



Department of Civil & Structural Engineering

Pennine Water Group

Food Waste Disposer Particle Characterisation

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Research by The University of Sheffield for InSinkErator

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Summary

InSinkEerator UK and The University of Sheffield have been collaborating since 2016 on a PhD project, which is jointly sponsored by the EPSRC funded STREAM Centre for Doctoral Training and InSinkEerator UK. The project has been investigating the potential impacts of the use of Food Waste Disposers on sewer networks and wastewater treatment plants. The project has developed new methods for estimating the risk of particles settling within a sewer network and also estimating the carbon load that can be transported via sewer networks to end of system wastewater treatment plants. Realisation of the full potential of these methods requires a robust database of the biochemical and physical characteristics of food particles produced by a food waste disposer for a range of common food types.

To assess the implications of added food waste particles at the wastewater treatment works it is important to understand the entire process from kitchen to treatment. Chemical oxygen demand (COD) measurements indicate the organic content of a particular food. Particle size distribution and settling velocity measurements indicate the transport times and mechanisms in a given flow. Biological oxygen demand (BOD) measurements indicate the rate of degradation of organic content during transport. Combining the initial COD with the degradation rate and the transport time, it is possible to calculate the remaining organic content reaching the WWTP.

The present consultancy project was designed to provide particle characteristic data for 10 foods that had been processed by a food waste disposer. The data was supplemented with the data of 8 foods that had already been collected as part of the PhD project, and with COD data also collected during the PhD. While the main output of the consultancy is the database found in the appendices, this report will describe the measurement techniques used, and will summarise the collected data. This data forms the basis of a tool that can be used to simulate the particle properties of a food mix representative of a particular region; this tool is available on request from a.nichols@sheffield.ac.uk or info@food-waste-disposer.org.uk.

The key findings were that most food particles are between 2mm and 4mm in size and the particle size distributions were unimodal (i.e. have a particle size distribution that has a single mode). The maximum settling velocity of FWD-derived particles is always less than 0.1m/s, except for egg shell particles, which showed maximum fall velocities up to 0.13m/s.

1 Introduction

Food Waste Disposers (FWDs) are commonly used in the USA (American housing survey for the United States, 2009) for disposing of food waste. The food waste is ground into particles that are subsequently released via the kitchen sink and then transported through the sewer network to a downstream wastewater treatment plant (WwTP). At plants where anaerobic digestion (AD) is available, the food waste particles can be digested and biogas can be recovered from the wastewater. This approach can also reduce the environmental impacts compared to traditional ways of handling food waste (Iacovidou et al., 2012), such as municipal solid waste collection and incineration/landfill, or separate collection of food waste for subsequent composting or AD (WRAP, 2013).

Comprehensive studies that define the circumstances in which FWDs are the ‘more sustainable’ option in managing food waste have not been conducted until the present PhD study at The University of Sheffield. The PhD study is collecting new scientific evidence as the current information published by two UK advisory bodies (CIWEM, 2016; Water UK, 2016) provides contradictory advice with regards to the potential increase in sewer blockage risk and the value of organic waste from FWDs.

The PhD project has developed a new method for quantifying the potential for food waste to contribute to energy recovery at wastewater treatment works, and the risk of particles settling within a sewer system. This method requires a robust database of food particle properties for a range of food types in order to characterise the behaviour of the food waste entering the sewer system in a given area. The PhD project has provided data for a range of food types. The present consultancy project was designed to provide additional fundamental data, making a complete ensemble consisting of:

- Apple ([pink lady, Tesco](#))
- Beef ([cooked slices, Tesco finest](#))
- Broccoli stem ([Tesco pre-packed](#))
- Cabbage ([sweetheart, Tesco](#))
- Carrot ([Tesco carrot batons](#))
- Celery ([Nightingale farms, Tesco](#))
- Cheese ([Cathedral city mature cheddar](#))
- Chicken carcass ([pre-cooked, meat removed, Tesco](#))
- Cornflakes ([Kelloggs, Tesco](#))
- Egg shell (Chicken eggs, various sources)
- Orange peel (Cambria Naval)
- Pasta ([Fresh penne, Tesco](#))
- Pineapple (Co-op, Costa Rica)
- Potato (Maris piper)
- Rice ([Tilda basmati pouch](#))
- Sunflower seeds ([Tesco](#))
- White bread ([Warburton's toastie](#))
- Whole mackerel (gutted, fishmonger)

The data forms the basis of a tool that can be used to simulate the particle properties of a food mix representative of a particular region; this tool is available on request from a.nichols@sheffield.ac.uk or info@food-waste-disposer.org.uk.

2 Methodology

The experimental work was undertaken in three parts – initial food processing, particle size characterisation and the particle settling velocity measurement. The equipment is shown in Figure 1. All parts of the testing took place on the same day for each food sample to ensure particles did not degrade between the different measurements. A detailed measurement protocol followed by the laboratory users can be found in Appendix A, and is summarised here. The entire process (from initial food processing to particle size and fall velocity measurement) was repeated three times for each food type to quantify variability and the data averaged to enhance accuracy.

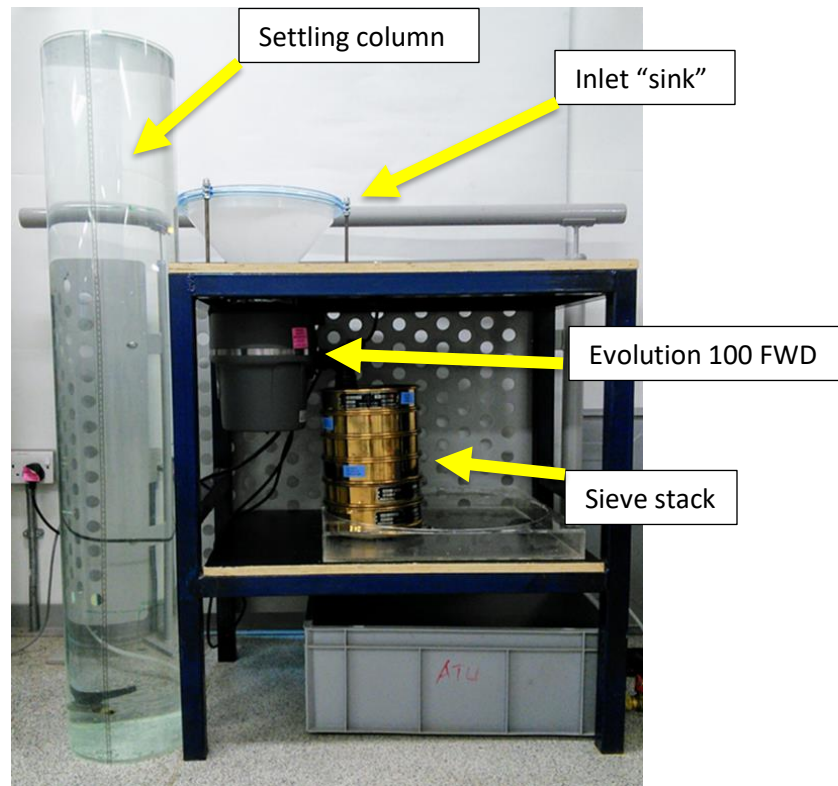


Figure 1: Laboratory equipment

2.1 Initial Food processing

The FWD used was an Evolution 100-1B (serial number 16093104329). The same FWD unit was used for all food types. Food samples were obtained from a commercial supermarket and stored according to the supplier instructions. Food was prepared by roughly cutting the food into pieces small enough to fit into the FWD unit (3-4 cm approximately). Foods were prepared in samples of around 500g, with the exact mass of each sample being recorded. Egg shells were mostly in a halved state (not crushed), and were rinsed before being introduced to the FWD.

The water supply to the FWD was turned on and supplied around 0.17 l/s. The entire 500g food sample was added into the FWD. The water supply was kept on until no visible particles could be seen exiting the disposer. This period lasted approximately 55 seconds for all tests.

The mixture of water and food particles exiting the disposer was collected in a clean and dry laboratory bucket. For scientific completeness and repeatability, a volume of 2 gallons (9.09 litres) was used each time to ensure the entirety of the particles were washed through the FWD, and immediately analysed according to section 2.2. In normal domestic use the water consumption of a FWD is much lower, estimated to average 1 litre per person per day (Diggelman & Ham, 2003), but this has not been conclusively or recently examined.

2.2 Particle Size Distribution Measurement

The purpose of this measurement is to determine the proportion of the sample mass that is converted into food particles within certain size fractions. To characterise the particle size distribution, a stack of sieves was used according to BS ISO 3310-1:2016 and BS ISO 3310-2:2013. The sieve sizes used ranged from 3ϕ to 4ϕ and were arranged in 0.5ϕ increments (where sieve size in mm is given by $2^{-\phi}$, and thus ranged from 0.06mm to 8.00mm). The water and particle mixture collected from the FWD was stirred to fully suspend the particles and tipped smoothly into the top of the sieve stack, ensuring all of the particles were emptied from the bucket by rinsing.

Beginning with the top sieve, a hose was used to gently wash the smaller particles through into the next sieve, without damaging the particles. This was repeated sieve by sieve, down the stack, spending at least 5 minutes on each sieve to ensure all particles smaller than the sieve size were washed through. Particles were agitated where necessary to allow the smaller particles to wash through the sieve rather than remaining trapped between the larger particles, but no particles were damaged in this process.

Once the particles had been separated on the sieves, the sieves had the excess water removed by firmly tapping them one-by-one repeatedly above a sink until no more excess water was being released. Each sieve (including the particles) was then weighed using a calibrated electronic balance, with a resolution of 0.1g.

Particles were then collected from the sieves to be used in the particle settling velocity measurements, and the sieves were thoroughly washed. The wet sieves were then tapped again to remove excess water, and were weighed (without particles). The wet sieve mass was subtracted from the wet sieve mass with particles to give the mass of wet particles collected in each sieve.

2.3 Particle Settling velocity

The maximum settling velocity of the food particles within each sieve size fraction for each food type was measured to determine the maximum likelihood of those particles settling within a sewer flow. To achieve this, food particles in each sieve were mixed to ensure uniformity, and 3 samples of food particles were taken from each sieve. Each sample was placed in the top of a 295mm wide, 1.293m tall settling column, where the water level was maintained at 1.275m. Settling time was recorded at regular 20cm intervals throughout the column to determine the point at which a stable terminal velocity was reached. For all foods, terminal velocity was reached by 27.5 to 38.5cm below the water level. Transit time was recorded between this start height and a height of 30.8cm (the lowest that was practicably measurable). The fastest falling particles within each size fraction were tracked for this measurement, as they represent a worst

case of the settling velocity, and the timings were always taken at eye level with the start and stop points to avoid parallax errors.

For each measurement, 2g of food was measured, and mixed with 15ml of water to form a suspension before being carefully tipped into the centre of the water surface, trying not to give the food particles any initial vertical velocity. The settling velocity of each size fraction for each food run was repeated 3 times to quantify variability and averaged to ensure accuracy. The maximum settling velocity reported was therefore an average of three separate measurements.

