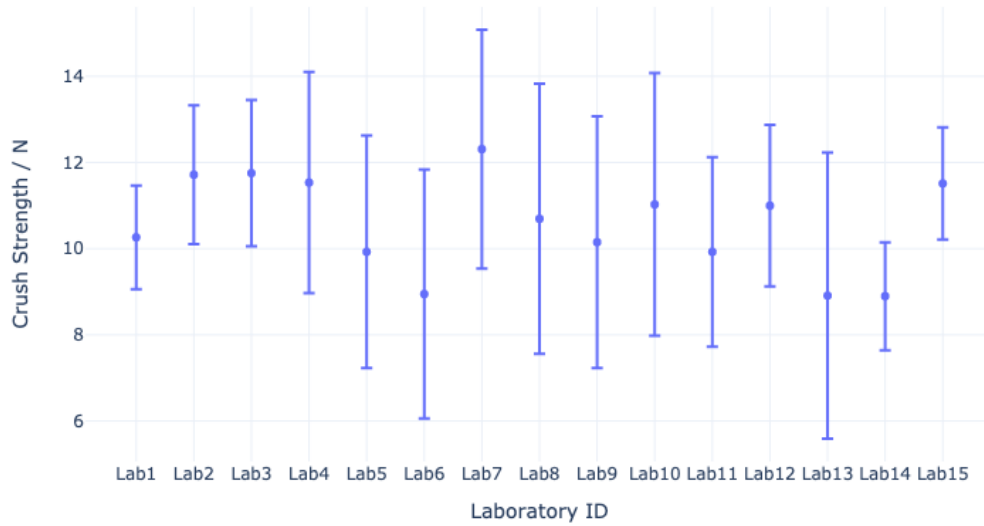
Crush Strength - Sample A - Day 3



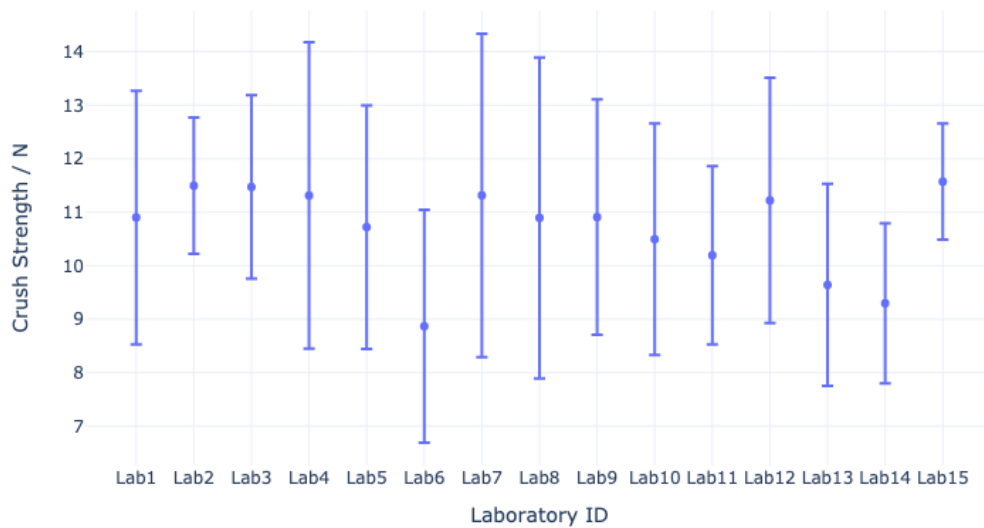
Crush Strength - Sample B - Day 1



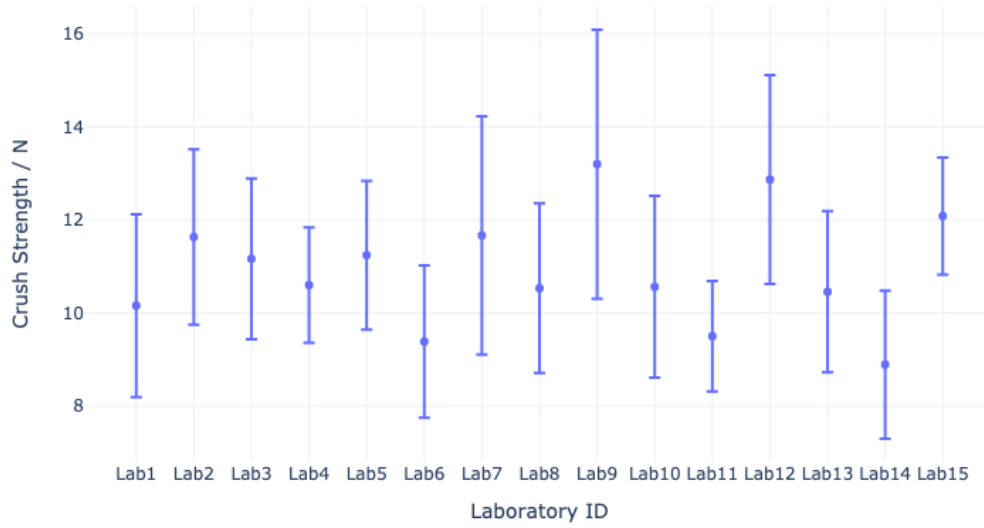
Crush Strength - Sample B - Day 2