2.4 Data Processing

The resulting data set for each food type thus included:

1. Mass of Food going into the FWD (ff)
2. Mass of Sieve with Wet Food on (sf)
3. Mass of Wet Sieve with no Food Particles (se)
4. Mass of Wet Food leaving the FWD per sieve ($= sf - se$)
5. Total mass of Wet Food (wf)
6. Mass of Water ($= wf - ff$)
7. Visual Observations of Food leaving the FWD
8. Maximum Settling Velocity for Each Particle Size Fraction (sv)

3 Overall findings

The primary output of this work is the particle data found in the appendices. However, the main findings are summarised here. Figure 2 presents the particle size distribution and maximum particle settling velocity data for all 18 food types. The horizontal axis in all of the subplots corresponds to the square hole sizes of the sieves used. The vertical axis of the left-hand subplots is the amount of recovered food mass that was collected within each sieve, as a percentage of the total recovered food mass. This is a common way of presenting particle size distribution data, and shows that for all food types there is a dominant mode (the sieve that shows the largest proportion of the recovered food mass) with lower amount of mass at smaller and larger sizes. The vertical axis of the right-hand subplots is the maximum velocity of particle settling recorded for the food particles within each sieve size fraction. It indicates the size fractions that exhibit the largest settling velocities, as these may be seen as having a greater risk of settling in pipes. Note that for some size fractions the amount of sample recovered is either zero or so close to zero that settling velocity could not be measured.

The particle size distributions were generally unimodal (one peak) and demonstrated a wide range of particle sizes. The narrowest size distribution was for rice, which showed a much larger mode (most common size fraction), as the rice particles were already close to this modal size when entering the FWD. For each food the size distribution was measured three times. The standard deviation between the mass recorded in each repeat measurement was calculated for each size fraction of each food. Averaged across all sizes and food types this standard deviation was 2.7 percentage points (of the total sample mass). Averaged across each food type, the standard deviation was generally below 5 percentage points, except for white bread (5.2pp) and beef (8pp).

Maximum particle settling velocities for fruits and vegetables, meat/fish, pasta, and cheese were all below 0.1m/s. The clear outlier was egg shell which showed maximum settling velocities up to almost 0.13m/s. For some foods the settling velocity of particles within some sieves could not be measured as there was an extremely low quantity of particles at that size fraction. The standard deviation between repeated measurements of particle fall velocity was calculated for size fractions of each food. Averaged across all sizes and foods, the standard deviation of the particle fall velocity was 4mm/s. Generally the standard deviation of particle fall averaged across each food type was below 5mm/s, except for chicken carcass (7mm/s), white bread (9mm/s) and egg shell (11mm/s). This is likely due to the complex nature of chicken carcass (mixture of bone, sinew, flesh etc.), variability of white bread size fractions (mentioned previously) and the larger measurement error for egg shells, as their fall velocity was much higher than for other foods.

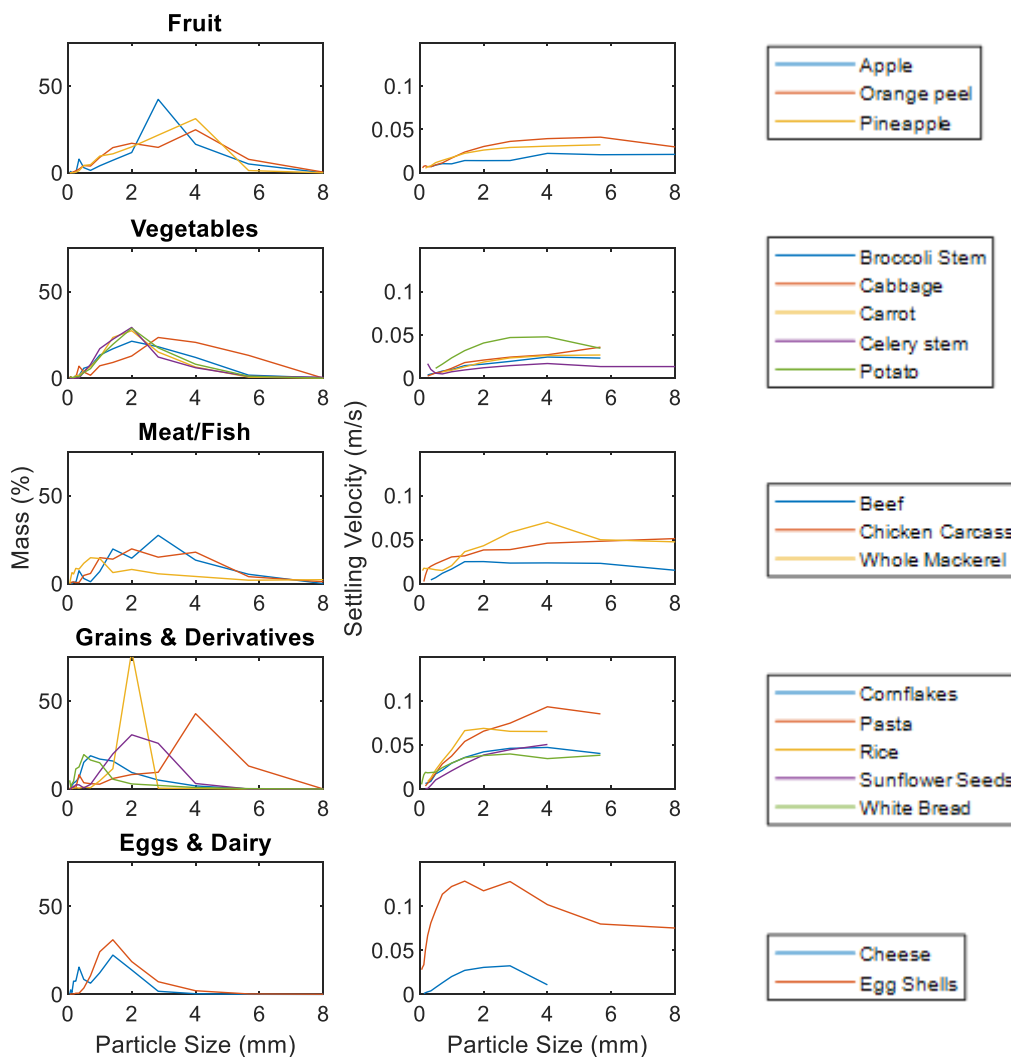


Figure 2: Food waste particle size distributions and settling velocity distributions

4 Chemical oxygen demand

Food waste inherently contains an amount organic content that would act as a load on a wastewater treatment works, but can also be a source of energy via anaerobic digestion. The chemical oxygen demand (COD) is a measure of the organic content being input into the sewer system (note that due to in-sewer degradation the amount reaching the WWTW is likely to be lower). There is some information available regarding the total COD of food waste mixes (Kim et al, 2015), but no data for individual foods that would enable quantification for any given mix. For the 18 foods listed in section 1, COD values have been collected. While the COD data was collected as part of the larger project and not this consultancy, the data is included here for completeness.

Each food sample was prepared according to manufacturer's instructions and a set amount was weighed (different foods require different amounts to stay within the limits of the test, and this was optimised experimentally). The sample was then added to 1L of tap water and blended for 1 minute using a standard kitchen hand blender. A 15ml sample was taken from the 1L blended solution and two further samples were created by performing two 50% serial dilutions.

The COD equipment used were Hach Lange LCI 400 units with a range of 0-1000mg/L O₂, which enables calculation of COD value based on light absorbance of the solution. The COD procedure was carried out according to the manufacturer's instructions, with 2ml of sample being added to each vial. A standard curve of known COD values was created using alpha-glucose so that absorbance measured for each food could be translated into a COD value. The COD values of the 18 foods are given in Table 1 (overleaf), alongside the calorific values stated on the packaging. There is a moderate correlation between the two sets of data.

Table 1: Chemical oxygen demand and calorific value of the 18 food types

Food	Calories (per 100g)	COD per gram of food (mg/g)
Apple	53	259
Beef	35	519
Bread	116	790
Broccoli	40	183
Cabbage	31	79
Carrot	43	139
Celery	10	63
Cheese	416	659
Chicken Breast	181	437
Cornflakes	383	1030
Mackerel	231	415
Orange Peel	97	343
Pasta	170	578
Pineapple Skin	3.5	118
Potato	79	231
Rice	143	179
Sunflower Seeds	625	1695

5 References

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Appendix A: Laboratory protocol

FOOD WASTE DISPOSER EXTENDED LAB PROTOCOL

Materials

- Food item(s)
- Food Waste Disposer (InSinkErator Evo 100)
- 200mm diameter sieve stack:

Phi scale	-3.0	-2.5	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
mm	8.00	5.66	4.00	2.83	2.00	1.41	1.00	0.71	0.50	0.35	0.25	0.18	0.13	0.09	0.06

(“Endecotts” and “Controls” Sieves manufactured to BS410/1986 and operated to BS ISO 3310-1:2016 and BS ISO 3310-2:2013)

- Settling Column (290mm internal diameter, clear plastic)
- Weighing scales (KERN FCB 8k0.1, accurate to 0.1g)
- Timer (ATP stopwatch accurate to 0.01s)

Method

This whole experiment (parts A & B) must be completed on the same day as the samples will degrade over time (it is not possible to store the sample) and this will change how they perform.

(A) Particle Size Distribution

1. Prepare your food sample. If your food is to be cooked, ensure that the item is cooked according to the recommendations on the packet. The food should fit easily into the unit and the food should not be excessively processed. 3-4 cm pieces is ideal.
As an example, if you have chicken breast, do not shred the meat and do not chop it up into tiny pieces e.g. that are similar sizes to rice, just do the minimum chopping to ensure that it will go into the FWD unit easily. Similarly, if you have cooked rice as your food, as it is small enough to go straight into the FWD, it will not need chopping up.
2. To generate the ground up sample, carefully measure approximately 500g of your food. With food that is difficult to get exactly 500g, get as close to 500g as possible. For every sample generated ensure that the original mass is recorded.

Note: the sample will be collected in a bucket to be taken to the sieve stack

3. Turn on the water to the FWD at approximately 0.17l/s, and immediately put the whole 500g food sample into the FWD. Do not turn off the tap until you cannot visibly see any food particles leaving the disposer.
4. Add the particles to the sieve stack

5. The particles should be thoroughly rinsed through each sieve.
There should be no particles still being washed through the top sieve for around 5 minutes before taking the top sieve off the stack and moving onto sieving the next sieve. This is the most important step of the experiment so it is absolutely necessary to rinse the particles through the sieves correctly.
It is acceptable to agitate the sample to allow the smaller particles to wash through the sieve rather than remain trapped between the larger particles. Do not use high pressure water and do not push particles through the sieve with fingers/ hose pipe/ brush.
This step should take 1-2 hours, depending on the food type. If you have a particularly slow-sieving food it may take longer.
6. Once the particles have been separated on the sieves, the sieves must have the excess water removed by firmly tapping the sieves on the wet-room floor/ sink until the sieves stop leaving water once being tapped and have little to no water particles falling onto the surface. The sieve should then be weighed on the balance with the particles on it.

The sieves, once the samples have been collected from each sieve, should then have the remaining particles washed off and the above step repeated; the sieves should be tapped on a flat surface till they're not dripping or shedding water when being tapped and then weighed.

(B) Settling Velocity

7. Samples of food particles should be taken from each sieve. This should be either the whole sample or as much sample as necessary to do the next part of the experiment (i.e. 2g per run on the settling column). It is useful to create a matrix of all the sieves (and thus all the different fractions collected) and how many repeats (recommend 3 repeats per sieve per run) you would like to do before starting so you don't miss anything out.

If the column you are using has not been used for this test before, you should do a few preliminary tests which track (timing) the particles along a number of intervals along the column to determine where terminal velocity is reached. You should start timing the rest of the experiment after the point on the column that particles have reached terminal velocity. Mark the column where you want to start timing from and also where you will stop timing. The second should be the greatest distance below the first point that you can time on the column. All measurements should be taken at eye level from a set distance. This may mean you crouching on the floor to ensure you are at eye level on the lowest point on the column. You should also mark a fill line on the column so that the water level can be maintained.

8. Weigh out 2g of sample
9. Suspend the sample in 15ml of water
10. Swill the sample in the water to ensure it remains suspended immediately prior to adding it to the column

11. Add the sample to the column. This must be as close to the centre of the column and as close to the meniscus of the water as possible. Do not disturb the meniscus of the water
12. Time the leading (fastest) particles as they travel between the two points
13. Ensure that the water level is maintained on the column

Data Processing

The resulting data set for each food type thus included:

9. Mass of Food going into the FWD (ff)
10. Mass of Sieve with Wet Food on (sf)
11. Mass of Wet Sieve with no Food Particles (se)
12. Mass of Wet Food leaving the FWD per sieve ($= sf - se$)
13. Total mass of Wet Food (wf)
14. Mass of Water ($= wf - ff$)
15. Visual Observations of Food leaving the FWD
16. Maximum Settling Velocity for Each Particle Size Fraction (sv)

Appendix B: Particle size and settling velocity data

Data for all 18 food types is presented in this appendix. Note that for 6 food types (broccoli, carrot, chicken carcass, egg shell, potato, sunflower seeds), sieve sizes of 1.5, 2.5 and 3.5 phi were omitted due to unavailability. However, there is very little sample in this range, and data was scaled accordingly such that the effect on results is negligible. This data forms the basis of a tool that can be used to simulate the particle properties of a food mix representative of a particular region; this tool is available on request from a.nichols@sheffield.ac.uk or info@food-waste-disposer.org.uk.

Food Type Apple Specific brand/ type [Apple \(pink lady, Tesco\)](#)

Particle Size				Total Sample Size (g)														
				300	300.1	300												
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	427.3	427.3	427.3									0.0	0.0	0.0	0.0	0.0	0.0	100.0
-2.5	450.0	450.0	450.0	482.8	479.8	478.4	32.8	29.8	28.4	30.3	2.2	10.9	9.9	9.5	10.1	0.7	5.1	94.9
-2	451.4	451.4	451.4	532.3	516.6	601.5	80.9	65.2	150.1	98.7	45.2	27.0	21.7	50.0	32.9	15.1	16.5	78.5
-1.5	441.3	441.3	441.3	738.0	690.2	658.2	296.7	248.9	216.9	254.2	40.2	98.9	82.9	72.3	84.7	13.4	42.4	36.1
-1	420.7	420.7	420.7	463.7	508.6	500.1	43.0	87.9	79.4	70.1	23.9	14.3	29.3	26.5	23.4	7.9	11.7	24.4
-0.5	538.0	538.0	538.0	573.6	585.1	585.1	35.6	47.1	47.1	43.3	6.6	11.9	15.7	15.7	14.4	2.2	7.2	17.2
0	408.7	408.7	408.7	430.7	436.3	431.5	22.0	27.6	22.8	24.1	3.0	7.3	9.2	7.6	8.0	1.0	4.0	13.2
0.5	362.4	362.4	362.4	369.5	371.0	371.0	7.1	8.6	8.6	8.1	0.9	2.4	2.9	2.9	2.7	0.3	1.3	11.9
1	338.1	338.1	338.1	350.1	355.9	361.1	12.0	17.8	23.0	17.6	5.5	4.0	5.9	7.7	5.9	1.8	2.9	8.9
1.5	292.6	292.6	292.6	339.6	339.7	340.6	47.0	47.1	48.0	47.4	0.6	15.7	15.7	16.0	15.8	0.2	7.9	1.0
2	328.4	328.4	328.4	326.7	326.0	330.4	-1.7	-2.4	2.0	-0.7	2.4	-0.6	-0.8	0.7	-0.2	0.8	-0.1	1.2
2.5	413.8	413.8	413.8	416.6	416.6	415.1	2.8	2.8	1.3	2.3	0.9	0.9	0.9	0.4	0.8	0.3	0.4	0.8
3	424.2	424.2	424.2	422.9	422.5	424.8	-1.3	-1.7	0.6	-0.8	1.2	-0.4	-0.6	0.2	-0.3	0.4	-0.1	0.9
3.5	264.5	264.5	264.5	265.9	269.5	272.1	1.4	5.0	7.6	4.7	3.1	0.5	1.7	2.5	1.6	1.0	0.8	0.1
4	298.0	298.0	298.0	297.3	297.2	301.8	-0.7	-0.8	3.8	0.8	2.6	-0.2	-0.3	1.3	0.3	0.9	0.1	0.0

Settling velocity		Fall Distance (m):		0.6							
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)			
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Average	Average	
-3	29.45	30.41	23.09	0.0204	0.0197	0.0260	0.0220	0.0034	0.0212		
-2.5	29.21	27.96	27.22	0.0205	0.0215	0.0220	0.0213	0.0008	0.0208		
-2	29.94	32.07	22.15	0.0200	0.0187	0.0271	0.0219	0.0045	0.0224		
-1.5	35.16	36.78	42.41	0.0171	0.0163	0.0141	0.0158	0.0015	0.0141		
-1	41.91	44.22	45.03	0.0143	0.0136	0.0133	0.0137	0.0005	0.0140		
-0.5	35.94	39.84	47.61	0.0167	0.0151	0.0126	0.0148	0.0021	0.0141		
0	58.28	43.74	68.09	0.0103	0.0137	0.0088	0.0109	0.0025	0.0103		
0.5	78.27	90.48	76.73	0.0077	0.0066	0.0078	0.0074	0.0006	0.0105		
1	118.59	40.03	83.37	0.0051	0.0150	0.0072	0.0091	0.0052	0.0088		
1.5	87.81	85.65	84.43	0.0068	0.0070	0.0071	0.0070	0.0001	0.0070		
2											
2.5											
3											
3.5											
4											

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	24.15	26.64	29.5	0.0248	0.0225	0.0203	0.0226	0.0023
-2.5	28.88	27.62	32.53	0.0208	0.0217	0.0184	0.0203	0.0017
-2	34.75	21.06	27.68	0.0173	0.0285	0.0217	0.0225	0.0057
-1.5	63.53	34.63	38.06	0.0094	0.0173	0.0158	0.0142	0.0042
-1	42.15	41.37	56.22	0.0142	0.0145	0.0107	0.0131	0.0021
-0.5	43.12	36.8	44.56	0.0139	0.0163	0.0135	0.0146	0.0015
0	47.11	44.63	65.61	0.0127	0.0134	0.0091	0.0118	0.0023
0.5	56.68	43.24	54.03	0.0106	0.0139	0.0111	0.0119	0.0018
1	52.59	62.4	63.64	0.0114	0.0096	0.0094	0.0102	0.0011
1.5								
2								
2.5								
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	27.74	37.68	31.52	0.0216	0.0159	0.0190	0.0189	0.0029
-2.5	28.41	29.38	28.63	0.0211	0.0204	0.0210	0.0208	0.0004
-2	22.85	34.82	24.19	0.0263	0.0172	0.0248	0.0228	0.0048
-1.5	45.91	128.62	31.22	0.0131	0.0047	0.0192	0.0123	0.0073
-1	42	36.25	40.72	0.0143	0.0166	0.0147	0.0152	0.0012
-0.5	38.24	48.02	55.49	0.0157	0.0125	0.0108	0.0130	0.0025
0	69.12	57.2	110.12	0.0087	0.0105	0.0054	0.0082	0.0026
0.5	64.94	80	30.47	0.0092	0.0075	0.0197	0.0121	0.0066
1	62.75	133.32	83.88	0.0096	0.0045	0.0072	0.0071	0.0025
1.5								
2								
2.5								
3								
3.5								
4								

Food Type Beef Specific brand/ type [Beef \(cooked slices, Tesco finest\)](#)

Particle Size				Total Sample Size (g)														
				300	300.1	300												
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	427.3	427.3	427.3														0.0	100.0
-2.5	450.0	450.0	450.0	461.3	518.6	514.0	11.3	68.6	64.0	48.0	31.8	3.8	22.9	21.3	16.0	10.6	5.3	94.7
-2	451.4	451.4	451.4	483.7	611.2	622.0	32.3	159.8	170.6	120.9	76.9	10.8	53.2	56.9	40.3	25.6	13.3	81.4
-1.5	441.3	441.3	441.3	778.7	715.8	576.1	337.4	274.5	134.8	248.9	103.7	112.5	91.5	44.9	83.0	34.6	27.4	54.0
-1	420.7	420.7	420.7	520.2	563.7	571.1	99.5	143.0	150.4	131.0	27.5	33.2	47.7	50.1	43.7	9.2	14.4	39.5
-0.5	538.0	538.0	538.0	764.0	696.7	688.4	226.0	158.7	150.4	178.4	41.5	75.3	52.9	50.1	59.4	13.8	19.7	19.9
0	408.7	408.7	408.7	498.7	458.4	455.9	90.0	49.7	47.2	62.3	24.0	30.0	16.6	15.7	20.8	8.0	6.9	13.0
0.5	362.4	362.4	362.4	360.6	361.4	393.1	-1.8	-1.0	30.7	9.3	18.5	-0.6	-0.3	10.2	3.1	6.2	1.0	12.0
1	338.1	338.1	338.1	389.1	354.9	349.1	51.0	16.8	11.0	26.3	21.6	17.0	5.6	3.7	8.8	7.2	2.9	9.1
1.5	292.6	292.6	292.6	351.5	365.7	360.3	58.9	73.1	67.7	66.6	7.2	19.6	24.4	22.6	22.2	2.4	7.3	1.8
2	328.4	328.4	328.4	332.8	337.5	331.4	4.4	9.1	3.0	5.5	3.2	1.5	3.0	1.0	1.8	1.1	0.6	1.1
2.5	413.8	413.8	413.8	422.5	421.4	421.9	8.7	7.6	8.1	8.1	0.6	2.9	2.5	2.7	2.7	0.2	0.9	0.2
3	424.2	424.2	424.2	422.2	425.2	425.2	-2.0	1.0	1.0	0.0	1.7	-0.7	0.3	0.3	0.0	0.6	0.0	0.2
3.5	264.5	264.5	264.5	267.4	267.7	266.4	2.9	3.2	1.9	2.7	0.7	1.0	1.1	0.6	0.9	0.2	0.3	0.0
4	298.0	298.0	298.0	296.7	298.0	298.1	-1.3	0.0	0.1	-0.4	0.8	-0.4	0.0	0.0	-0.1	0.3	0.0	0.0