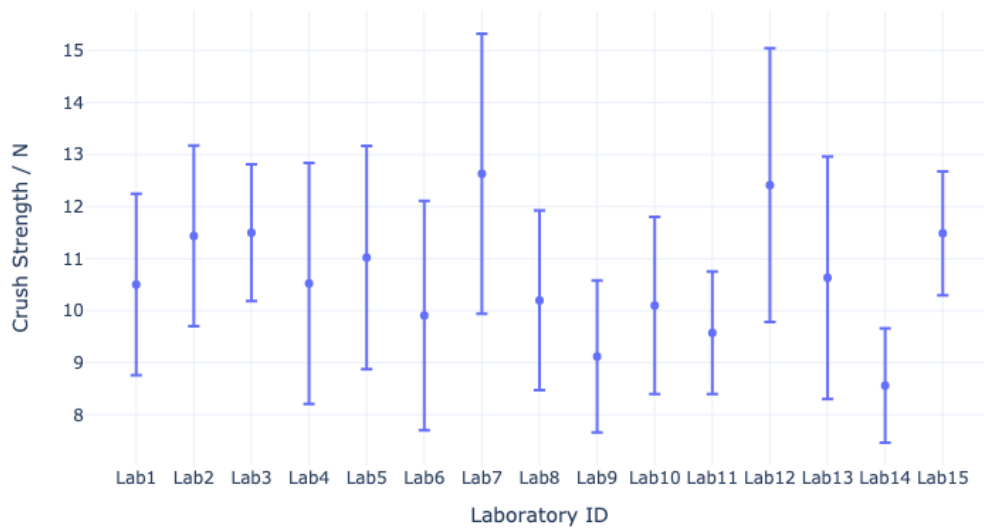
Crush Strength - Sample B - Day 3



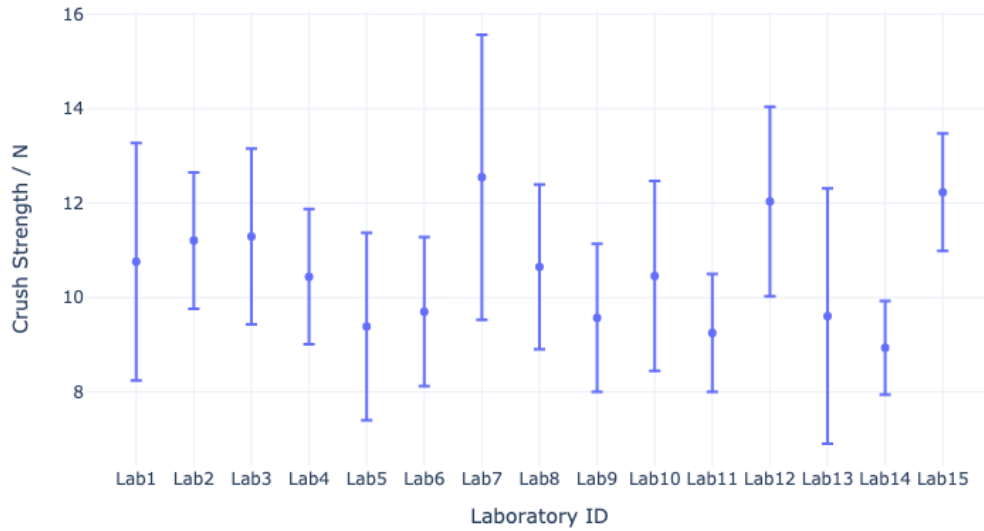
Crush Strength - Sample C - Day 1



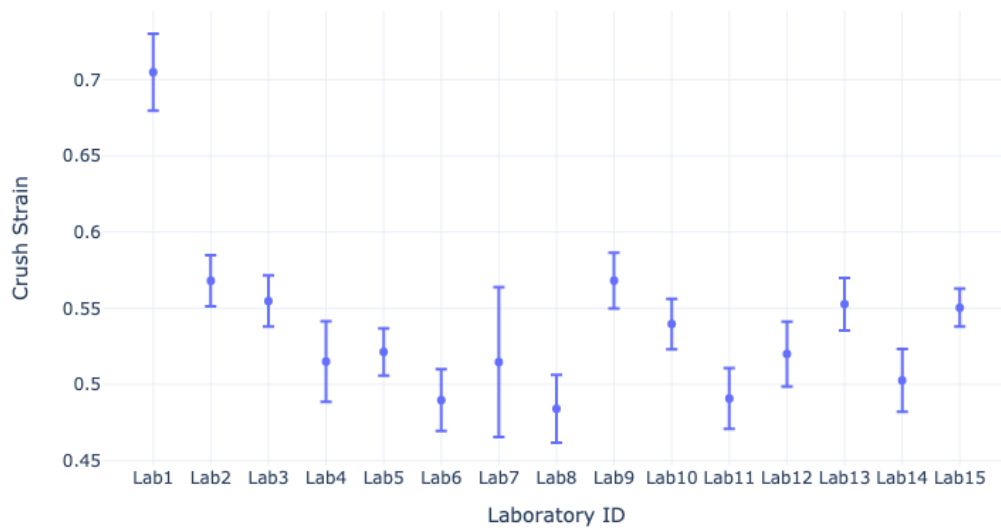