Settling velocity		Fall Distance (m): 0.6								
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	Average	Average
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3				
-3	28.47	45.22	36.34	0.0211	0.0133	0.0165	0.0170	0.0039		0.0151
-2.5	31.75	20.55	27.56	0.0189	0.0292	0.0218	0.0233	0.0053		0.0230
-2	27.78	24.62	21.6	0.0216	0.0244	0.0278	0.0246	0.0031		0.0235
-1.5	21.81	24.5	19.87	0.0275	0.0245	0.0302	0.0274	0.0029		0.0233
-1	39.19	31.49	18.97	0.0153	0.0191	0.0316	0.0220	0.0085		0.0250
-0.5	22	12.66	26.68	0.0273	0.0474	0.0225	0.0324	0.0132		0.0249
0	37.88	35.93	33.84	0.0158	0.0167	0.0177	0.0168	0.0009		0.0165
0.5	40.09	42.65	28.44	0.0150	0.0141	0.0211	0.0167	0.0038		0.0117
1	92	92.68	151.32	0.0065	0.0065	0.0040	0.0057	0.0015		0.0068
1.5	160.27	155.35	218.34	0.0037	0.0039	0.0027	0.0035	0.0006		0.0042
2										
2.5										
3										
3.5										
4										

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	27.09	44.15	47.38	0.0221	0.0136	0.0127	0.0161	0.0052
-2.5	27.96	14.53	26.72	0.0215	0.0413	0.0225	0.0284	0.0112
-2	31.6	19.53	24.68	0.0190	0.0307	0.0243	0.0247	0.0059
-1.5	36.59	32.94	25.5	0.0164	0.0182	0.0235	0.0194	0.0037
-1	14.07	22.34	55.56	0.0426	0.0269	0.0108	0.0268	0.0159
-0.5	29.38	25.5	23.94	0.0204	0.0235	0.0251	0.0230	0.0024
0	32.5	39.84	43.15	0.0185	0.0151	0.0139	0.0158	0.0024
0.5	67.31	71.03	48.01	0.0089	0.0084	0.0125	0.0100	0.0022
1	82.31	47.86	120.47	0.0073	0.0125	0.0050	0.0083	0.0039
1.5	232.57	163.35	108.15	0.0026	0.0037	0.0055	0.0039	0.0015
2								
2.5								
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	47.06	59.78	43.57	0.0127	0.0100	0.0138	0.0122	0.0019
-2.5	27.97	32.5	51.32	0.0215	0.0185	0.0117	0.0172	0.0050
-2	27.03	24.19	35.72	0.0222	0.0248	0.0168	0.0213	0.0041
-1.5	44.25	19.69	23.97	0.0136	0.0305	0.0250	0.0230	0.0086
-1	15.94	30.68	28.41	0.0376	0.0196	0.0211	0.0261	0.0100
-0.5	29.5	24.16	46.44	0.0203	0.0248	0.0129	0.0194	0.0060
0	35.1	39	33.22	0.0171	0.0154	0.0181	0.0168	0.0014
0.5	100.22	51.65	75.12	0.0060	0.0116	0.0080	0.0085	0.0029
1	112.03	78.53	92.22	0.0054	0.0076	0.0065	0.0065	0.0011
1.5	65.49	260.57	143.91	0.0092	0.0023	0.0042	0.0052	0.0035
2								
2.5								
3								
3.5								
4								

Food Type Broccoli stem Specific brand/ type [Broccoli stem \(Tesco pre-packed\)](#)

Particle Size		Total Sample Size (g)																				
		499.9	500.6	500.1																		
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	Std (g)	% of original mass			Av %	SD %	% of collected mass	% smaller than	ted for missing s	% smaller than		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3					%			
-3	430.1	429.7	427.8	432.7	430.2	428.5	2.6	0.5	0.7	1.3	1.2	0.5	0.1	0.1	0.3	0.2	0.19	99.81	0.2	99.8		
-2.5	449.8	449.5	447.3	461.7	460.2	459.9	11.9	10.7	12.6	11.7	1.0	2.4	2.1	2.5	2.3	0.2	1.75	98.06	1.8	98.1		
-2	453.2	450.8	451.3	531.0	530.7	534.1	77.8	79.9	82.8	80.2	2.5	15.6	16.0	16.6	16.0	0.5	11.97	86.09	12.0	86.1		
-1.5	442.0	440.7	439.5	600.8	548.0	537.6	158.8	107.3	98.1	121.4	32.7	31.8	21.4	19.6	24.3	6.6	18.12	67.97	18.1	68.0		
-1	421.1	417.4	416.7	561.9	560.8	561.2	140.8	143.4	144.5	142.9	1.9	28.2	28.6	28.9	28.6	0.4	21.33	46.64	21.3	46.6		
-0.5	527.9	522.9	527.3	638.0	639.5	641.1	110.1	116.6	113.8	113.5	3.3	22.0	23.3	22.8	22.7	0.6	16.94	29.70	16.9	29.7		
0	387.5	381.2	383.5	476.1	468.7	475.3	88.6	87.5	91.8	89.3	2.2	17.7	17.5	18.4	17.9	0.5	13.33	16.37	13.3	16.4		
0.5	359.2	360.9	357.2	413.7	397.7	405.2	54.5	36.8	48.0	46.4	9.0	10.9	7.4	9.6	9.3	1.8	6.93	9.44	6.9	9.4		
1	337.0	337.3	337.9	379.2	375.4	372.9	42.2	38.1	35.0	38.4	3.6	8.4	7.6	7.0	7.7	0.7	5.74	3.71	5.7	3.7		
1.5																		3.71	1.5	2.2		
2	324.0	324.6	325.3	349.6	343.5	342.7	25.6	18.9	17.4	20.6	4.4	5.1	3.8	3.5	4.1	0.9	3.08	0.63	1.5	0.6		
2.5																		0.63	0.3	0.4		
3			419.3			422.8			3.5	3.5				0.7	0.7		0.52	0.10	0.3	0.1		
3.5																		0.10	0.1	0.1		
4			296.9			297.6			0.7	0.7				0.1	0.1		0.10	0.00	0.1	0.0		

Settling velocity	Fall Distance (m):	0.71
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Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	40.3	27.1	31.2	0.0176	0.0262	0.0228	0.0222	0.0043
-2	25.7	28.4	30.8	0.0276	0.0250	0.0231	0.0252	0.0023
-1.5	36.3	41.8	37	0.0196	0.0170	0.0192	0.0186	0.0014
-1	43.7	49.7	45.5	0.0162	0.0143	0.0156	0.0154	0.0010
-0.5	43.8	49.6	42.5	0.0162	0.0143	0.0167	0.0157	0.0013
0	83.4	73.8	74.2	0.0085	0.0096	0.0096	0.0092	0.0006
0.5	93.3	88.4	85.2	0.0076	0.0080	0.0083	0.0080	0.0004
1	105.9	92.6	107.1	0.0067	0.0077	0.0066	0.0070	0.0006
1.5								
2	185.3	235.2	144.2	0.0038	0.0030	0.0049	0.0039	0.0010
2.5								
3								
3.5								
4								

Average
0.0232
0.0244
0.0194
0.0162
0.0145
0.0099
0.0082
0.0059
0.0037

Average gaps filled
0.0232
0.0244
0.0194
0.0162
0.0145
0.0099
0.0082
0.0059
0.0048
0.0037

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	29.3	31.6	30.4	0.024	0.022	0.023	0.023	0.001
-2	30.1	29.9	28	0.024	0.024	0.025	0.024	0.001
-1.5	39	37.9	29.4	0.018	0.019	0.024	0.020	0.003
-1	45.6	45.8	37.1	0.016	0.016	0.019	0.017	0.002
-0.5	64.2	55.4	49.2	0.011	0.013	0.014	0.013	0.002
0	78	77.5	88.2	0.009	0.009	0.008	0.009	0.001
0.5	86.2	84.7	93.1	0.008	0.008	0.008	0.008	0.000
1	123.5	144.8	175.6	0.006	0.005	0.004	0.005	0.001
1.5								
2	152.5	248.2	236.6	0.005	0.003	0.003	0.004	0.001
2.5								
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	21.4	35.9	36.3	0.033	0.020	0.020	0.024	0.008
-2	30.1	29	30.1	0.024	0.024	0.024	0.024	0.001
-1.5	37.3	42.4	31.8	0.019	0.017	0.022	0.019	0.003
-1	43.1	40.6	45.1	0.016	0.017	0.016	0.017	0.001
-0.5	45.1	46.5	51.1	0.016	0.015	0.014	0.015	0.001
0	66.1	50.7	69.1	0.011	0.014	0.010	0.012	0.002
0.5	93.3	72	87.9	0.008	0.010	0.008	0.009	0.001
1	132.2	115.8	128.7	0.005	0.006	0.006	0.006	0.000
1.5								
2	254.8	148	191.1	0.003	0.005	0.004	0.004	0.001
2.5								
3								
3.5								
4								

Food Type Cabbage Specific brand/ type [Cabbage \(sweetheart, Tesco\)](#)

Particle Size				Total Sample Size (g)														
				300	300.1	300												
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	427.3	427.3	427.3									0.0	0.0	0.0	0.0	0.0	0.0	100.0
-2.5	450.0	450.0	450.0	554.4	580.0	504.9	104.4	130.0	54.9	96.4	38.2	34.8	43.3	18.3	32.1	12.7	13.2	86.8
-2	451.4	451.4	451.4	586.0	590.3	632.5	134.6	138.9	181.1	151.5	25.7	44.9	46.3	60.4	50.5	8.6	20.7	66.2
-1.5	441.3	441.3	441.3	605.1	630.6	604.5	163.8	189.3	163.2	172.1	14.9	54.6	63.1	54.4	57.4	5.0	23.5	42.7
-1	420.7	420.7	420.7	511.9	484.7	547.0	91.2	64.0	126.3	93.8	31.2	30.4	21.3	42.1	31.3	10.4	12.8	29.9
-0.5	538.0	538.0	538.0	605.1	595.0	613.2	67.1	57.0	75.2	66.4	9.1	22.4	19.0	25.1	22.1	3.0	9.1	20.8
0	408.7	408.7	408.7	461.5	450.4	471.5	52.8	41.7	62.8	52.4	10.6	17.6	13.9	20.9	17.5	3.5	7.2	13.7
0.5	362.4	362.4	362.4	371.8	370.8	381.2	9.4	8.4	18.8	12.2	5.7	3.1	2.8	6.3	4.1	1.9	1.7	12.0
1	338.1	338.1	338.1	361.9	363.1	367.4	23.8	25.0	29.3	26.0	2.9	7.9	8.3	9.8	8.7	1.0	3.6	8.5
1.5	292.6	292.6	292.6	342.2	344.6	343.3	49.6	52.0	50.7	50.8	1.2	16.5	17.3	16.9	16.9	0.4	6.9	1.5
2	328.4	328.4	328.4	332.1	332.4	330.5	3.7	4.0	2.1	3.3	1.0	1.2	1.3	0.7	1.1	0.3	0.4	1.1
2.5	413.8	413.8	413.8	414.2	416.0	415.9	0.4	2.2	2.1	1.6	1.0	0.1	0.7	0.7	0.5	0.3	0.2	0.9
3	424.2	424.2	424.2	422.4	425.2	424.0	-1.8	1.0	-0.2	-0.3	1.4	-0.6	0.3	-0.1	-0.1	0.5	0.0	0.9
3.5	264.5	264.5	264.5	270.1	273.4	270.2	5.6	8.9	5.7	6.7	1.9	1.9	3.0	1.9	2.2	0.6	0.9	0.0
4	298.0	298.0	298.0	297.6	299.1	297.2	-0.4	1.1	-0.8	0.0	1.0	-0.1	0.4	-0.3	0.0	0.3	0.0	0.0

Settling velocity		Fall Distance (m): 0.6								
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	Average	Average
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3				
-3										
-2.5	45.22	10.85	25.81	0.0133	0.0553	0.0232	0.0306	0.0220		0.0358
-2	24.1	32.66	20.94	0.0249	0.0184	0.0287	0.0240	0.0052		0.0270
-1.5	25	24.28	26.03	0.0240	0.0247	0.0231	0.0239	0.0008		0.0243
-1	36.81	30.56	31	0.0163	0.0196	0.0194	0.0184	0.0018		0.0209
-0.5	43.19	28.41	33.03	0.0139	0.0211	0.0182	0.0177	0.0036		0.0180
0	43.12	64.91	50.81	0.0139	0.0092	0.0118	0.0117	0.0023		0.0114
0.5	85.31	78.5	105.43	0.0070	0.0076	0.0057	0.0068	0.0010		0.0074
1	118.72	100.53	94.22	0.0051	0.0060	0.0064	0.0058	0.0007		0.0060
1.5	156.19	163.03	160.75	0.0038	0.0037	0.0037	0.0038	0.0001		0.0039
2	156.76	239.56	468.34	0.0038	0.0025	0.0013	0.0025	0.0013		0.0025
2.5										
3										
3.5										
4										

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	16.09	36.71	11.6	0.0373	0.0163	0.0517	0.0351	0.0178
-2	32.25	26.4	21.22	0.0186	0.0227	0.0283	0.0232	0.0049
-1.5	26.29	25	23.1	0.0228	0.0240	0.0260	0.0243	0.0016
-1	35.88	27.84	32.34	0.0167	0.0216	0.0186	0.0189	0.0024
-0.5	29.35	35.07	36.81	0.0204	0.0171	0.0163	0.0180	0.0022
0	63.25	33.84	50.03	0.0095	0.0177	0.0120	0.0131	0.0042
0.5	73.84	83	83.47	0.0081	0.0072	0.0072	0.0075	0.0005
1	130.09	100.62	118.28	0.0046	0.0060	0.0051	0.0052	0.0007
1.5	158.37	160.28	163.79	0.0038	0.0037	0.0037	0.0037	0.0001
2	239.56			0.0025			0.0025	
2.5								
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	28.4	10.56	12.75	0.0211	0.0568	0.0471	0.0417	0.0184
-2	13.56	22.66	19.5	0.0442	0.0265	0.0308	0.0338	0.0093
-1.5	23.79	27.54	22.15	0.0252	0.0218	0.0271	0.0247	0.0027
-1	24.47	21.56	25.34	0.0245	0.0278	0.0237	0.0253	0.0022
-0.5	37.38	30.34	31.22	0.0161	0.0198	0.0192	0.0183	0.0020
0	71.59	62.9	56.15	0.0084	0.0095	0.0107	0.0095	0.0012
0.5	84.44	75.5	73.19	0.0071	0.0079	0.0082	0.0078	0.0006
1	58.43	116.34	112.78	0.0103	0.0052	0.0053	0.0069	0.0029
1.5	144.94	119.78	184.67	0.0041	0.0050	0.0032	0.0041	0.0009
2								
2.5								
3								
3.5								
4								

Food Type CARROT Specific brand/ type [Carrot \(Tesco carrot batons\)](#)

Particle Size		Total Sample Size (g)																
		503.27	502.55	502.09														
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	Std (g)	% of original mass			Av %	SD %	sted for missing s %	% smaller than
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3																	0.00	100.0
-2.5	448.7	452.0	451.3	453.3	3.3	2.6	4.6	3.5	1.0	0.7	0.5	0.9	0.7	0.2	0.6	0.4	0.62	99.4
-2	451.0	493.1	488.2	481.6	42.1	37.2	30.6	36.6	5.8	8.4	7.4	6.1	7.3	1.1	6.4	3.3	6.44	92.9
-1.5	442.7	532.0	506.8	546.7	89.3	64.1	104.0	85.8	20.2	17.7	12.8	20.7	17.1	4.0	15.1	8.8	15.09	77.9
-1	419.7	561.7	570.7	594.3	142.0	151.0	174.6	155.9	16.8	28.2	30.0	34.8	31.0	3.4	27.4	17.1	27.41	50.4
-0.5	409.1	545.3	547.9	534.8	136.2	138.8	125.7	133.6	6.9	27.1	27.6	25.0	26.6	1.4	23.5	14.1	23.49	26.9
0	386.8	444.2	460.4	461.2	57.4	73.6	74.4	68.5	9.6	11.4	14.6	14.8	13.6	1.9	12.0	7.1	12.04	14.9
0.5	358.5	398.9	386.8	404.5	40.4	28.3	46.0	38.2	9.0	8.0	5.6	9.2	7.6	1.8	6.7	3.9	6.72	8.2
1	337.5	362.3	363.5	356.4	24.8	26.0	18.9	23.2	3.8	4.9	5.2	3.8	4.6	0.8	4.1	2.0	4.09	4.1
1.5																	1.42	2.7
2	321.6	336.5	340.3	336.6	14.9	18.7	15.0	16.2	2.2	3.0	3.7	3.0	3.2	0.4	2.8	1.5	1.42	1.2
2.5																	0.35	0.9
3	418.3	423.7	423.1	420.0	5.4	4.8	1.7	4.0	2.0	1.1	1.0	0.3	0.8	0.4	0.7	0.2	0.35	0.6
3.5																	0.28	0.3
4	296.0	297.0	298.0	302.4	1.0	2.0	6.4	3.1	2.9	0.2	0.4	1.3	0.6	0.6	0.6	0.4	0.28	0.0

Settling velocity		Fall Distance (m):								
Run 1		0.6								
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	Average	
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3				Average
-3										
-2.5	22.88	21.75	28.81	0.0262	0.0276	0.0208	0.0249	0.0036	0.0267	
-2	20	22.03	22.81	0.0300	0.0272	0.0263	0.0278	0.0019	0.0262	
-1.5	28.09	24.93	24.82	0.0214	0.0241	0.0242	0.0232	0.0016	0.0234	
-1	27.43	35.03	32.52	0.0219	0.0171	0.0185	0.0192	0.0024	0.0186	
-0.5	49.32	44.78	45.56	0.0122	0.0134	0.0132	0.0129	0.0007	0.0131	
0	68.1	61.91	61.89	0.0088	0.0097	0.0097	0.0094	0.0005	0.0092	
0.5	71.18	82.02	82.67	0.0084	0.0073	0.0073	0.0077	0.0007	0.0073	
1										
1.5										
2										
2.5										
3										
3.5										
4										

Settling velocity		Fall Distance (m):		0.6					
Run 2									
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3			
-3									
-2.5	19.18	23.44	18.56	0.031	0.026	0.032	0.030	0.004	
-2	23.65	26.28	19.75	0.025	0.023	0.030	0.026	0.004	
-1.5	25.59	23.09	24.85	0.023	0.026	0.024	0.025	0.001	
-1	33.35	34.12	33	0.018	0.018	0.018	0.018	0.000	
-0.5	46.65	45.57	49.34	0.013	0.013	0.012	0.013	0.001	
0	61.59	69.25	65.31	0.010	0.009	0.009	0.009	0.001	
0.5	87.56	89.87	71.62	0.007	0.007	0.008	0.007	0.001	
1									
1.5									
2									
2.5									
3									
3.5									
4									

Settling velocity		Fall Distance (m):		0.6					
Run 3									
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3			
-3									
-2.5	27.03	23.09	21.43	0.022	0.026	0.028	0.025	0.003	
-2	25.25	24.69	23.43	0.024	0.024	0.026	0.025	0.001	
-1.5	26.43	27.22	26.56	0.023	0.022	0.023	0.022	0.000	
-1	29.97	32.06	35.19	0.020	0.019	0.017	0.019	0.001	
-0.5	44.5	42.72	46	0.013	0.014	0.013	0.014	0.001	
0	69.87	57.32	74.44	0.009	0.010	0.008	0.009	0.001	
0.5	88.22	82.78	88.28	0.007	0.007	0.007	0.007	0.000	
1									
1.5									
2									
2.5									
3									
3.5									
4									

Food Type Celery Stem Specific brand/ type [Celery \(Nightingale farms, Tesco\)](#)

Particle Size		Total Sample Size (g)																
		490.8	499.4	501														
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
	1	2	3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	426.1	425.8	425.7	427.9	426.1	427.0	1.8	0.3	1.3	1.1	0.8	0.4	0.1	0.3	0.2	0.2	0.52	99.5
-2.5	444.2	445.3	445.7	445.2	448.1	449.3	1.0	2.8	3.6	2.5	1.3	0.2	0.6	0.7	0.5	0.3	1.12	98.4
-2	445.0	446.7	445.0	454.6	467.4	454.4	9.6	20.7	9.4	13.2	6.5	2.0	4.1	1.9	2.7	1.3	6.03	92.3
-1.5	435.8	436.9	435.6	467.2	461.2	459.9	31.4	24.3	24.3	26.7	4.1	6.4	4.9	4.9	5.4	0.9	12.19	80.1
-1	413.0	412.9	413.0	498.1	469.4	463.5	85.1	56.5	50.5	64.0	18.5	17.3	11.3	10.1	12.9	3.9	29.29	50.8
-0.5	520.9	524.3	521.9	569.0	574.3	571.2	48.1	50.0	49.3	49.1	1.0	9.8	10.0	9.8	9.9	0.1	22.43	28.4
0	383.2	385.5	383.1	416.6	426.1	420.9	33.4	40.6	37.8	37.3	3.6	6.8	8.1	7.5	7.5	0.7	17.00	11.4
0.5	349.7	349.2	349.6	362.8	379.3	358.6	13.1	30.1	9.0	17.4	11.2	2.7	6.0	1.8	3.5	2.2	7.94	3.5
1	331.8	330.4	330.9	335.1	342.2	338.5	3.3	11.8	7.6	7.6	4.3	0.7	2.4	1.5	1.5	0.8	3.44	0.0
1.5	287.8	287.6	288.1	287.8	287.7	288.3	0.0	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.05	0.0
2												0.0	0.0	0.0	0.0	0.0	0.00	0.0
2.5												0.0	0.0	0.0	0.0	0.0	0.00	0.0
3												0.0	0.0	0.0	0.0	0.0	0.00	0.0
3.5												0.0	0.0	0.0	0.0	0.0	0.00	0.0
4												0.0	0.0	0.0	0.0	0.0	0.00	0.0