Crush Strength - Sample C - Day 2



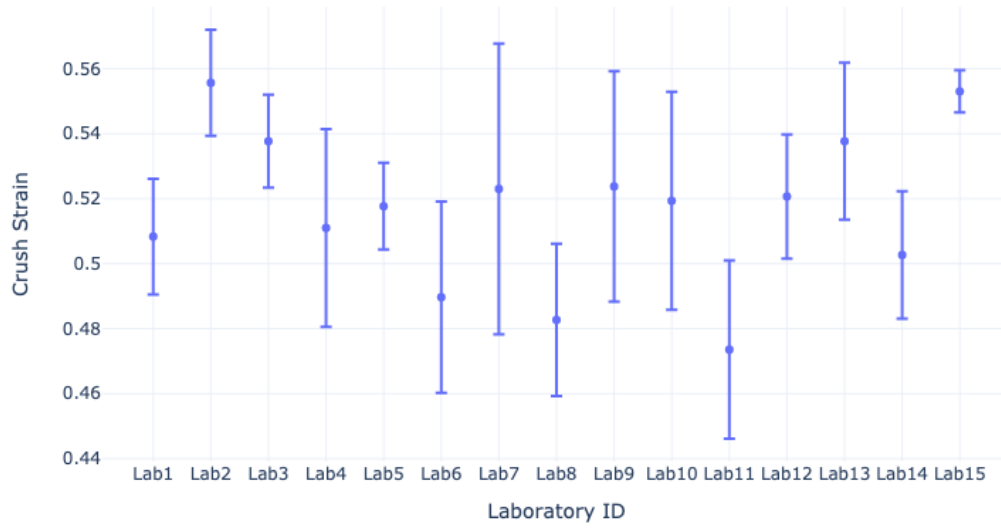
Crush Strength - Sample C - Day 3



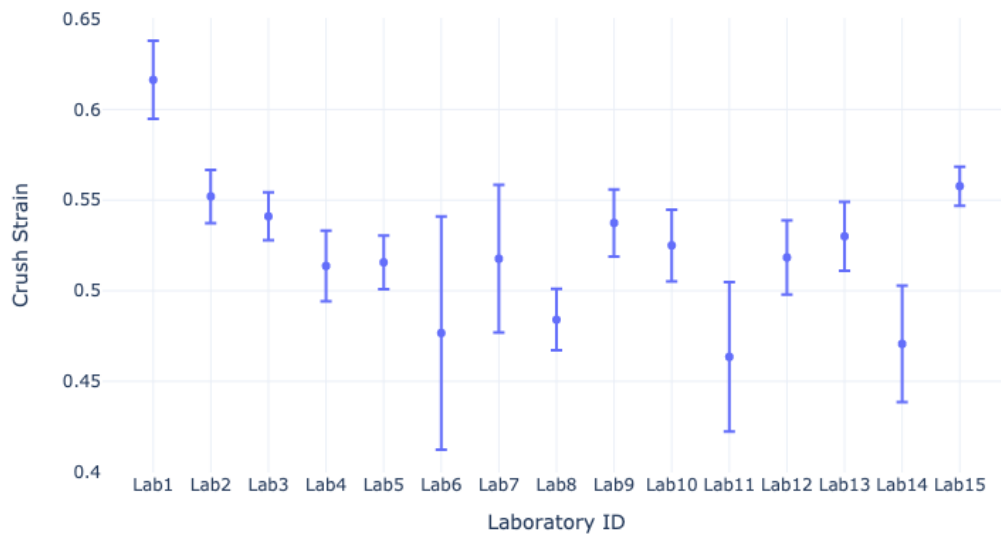
Crush Strain - Sample A - Day 1



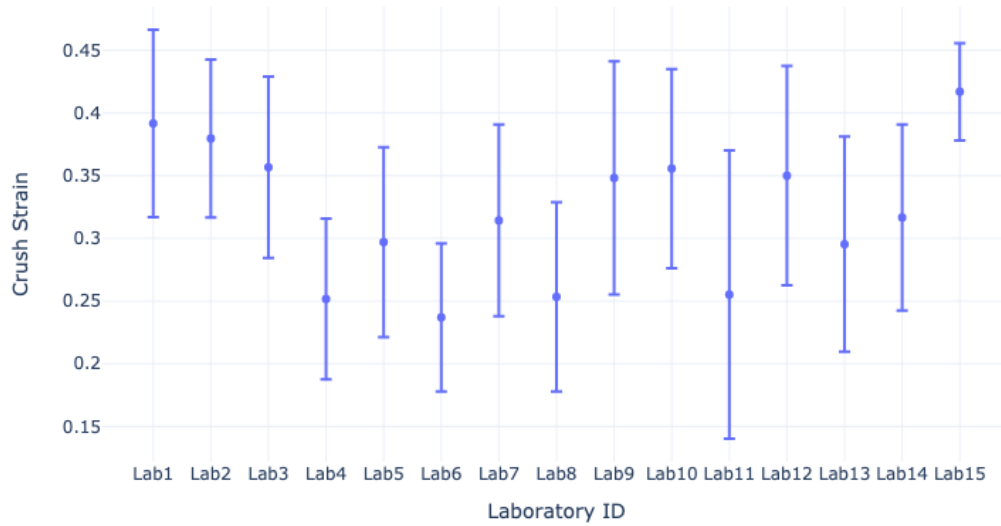