Settling velocity		Fall Distance (m):		0.71							
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	Average		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3				Average	
-3									0.0134		
-2.5									0.0134		
-2	66.2	55.7	54.2	0.0107	0.0127	0.0131	0.0122	0.0013	0.0169		
-1.5	48	44.3	49.7	0.0148	0.0160	0.0143	0.0150	0.0009	0.0145		
-1	48.9	59.8	55.6	0.0145	0.0119	0.0128	0.0131	0.0013	0.0120		
-0.5	57.6	66.7	65.3	0.0123	0.0106	0.0109	0.0113	0.0009	0.0095		
0	76.9	83.4	79.8	0.0092	0.0085	0.0089	0.0089	0.0004	0.0074		
0.5	141.5	111.8	106.4	0.0050	0.0064	0.0067	0.0060	0.0009	0.0049		
1	117.8	75.9	83.7	0.0060	0.0094	0.0085	0.0080	0.0017	0.0057		
1.5	98.8			0.0072			0.0072		0.0101		
2	42.6			0.0167			0.0167		0.0167		
2.5											
3											
3.5											
4											

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	44.3	49.3	42.1	0.016	0.014	0.017	0.016	0.001
-2	37.9	37.3	37.8	0.019	0.019	0.019	0.019	0.000
-1.5	46.8	50.8	46.3	0.015	0.014	0.015	0.015	0.001
-1	59.4	64.2	61.9	0.012	0.011	0.011	0.011	0.000
-0.5	74.4	79.3	72.8	0.010	0.009	0.010	0.009	0.000
0	99.4	84.6	114.7	0.007	0.008	0.006	0.007	0.001
0.5	131.6	203.7	224.2	0.005	0.003	0.003	0.004	0.001
1	116.6	124.3	157.6	0.006	0.006	0.005	0.005	0.001
1.5	169.1			0.004			0.004	
2								
2.5								
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	x	70.1	59.8		0.010	0.012	0.011	0.001
-2	33.9	37.7	37.5	0.021	0.019	0.019	0.020	0.001
-1.5	53.1	55.6	48.5	0.013	0.013	0.015	0.014	0.001
-1	65.1	60.9	58.3	0.011	0.012	0.012	0.012	0.001
-0.5	88.8	97.5	87.2	0.008	0.007	0.008	0.008	0.000
0	118.5	120.1	115.3	0.006	0.006	0.006	0.006	0.000
0.5	139.9	164.3	152	0.005	0.004	0.005	0.005	0.000
1	192	194.6	186.9	0.004	0.004	0.004	0.004	0.000
1.5	37.6			0.019			0.019	
2								
2.5								
3								
3.5								
4								

Food Type Specific brand/ type [Cheese \(Cathedral city mature cheddar\)](#)

Particle Size				Total Sample Size (g)														
				300	300.1	300												
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)		Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	427.3	427.3	427.0			427.0			0.0	0.0		0.0	0.0	0.0	0.0	0.0	100.0	
-2.5	450.0	450.0	447.1	448.7	450.8	447.1		0.8	0.0	0.4	0.6	0.0	0.3	0.0	0.1	0.2	99.9	
-2	451.4	451.4	452.8	451.6	454.6	454.6	0.2	3.2	1.8	1.7	1.5	0.1	1.1	0.6	0.6	0.5	99.6	
-1.5	441.3	441.3	440.5	445.0	450.4	451.6	3.7	9.1	11.1	8.0	3.8	1.2	3.0	3.7	2.7	1.3	97.8	
-1	420.7	420.7	420.1	460.1	549.2	437.9	39.4	128.5	17.8	61.9	58.7	13.1	42.8	5.9	20.6	19.6	83.9	
-0.5	538.0	538.0	529.9	683.1	662.6	558.6	145.1	124.6	28.7	99.5	62.1	48.4	41.5	9.6	33.2	20.7	61.5	
0	408.7	408.7	382.2	483.8	460.4	419.5	75.1	51.7	37.3	54.7	19.1	25.0	17.2	12.4	18.2	6.4	49.2	
0.5	362.4	362.4	347.6	378.9	365.5	412.9	16.5	3.1	65.3	28.3	32.7	5.5	1.0	21.8	9.4	10.9	42.9	
1	338.1	338.1	337.6	367.8	392.5	367.4	29.7	54.4	29.8	38.0	14.2	9.9	18.1	9.9	12.7	4.7	34.3	
1.5	292.6	292.6	303.2	385.5	394.6	315.4	92.9	102.0	12.2	69.0	49.4	31.0	34.0	4.1	23.0	16.5	18.8	
2	328.4	328.4	321.5	360.7	377.1	340.9	32.3	48.7	19.4	33.5	14.7	10.8	16.2	6.5	11.2	4.9	11.3	
2.5	413.8	413.8	280.8	453.2	467.2	288.7	39.4	53.4	7.9	33.6	23.3	13.1	17.8	2.6	11.2	7.8	3.8	
3	424.2	424.2	421.3	426.2	435.2	423.6	2.0	11.0	2.3	5.1	5.1	0.7	3.7	0.8	1.7	1.1	2.6	
3.5	264.5	264.5	264.5	278.3	285.6		13.8	21.1		17.5	5.2	4.6	7.0	0.0	3.9	3.6	0.0	
4	298.0	298.0	298.0	298.2	297.0		0.2			0.2		0.1	0.0	0.0	0.0	0.0	0.0	

Settling velocity		Fall Distance (m): 0.6								
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	Average	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3				
-2.5										
-2	55.2			0.0109			0.0109		0.0109	
-1.5	16.37	16.21	27.25	0.0367	0.0370	0.0220	0.0319	0.0086	0.0325	
-1	20.77	20.71	21.2	0.0289	0.0290	0.0283	0.0287	0.0004	0.0307	
-0.5	27.72	29.41	14.27	0.0216	0.0204	0.0420	0.0280	0.0122	0.0273	
0	21.78	27.25	25.87	0.0275	0.0220	0.0232	0.0243	0.0029	0.0203	
0.5	40.5	64.22	43.31	0.0148	0.0093	0.0139	0.0127	0.0029	0.0132	
1	80.56	96.15	65.19	0.0074	0.0062	0.0092	0.0076	0.0015	0.0079	
1.5	240.32	110.56		0.0025	0.0054		0.0040	0.0021	0.0040	
2	234.45	190.41		0.0026	0.0032		0.0029	0.0004	0.0029	
2.5	180.36	452.34	506.34	0.0033	0.0013	0.0012	0.0019	0.0012	0.0019	
3	634.75			0.0009			0.0009		0.0009	
3.5										
4										

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5								
-2								
-1.5	18.57	20.68	16.91	0.0323	0.0290	0.0355	0.0323	0.0032
-1	20.99	17.63	16.97	0.0286	0.0340	0.0354	0.0327	0.0036
-0.5	29.03	19.71	27.94	0.0207	0.0304	0.0215	0.0242	0.0054
0	19.71	36.78	27.66	0.0304	0.0163	0.0217	0.0228	0.0071
0.5	46.78	44.16	39.09	0.0128	0.0136	0.0153	0.0139	0.0013
1	54.79	112.42	110.75	0.0110	0.0053	0.0054	0.0072	0.0032
1.5								
2								
2.5								
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5								
-2								
-1.5	18.12	16.24	19.98	0.0331	0.0369	0.0300	0.0334	0.0035
-1								
-0.5	14.94	24.62	24.15	0.0402	0.0244	0.0248	0.0298	0.0090
0	48.16	45.18	37.94	0.0125	0.0133	0.0158	0.0139	0.0017
0.5	47.32	48.21	43.75	0.0127	0.0124	0.0137	0.0129	0.0007
1	90.59	81.27	49.18	0.0066	0.0074	0.0122	0.0087	0.0030
1.5								
2								
2.5								
3								
3.5								
4								

Food Type Chicken Specific brand/ type [Chicken carcass \(pre-cooked, meat removed, Tesco\)](#)

Particle Size		Total Sample Size (g)																
Sieve (phi)	Sieve Weight (g)	Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than		
		Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3						
-3	428.7	433.6	435.0	431.2	4.9	6.3	2.5	4.6	1.9	1.0	1.4	0.5	1.0	0.4	1.0	99.0		
-2.5	446.8	462.4	464.0	466.0	15.6	17.2	19.2	17.3	1.8	3.1	3.7	4.0	3.6	0.4	3.9	95.0		
-2	451.4	542.2	520.7	527.6	90.8	69.3	76.2	78.8	11.0	18.2	14.9	15.8	16.3	1.7	17.8	77.2		
-1.5	440.6	498.8	517.1	503.4	58.2	76.5	62.8	65.8	9.5	11.6	16.4	13.0	13.7	2.5	15.0	62.2		
-1	419.5	523.6	504.7	491.1	104.1	85.2	71.6	87.0	16.3	20.8	18.3	14.9	18.0	3.0	19.7	42.4		
-0.5	531.5	606.3	571.6	601.2	74.8	40.1	69.7	61.5	18.7	15.0	8.6	14.5	12.7	3.5	13.9	28.5		
0	390.4	459.1	451.9	454.7	68.7	61.5	64.3	64.8	3.6	13.7	13.2	13.4	13.4	0.3	14.7	13.8		
0.5	360.4	386.0	381.5	389.7	25.6	21.1	29.3	25.3	4.1	5.1	4.5	6.1	5.2	0.8	5.7	8.1		
1	336.6	353.8	360.2	356.6	17.2	23.6	20.0	20.3	3.2	3.4	5.1	4.2	4.2	0.8	4.6	3.5		
1.5					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5		
2	325.6	331.9	345.4	315.2	6.3	19.8	-10.4	5.2	15.1	1.3	4.3	-2.2	1.1	3.2	1.2	2.2		
2.5					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2		
3	420.1	423.4	427.3	433.3	3.3	7.2	13.2	7.9	5.0	0.7	1.5	2.7	1.6	1.0	1.8	0.4		
3.5					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4		
4	296	299.1	297.9	296.7	3.1	1.9	0.7	1.9	1.2	0.6	0.4	0.1	0.4	0.2	0.4	0.0		

Adjusted for missing sieves %	% smaller than
1.0	99.0
3.9	95.0
17.8	77.2
15.0	62.2
19.7	42.4
13.9	28.5
14.7	13.8
5.7	8.1
4.6	3.5
0.6	2.8
0.6	2.2
0.9	1.3
0.9	0.4
0.2	0.2
0.2	0.0

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	14.2	14.3	13.7	0.0500	0.0497	0.0518	0.0505	0.0012
-2.5	11.6	13.7	12.4	0.0612	0.0518	0.0573	0.0568	0.0047
-2	13.7	15.1	12.8	0.0518	0.0470	0.0555	0.0514	0.0042
-1.5	16.7	15.9	14.9	0.0425	0.0447	0.0477	0.0449	0.0026
-1	16.5	15.8	16.1	0.0430	0.0449	0.0441	0.0440	0.0010
-0.5	20.3	18.9	18.8	0.0350	0.0376	0.0378	0.0368	0.0016
0	19.1	20.5	22.3	0.0372	0.0346	0.0318	0.0345	0.0027
0.5	25.3	17.2	23.3	0.0281	0.0413	0.0305	0.0333	0.0070
1	26.2	27.8	28	0.0271	0.0255	0.0254	0.0260	0.0010
1.5								
2	46.2	48.7	44.9	0.0154	0.0146	0.0158	0.0153	0.0006
2.5								
3	310.8	321.9	301.3	0.0023	0.0022	0.0024	0.0023	0.0001
3.5								
4								

Average Average
0.0511
0.0481
0.0459
0.0386
0.0382
0.0315
0.0303
0.0258
0.0225
0.0169
0.0023

Average gaps filled
0.0511
0.0481
0.0459
0.0386
0.0382
0.0315
0.0303
0.0258
0.0225
0.0197
0.0169
0.0096
0.0023

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	9.1	11.4	9.2	0.078	0.062	0.077	0.072	0.009
-2.5	16.8	13.7	12.9	0.042	0.052	0.055	0.050	0.007
-2	12.7	13.2	16.6	0.056	0.054	0.043	0.051	0.007
-1.5	20.2	18.7	17.9	0.035	0.038	0.040	0.038	0.002
-1	18.6	17.3	20.3	0.038	0.041	0.035	0.038	0.003
-0.5	27.4	23.1	25.6	0.026	0.031	0.028	0.028	0.002
0	33.2	30.5	29.7	0.021	0.023	0.024	0.023	0.001
0.5	31.7	34.5	28.1	0.022	0.021	0.025	0.023	0.002
1	38.5	35.9	40.4	0.018	0.020	0.018	0.019	0.001
1.5								
2	47.7	49.7	47.1	0.015	0.014	0.015	0.015	0.000
2.5								
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	23.6	21.5	25.8	0.030	0.033	0.028	0.030	0.003
-2.5	20	21.2	15.9	0.036	0.033	0.045	0.038	0.006
-2	19.9	18.7	21.5	0.036	0.038	0.033	0.036	0.002
-1.5	21.4	19.6	23.3	0.033	0.036	0.030	0.033	0.003
-1	23.9	21.4	20.5	0.030	0.033	0.035	0.033	0.003
-0.5	25.8	25.7	21.2	0.028	0.028	0.033	0.030	0.003
0	17.8	22.5	24.2	0.040	0.032	0.029	0.034	0.006
0.5	35.4	33.3	31.8	0.020	0.021	0.022	0.021	0.001
1	28.7	35.8	29.3	0.025	0.020	0.024	0.023	0.003
1.5								
2	34.4	33.7	35	0.021	0.021	0.020	0.021	0.000
2.5	>10min							
3	>10min							
3.5	>10min							
4	>10min							

Food Type Cornflakes Specific brand/ type [Cornflakes \(Kelloggs, Tesco\)](#)

Particle Size		Total Sample Size (g)														
		500	300	300												
Sieve (phi)	Sieve Weight (g)	Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
		Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	426									0.0	0.0	0.0	0.0	0.0	0.0	100.0
-2.5	448.8		449.6			0.8		0.8		0.0	0.3	0.0	0.1	0.2	0.0	100.0
-2	447.2	465.0	465.5	458.1	17.8	18.3	10.9	15.7	4.1	3.6	6.1	3.6	4.4	1.4	1.7	98.2
-1.5	437.9	507.9	468.1	481.6	70.0	30.2	43.7	48.0	20.2	14.0	10.1	14.6	12.9	2.5	5.1	93.1
-1	415.5	523.6	510.9	469.9	108.1	95.4	54.4	86.0	28.1	21.6	31.8	18.1	23.9	7.1	9.4	83.7
-0.5	526	718.5	675.4	624.3	192.5	149.4	98.3	146.7	47.2	38.5	49.8	32.8	40.4	8.7	15.9	67.8
0	384.6	586.3	537.8	498.4	201.7	153.2	113.8	156.2	44.0	40.3	51.1	37.9	43.1	7.0	17.0	50.8
0.5	351.9	568.6	502.5	502.7	216.7	150.6	150.8	172.7	38.1	43.3	50.2	50.3	47.9	4.0	18.9	32.0
1	332.3	579.6	401.2	461.1	247.3	68.9	128.8	148.3	90.8	49.5	23.0	42.9	38.5	13.8	15.2	16.8
1.5	290.8	320.3	351.4	359.2	29.5	60.6	68.4	52.8	20.6	5.9	20.2	22.8	16.3	9.1	6.4	10.4
2	319.1	340.5	369.3	352.2	21.4	50.2	33.1	34.9	14.5	4.3	16.7	11.0	10.7	6.2	4.2	6.2
2.5	411.3	433.7	442.5	443.7	22.4	31.2	32.4	28.7	5.5	4.5	10.4	10.8	8.6	3.5	3.4	2.8
3	418	430.6	438.0	437.0	12.6	20.0	19.0	17.2	4.0	2.5	6.7	6.3	5.2	2.3	2.0	0.8
3.5	263	272.9	264.4	268.4	9.9	1.4	5.4	5.6	4.3	2.0	0.5	1.8	1.4	0.8	0.6	0.2
4	295.8	297.2	297.9	297.3	1.4	2.1	1.5	1.7	0.4	0.3	0.7	0.5	0.5	0.2	0.2	0.0

Settling velocity	1	Fall Distance (m):	0.71
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Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5								
-2	12.8	15.6	17.1	0.0555	0.0455	0.0415	0.0475	0.0072
-1.5	14.9	14.6	17.5	0.0477	0.0486	0.0406	0.0456	0.0044
-1	17.4	17.5	17.2	0.0408	0.0406	0.0413	0.0409	0.0004
-0.5	19.5	19.9	21	0.0364	0.0357	0.0338	0.0353	0.0013
0	23.3	21.8	23.7	0.0305	0.0326	0.0300	0.0310	0.0014
0.5	26.9	28.7	30.1	0.0264	0.0247	0.0236	0.0249	0.0014
1	25.3	33	36.9	0.0281	0.0215	0.0192	0.0229	0.0046
1.5	82.8	81.9	80.3	0.0086	0.0087	0.0088	0.0087	0.0001
2	115.5	118.3	121.1	0.0061	0.0060	0.0059	0.0060	0.0001
2.5	165.7	181.2	170.1	0.0043	0.0039	0.0042	0.0041	0.0002
3								
3.5								
4								

Average
Average
0.0403
0.0472
0.0462
0.0422
0.0358
0.0293
0.0214
0.0171
0.0087
0.0070
0.0063

Settling velocity		2		Fall Distance (m):		0.71					
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)			
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3					
-3											
-2.5	17.6	--	--	0.040			0.040				
-2	19	17.9	18	0.037	0.040	0.039	0.039	0.001			
-1.5	17.1	15.8	15.1	0.042	0.045	0.047	0.044	0.003			
-1	19	19.4	18.6	0.037	0.037	0.038	0.037	0.001			
-0.5	22.5	21.9	21.8	0.032	0.032	0.033	0.032	0.001			
0	26.2	26.3	27.2	0.027	0.027	0.026	0.027	0.001			
0.5	35	41.9	40	0.020	0.017	0.018	0.018	0.002			
1	49	49.2	55	0.014	0.014	0.013	0.014	0.001			
1.5	75.2	72.5	81.4	0.009	0.010	0.009	0.009	0.001			
2	132.7	135.3	143.2	0.005	0.005	0.005	0.005	0.000			
2.5	170.2	179.1	184.8	0.004	0.004	0.004	0.004	0.000			
3											
3.5											
4											

Settling velocity		3		Fall Distance (m):		0.71					
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)			
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3					
-3											
-2.5											
-2	13.1	10.9	15.4	0.054	0.065	0.046	0.055	0.010			
-1.5	16.5	12.8	15.2	0.043	0.055	0.047	0.048	0.006			
-1	15.2	14.3	14.6	0.047	0.050	0.049	0.048	0.001			
-0.5	17.4	17	19.3	0.041	0.042	0.037	0.040	0.003			
0	22.9	23.4	24.6	0.031	0.030	0.029	0.030	0.001			
0.5	34.6	33.8	33.8	0.021	0.021	0.021	0.021	0.000			
1	51.1	49.7	47.3	0.014	0.014	0.015	0.014	0.001			
1.5	94.2	88.4	82.9	0.008	0.008	0.009	0.008	0.001			
2	75.9	68	72.5	0.009	0.010	0.010	0.010	0.001			
2.5	64.9	66.1	65.3	0.011	0.011	0.011	0.011	0.000			
3											
3.5											
4											

Food Type Egg shells Specific brand/ type Egg shell (Chicken eggs, various sources)

Particle Size		Total Sample Size (g)																									
		500.1		500		500																					
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than	ted for missing s	% smaller than							
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3					%								
-3	429.5	428.0	426.8	431.8	428.0	426.8	2.3	0.0	0.0	0.8	1.3	0.5	0.0	0.0	0.2	0.3	0.12	99.88	0.1	99.9							
-2.5	446.0	448.2	446.7	449.7	449.2	447.0	3.7	1.0	0.3	1.7	1.8	0.7	0.2	0.1	0.3	0.4	0.27	99.61	0.3	99.6							
-2	449.6	448.6	447.3	466.2	463.3	455.5	16.6	14.7	8.2	13.2	4.4	3.3	2.9	1.6	2.6	0.9	2.09	97.52	2.1	97.5							
-1.5	438.3	438.8	438.2	495.0	481.5	474.9	56.7	42.7	36.7	45.4	10.3	11.3	8.5	7.3	9.1	2.1	7.22	90.30	7.2	90.3							
-1	418.3	416.0	415.7	536.0	549.5	516.3	117.7	133.5	100.6	117.3	16.5	23.5	26.7	20.1	23.5	3.3	18.65	71.65	18.7	71.6							
-0.5	526.9	524.6	523.7	710.4	710.7	739.5	183.5	186.1	215.8	195.1	17.9	36.7	37.2	43.2	39.0	3.6	31.04	40.61	31.0	40.6							
0	385.2	387.4	383.0	532.1	535.0	545.3	146.9	147.6	162.3	152.3	8.7	29.4	29.5	32.5	30.5	1.7	24.22	16.39	24.2	16.4							
0.5	354.5	359.0	351.2	421.7	416.6	426.7	67.2	57.6	75.5	66.8	9.0	13.4	11.5	15.1	13.4	1.8	10.62	5.77	10.6	5.8							
1	336.7	337.8	333.6	358.9	357.6	359.4	22.2	19.8	25.8	22.6	3.0	4.4	4.0	5.2	4.5	0.6	3.59	2.17	3.6	2.2							
1.5							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	2.17	0.7	1.5							
2	327.5	323.9	320.3	334.5	333.4	329.3	7.0	9.5	9.0	8.5	1.3	1.4	1.9	1.8	1.7	0.3	1.35	0.82	0.7	0.8							
2.5							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.82	0.2	0.6							
3	419.6	418.9	416.8	421.9	420.9	421.1	2.3	2.0	4.3	2.9	1.3	0.5	0.4	0.9	0.6	0.3	0.46	0.37	0.2	0.4							
3.5							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.37	0.2	0.2							
4	295.2	295.6	291.0	296.4	296.1	296.2	1.2	0.5	5.2	2.3	2.5	0.2	0.1	1.0	0.5	0.5	0.37	0.00	0.2	0.0							