Crush Strain - Sample A - Day 2



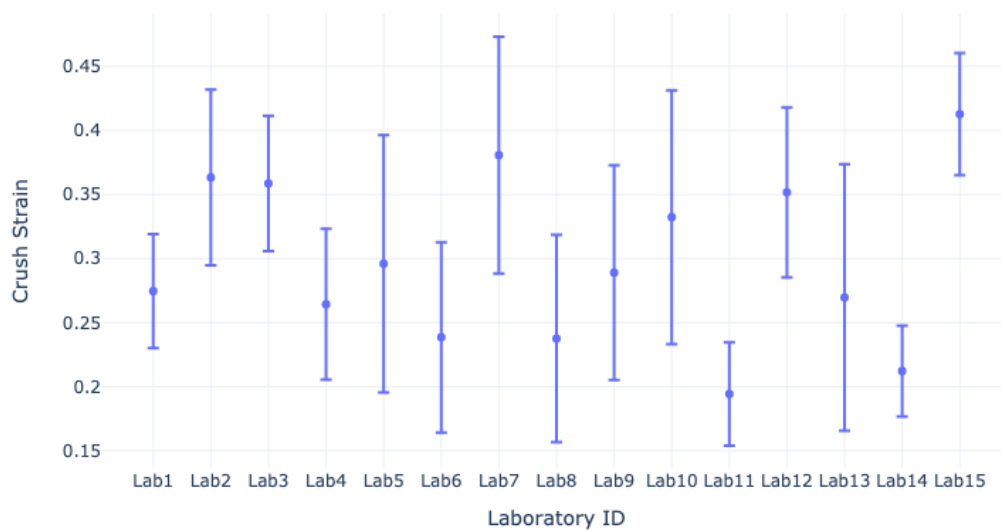
Crush Strain - Sample A - Day 3



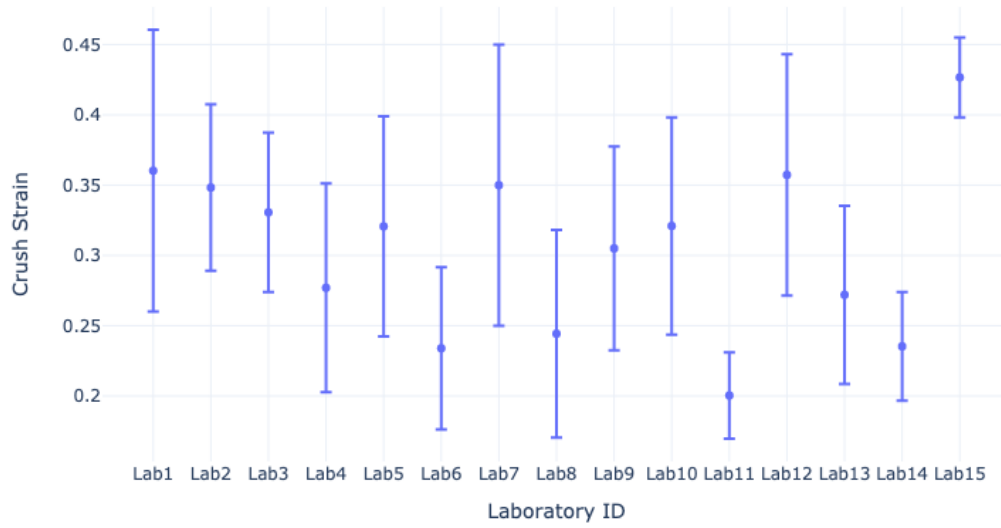
Crush Strain - Sample B - Day 1



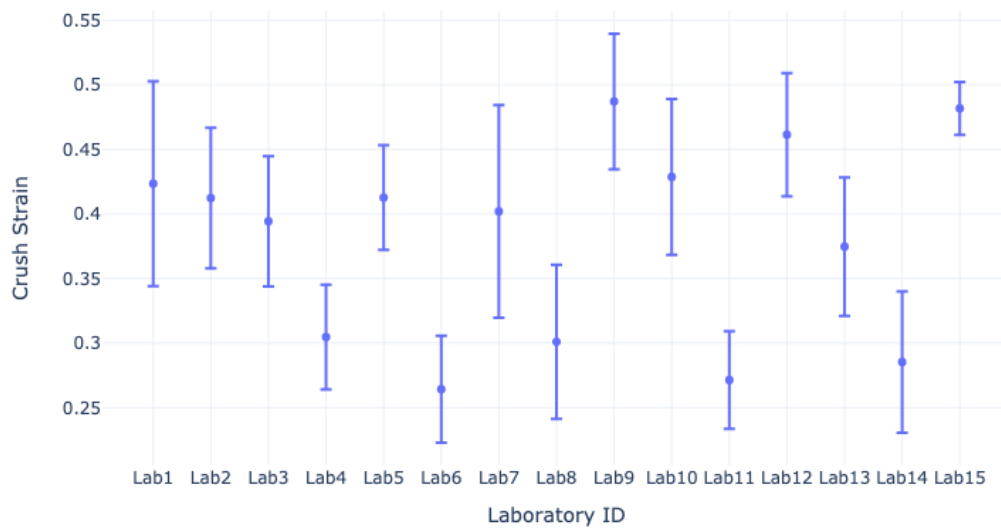
Crush Strain - Sample B - Day 2



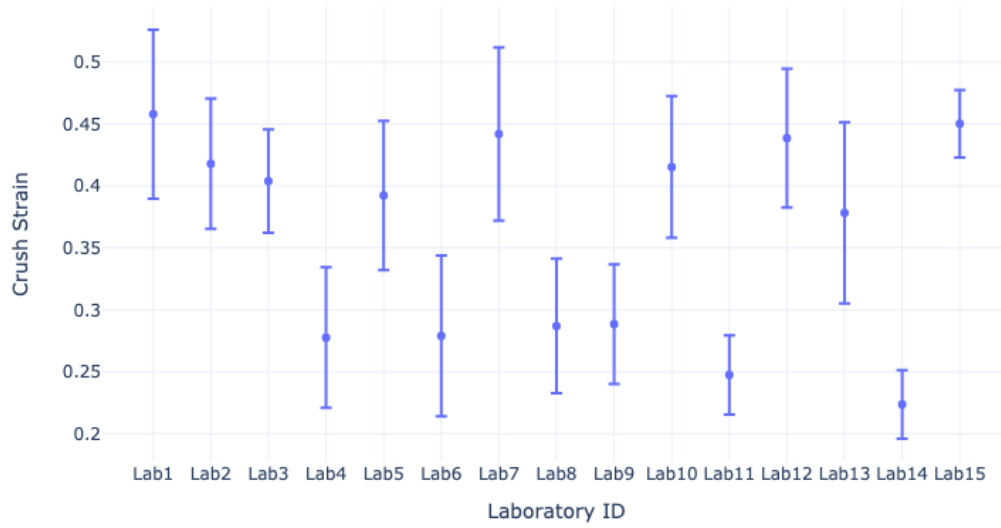
Crush Strain - Sample B - Day 3



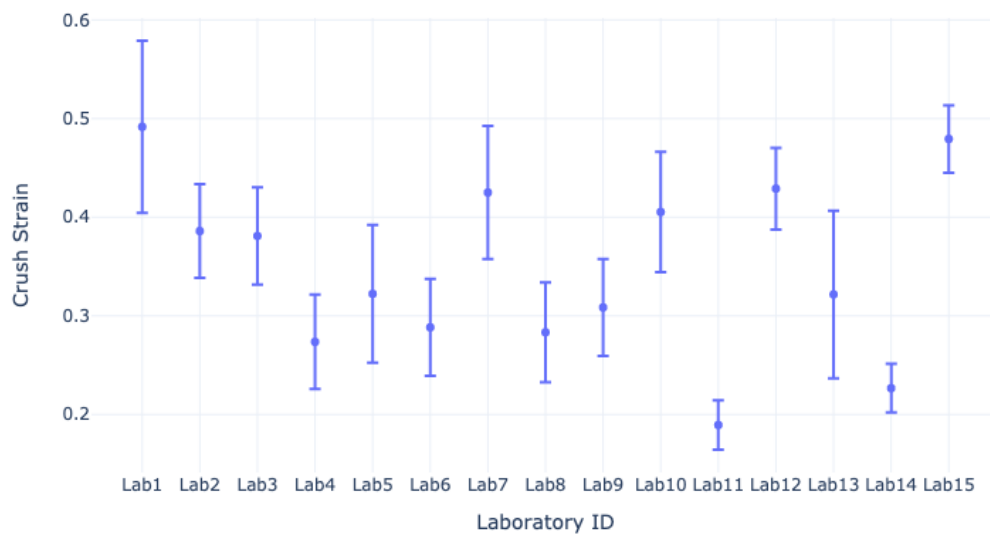
Crush Strain - Sample C - Day 1



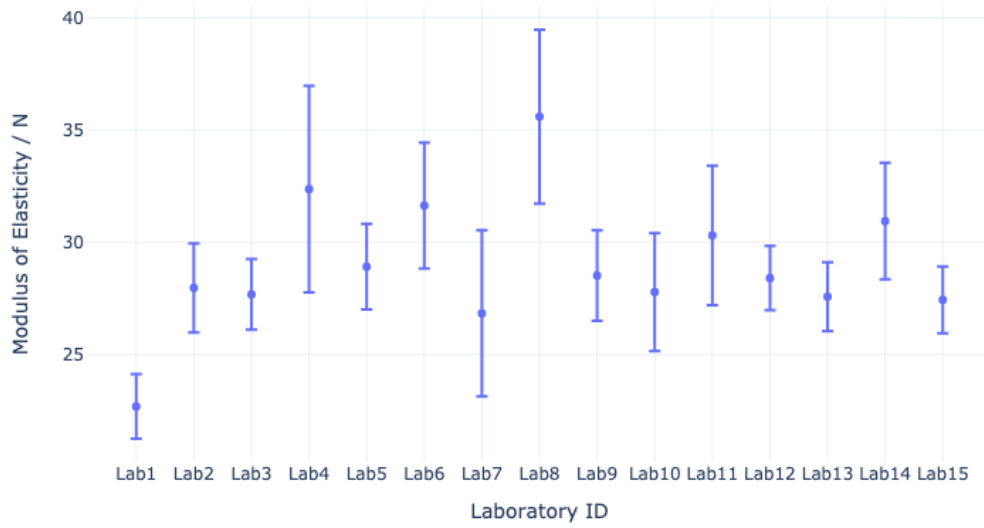
Crush Strain - Sample C - Day 2



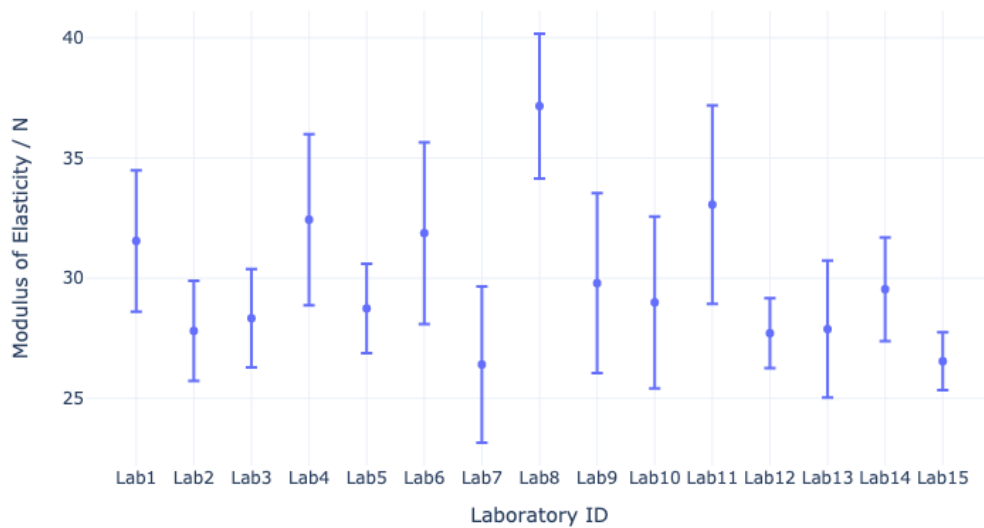
Crush Strain - Sample C - Day 3



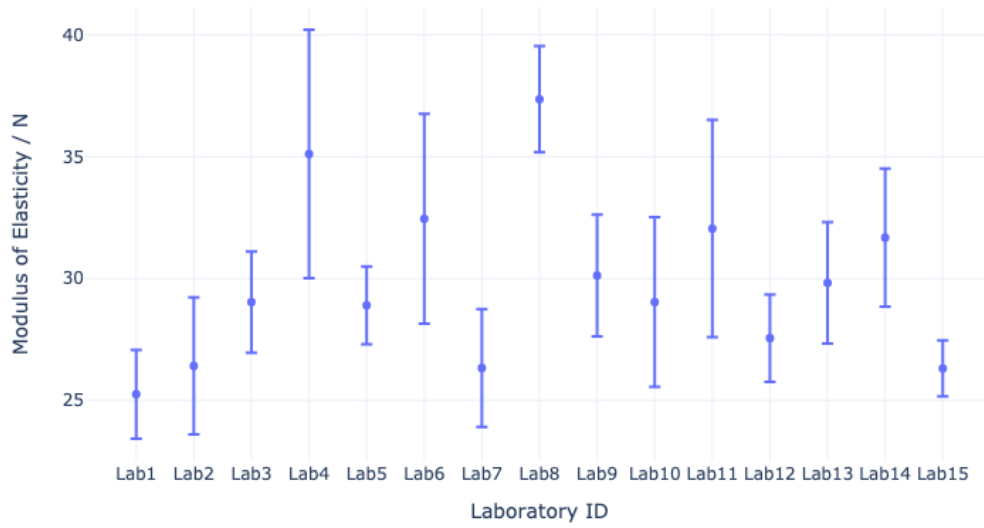
Modulus Of Elasticity - Sample A - Day 1



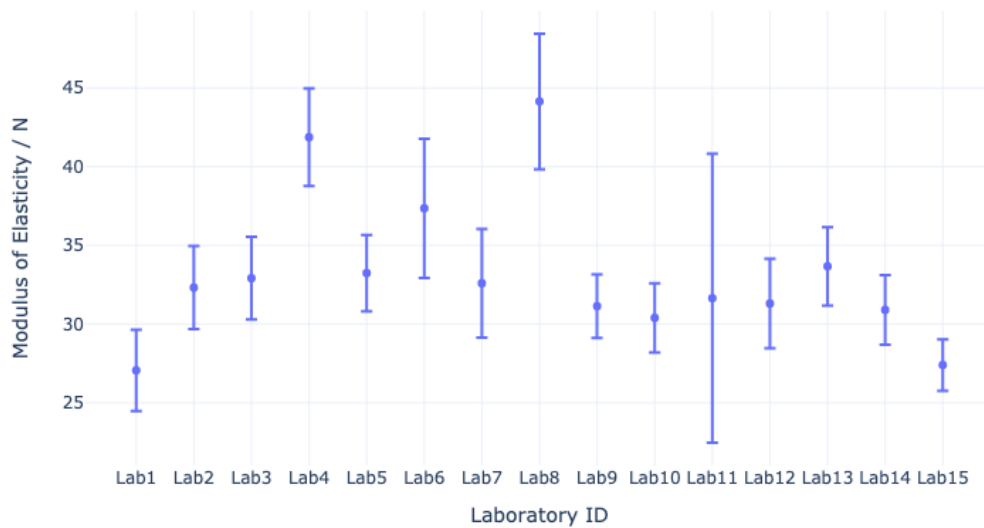
Modulus Of Elasticity - Sample A - Day 2



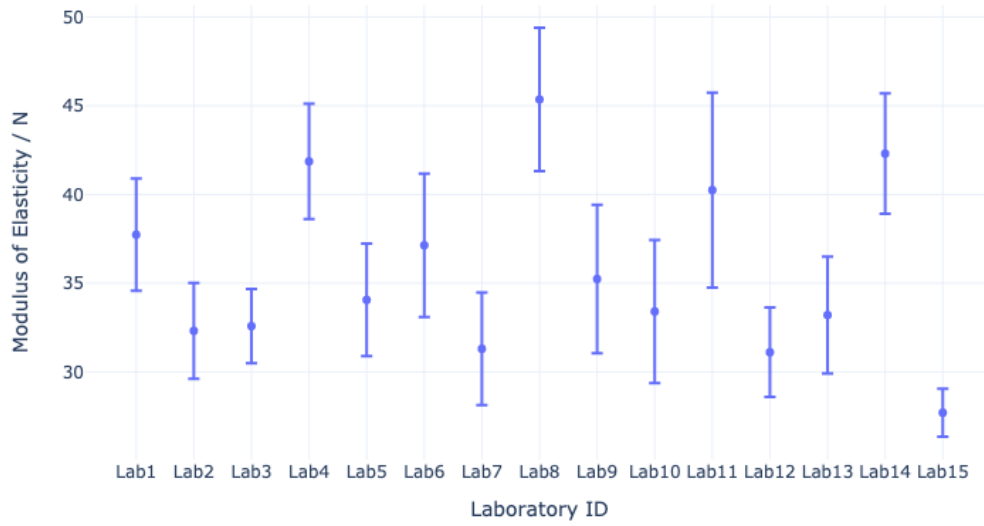
Modulus Of Elasticity - Sample A - Day 3



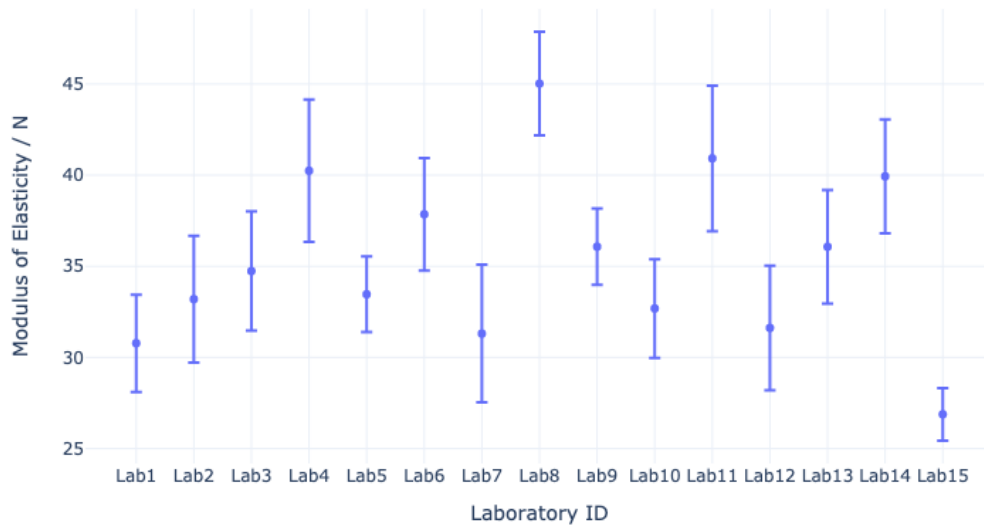
Modulus Of Elasticity - Sample B - Day 1



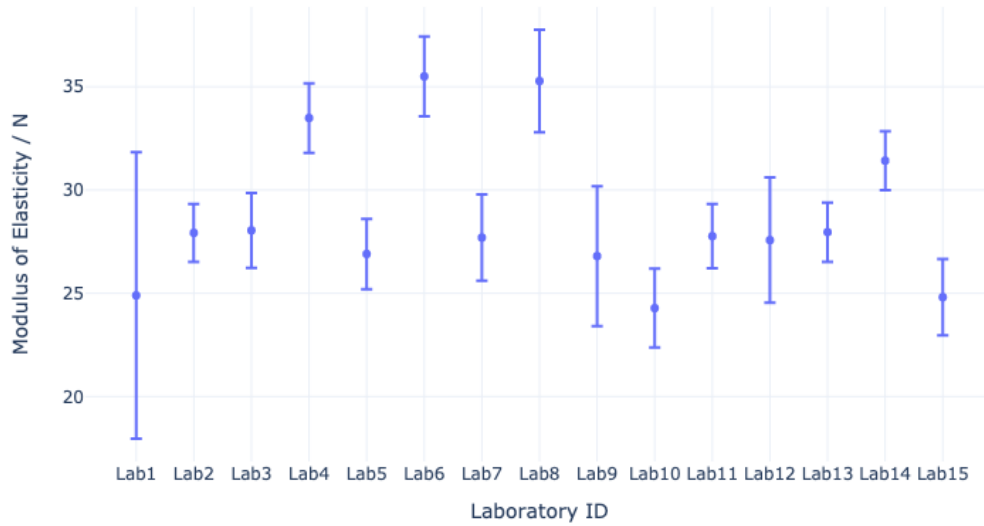
Modulus Of Elasticity - Sample B - Day 2



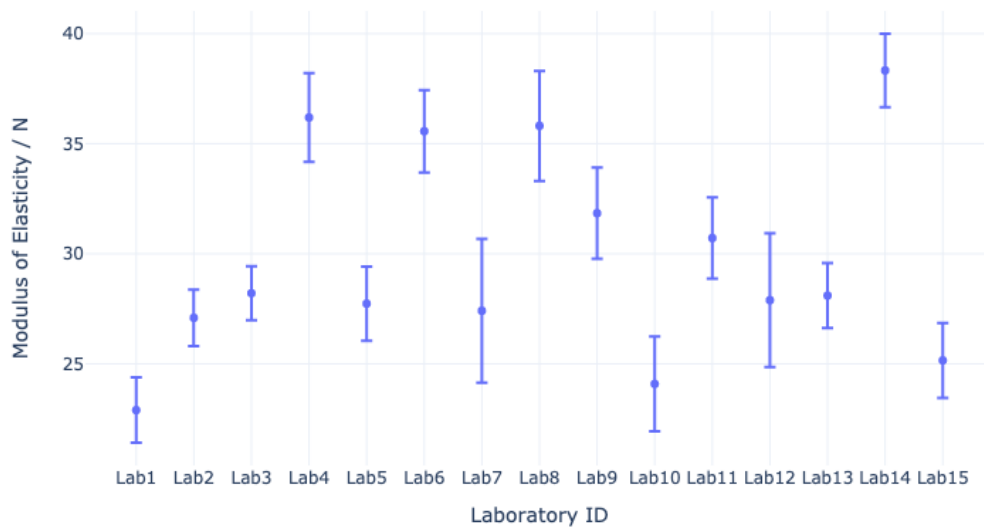
Modulus Of Elasticity - Sample B - Day 3



Modulus Of Elasticity - Sample C - Day 1



Modulus Of Elasticity - Sample C - Day 2



Modulus Of Elasticity - Sample C - Day 3