Setting velocity	Fall Distance (m):	0.71
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Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	8.8	10	9.1	0.0807	0.0710	0.0780	0.0766	0.0050
-2.5	11.9	8.9	13.6	0.0597	0.0798	0.0522	0.0639	0.0143
-2	8.1	6.3	10.2	0.0877	0.1127	0.0696	0.0900	0.0216
-1.5	7.6	6.6	6.5	0.0934	0.1076	0.1092	0.1034	0.0087
-1	5.4	6.3	6.8	0.1315	0.1127	0.1044	0.1162	0.0139
-0.5	6	6	4.9	0.1183	0.1183	0.1449	0.1272	0.0153
0	5.4	6	7.2	0.1315	0.1183	0.0986	0.1161	0.0165
0.5	6.3	6.1	6.3	0.1127	0.1164	0.1127	0.1139	0.0021
1	8.1	7.7	7.8	0.0877	0.0922	0.0910	0.0903	0.0024
1.5								
2	12.8	11.7	10.5	0.0555	0.0607	0.0676	0.0613	0.0061
2.5								
3	19.9	20.9	28.6	0.0357	0.0340	0.0248	0.0315	0.0058
3.5								
4	19	18.5	14.3	0.0374	0.0384	0.0497	0.0418	0.0068

Average Average
0.0754
0.0800
0.1020
0.1282
0.1177
0.1287
0.1226
0.1138
0.0955
0.0669
0.0337
0.0281

Average gaps filled
0.0754
0.0800
0.1020
0.1282
0.1177
0.1287
0.1226
0.1138
0.0955
0.0812
0.0669
0.0503
0.0337
0.0309
0.0281

Settling velocity		Fall Distance (m): 0.71							
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			
-3	9.9	9.8	9.1	0.072	0.072	0.078	0.074	0.003	
-2.5	9.1	9.4	7.6	0.078	0.076	0.093	0.082	0.010	
-2	7.9	6	6.5	0.090	0.118	0.109	0.106	0.015	
-1.5	5.7	5.5	5.3	0.125	0.129	0.134	0.129	0.005	
-1	5.2	6	6.4	0.137	0.118	0.111	0.122	0.013	
-0.5	5.1	5.3	5.9	0.139	0.134	0.120	0.131	0.010	
0	5.8	5.6	5.6	0.122	0.127	0.127	0.125	0.003	
0.5	6.4	6.4	6.1	0.111	0.111	0.116	0.113	0.003	
1	7.7	7.2	7.2	0.092	0.099	0.099	0.096	0.004	
1.5									
2	11.1	11	11.7	0.064	0.065	0.061	0.063	0.002	
2.5									
3	18.5	27.2		0.038	0.026		0.032	0.009	
3.5									
4	25.2	45.7	29.3	0.028	0.016	0.024	0.023	0.006	

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	9.4			0.076			0.076	#DIV/0!
-2.5	8.3	7.8	6.8	0.086	0.091	0.104	0.094	0.010
-2	5.8	5.8	8.3	0.122	0.122	0.086	0.110	0.021
-1.5	4.5	4.2	5.5	0.158	0.169	0.129	0.152	0.021
-1	6	6.8	5.8	0.118	0.104	0.122	0.115	0.009
-0.5	5.7	5.7	5.3	0.125	0.125	0.134	0.128	0.005
0	5.4	5.9	5.6	0.131	0.120	0.127	0.126	0.006
0.5	6	6.3	6.3	0.118	0.113	0.113	0.115	0.003
1	7	7.5	6.9	0.101	0.095	0.103	0.100	0.004
1.5								
2	8.5	9.5	10	0.084	0.075	0.071	0.076	0.006
2.5								
3	17.5	24.5	16.8	0.041	0.029	0.042	0.037	0.007
3.5								
4	27.8	49.4		0.026	0.014		0.020	0.008

Food Type Orange Peel Specific brand/ type Cambria Naval

Particle Size				Total Sample Size (g)														
				497	315	317												
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
	1	2	3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	425.2	426.3	425.9	430.6	426.9	428.2	5.4	0.6	2.3	2.77	2.43	1.09	0.19	0.73	0.67	0.45	0.35	99.65
-2.5	449.4	447.6	446.8	559.4	487.5	478.3	110	39.9	31.5	60.47	43.10	22.13	12.67	9.94	14.91	6.40	7.74	91.91
-2	412.9	445.5	445.6	677.5	600	576.4	264.6	154.5	130.8	183.30	71.40	53.24	49.05	41.26	47.85	6.08	24.83	67.08
-1.5	437.4	435.9	436	557.5	519.4	543.6	120.1	83.5	107.6	103.73	18.60	24.16	26.51	33.94	28.21	5.11	14.64	52.44
-1	414.4	413.1	413.2	602.8	514	503.4	188.4	100.9	90.2	126.50	53.87	37.91	32.03	28.45	32.80	4.77	17.02	35.42
-0.5	524.6	523.7	505.6	677.8	599	598.2	153.2	75.3	92.6	107.03	40.91	30.82	23.90	29.21	27.98	3.62	14.52	20.89
0	384.6	385	383.8	477.9	436.1	435.4	93.3	51.1	51.6	65.33	24.22	18.77	16.22	16.28	17.09	1.46	8.87	12.02
0.5	350.7	350.8	350.1	382.9	379.1	372.2	32.2	28.3	22.1	27.53	5.09	6.48	8.98	6.97	7.48	1.33	3.88	8.14
1	331.8	332.1	331.4	382.4	355.8	351.6	50.6	23.7	20.2	31.50	16.63	10.18	7.52	6.37	8.03	1.95	4.17	3.98
1.5	289	288.6	288.8	309.9	304.8	297.4	20.9	16.2	8.6	15.23	6.21	4.21	5.14	2.71	4.02	1.23	2.09	1.89
2	318.9	316.5	316.8	330.1	326.5	320.3	11.2	10	3.5	8.23	4.14	2.25	3.17	1.10	2.18	1.04	1.13	0.76
2.5	412	411.1	409.2	417.7	414.8	411.4	5.7	3.7	2.2	3.87	1.76	1.15	1.17	0.69	1.01	0.27	0.52	0.24
3	416	415.3	412.6	418.3	417.4	412.8	2.3	2.1	0.2	1.53	1.16	0.46	0.67	0.06	0.40	0.31	0.21	0.03
3.5		263.7	261.7		264.2	261.8	0	0.5	0.1	0.20	0.26	0.00	0.16	0.03	0.06	0.08	0.03	0.00
4							0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Settling velocity		Fall Distance (m): 0.71								
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	Average	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3				
-3	27.6	19.7	20.9	0.026	0.036	0.034	0.032	0.005	0.030	
-2.5	18	16.2	18.2	0.039	0.044	0.039	0.041	0.003	0.041	
-2	21.8	17.6	17.9	0.033	0.040	0.040	0.038	0.004	0.039	
-1.5	17.3	20.7	20.2	0.041	0.034	0.035	0.037	0.004	0.036	
-1	22.3	22.8	23.3	0.032	0.031	0.030	0.031	0.001	0.030	
-0.5	30.9	30.7	29	0.023	0.023	0.024	0.024	0.001	0.024	
0	43.2	58.5	53.3	0.016	0.012	0.013	0.014	0.002	0.017	
0.5	67.7	81.8	71.1	0.010	0.009	0.010	0.010	0.001	0.011	
1	75.4	76.8	70.2	0.009	0.009	0.010	0.010	0.000	0.009	
1.5	109.5	108.6	78.6	0.006	0.007	0.009	0.007	0.001	0.007	
2	65.2			0.011			0.011		0.007	
2.5	68.4	66.7	74.3	0.010	0.011	0.010	0.010	0.001	0.008	
3	91.7			0.008			0.008		0.007	
3.5									0.006	
4										

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	19.8	16.8	16.4	0.036	0.042	0.043	0.040	0.004
-2	16.8	19.6	18.3	0.042	0.036	0.039	0.039	0.003
-1.5	19.4	19.9	20.3	0.037	0.036	0.035	0.036	0.001
-1	23.8	22.1	22.3	0.030	0.032	0.032	0.031	0.001
-0.5	27.5	30.8	30.3	0.026	0.023	0.023	0.024	0.001
0	42.3	37.3	44.4	0.017	0.019	0.016	0.017	0.002
0.5	60.5	51.8	62.5	0.012	0.014	0.011	0.012	0.001
1	71.9	75.2	88	0.010	0.009	0.008	0.009	0.001
1.5	113.6	110.7	92.7	0.006	0.006	0.008	0.007	0.001
2	199.1	226.8	110.3	0.004	0.003	0.006	0.004	0.002
2.5	76.1	84.3	73.3	0.009	0.008	0.010	0.009	0.001
3	99			0.007			0.007	
3.5	159.1			0.004			0.004	
4								

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3		25.6			0.028		0.028	
-2.5	19.8	13.9	18	0.036	0.051	0.039	0.042	0.008
-2	15.6	17.7	18.2	0.046	0.040	0.039	0.042	0.003
-1.5	19.4	20.1	19.5	0.037	0.035	0.036	0.036	0.001
-1	28.5	22.7	23.9	0.025	0.031	0.030	0.029	0.003
-0.5	30.6	29.9	27.9	0.023	0.024	0.025	0.024	0.001
0	34.5	37	38.5	0.021	0.019	0.018	0.019	0.001
0.5	61.4	53.7	61.3	0.012	0.013	0.012	0.012	0.001
1	89.2	74.7	85.4	0.008	0.010	0.008	0.009	0.001
1.5	117	93.8	107.8	0.006	0.008	0.007	0.007	0.001
2	126.1	123.8	123.5	0.006	0.006	0.006	0.006	0.000
2.5	150.1	123	158	0.005	0.006	0.004	0.005	0.001
3								
3.5	100.9			0.007			0.007	
4								

Food Type Specific brand/ type [Pasta \(Fresh penne, Tesco\)](#)

Particle Size				Total Sample Size (g)														
				300	300.1	300												
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	427.3	427.3	427.3									0.0	0.0	0.0	0.0	0.0	0.0	100.0
-2.5	450.0	450.0	450.0	632.8	523.1	518.0	182.8	73.1	68.0	108.0	64.9	60.9	24.4	22.7	36.0	21.6	13.1	86.9
-2	451.4	451.4	451.4	779.8	811.5	823.8	328.4	360.1	372.4	353.6	22.7	109.5	120.0	124.1	117.9	7.6	42.8	44.1
-1.5	441.3	441.3	441.3	487.5	542.0	529.9	46.2	100.7	88.6	78.5	28.6	15.4	33.6	29.5	26.2	9.5	9.5	34.6
-1	420.7	420.7	420.7	480.1	496.6	488.9	59.4	75.9	68.2	67.8	8.3	19.8	25.3	22.7	22.6	2.7	8.2	26.4
-0.5	538.0	538.0	538.0	575.5	596.1	590.3	37.5	58.1	52.3	49.3	10.6	12.5	19.4	17.4	16.4	3.5	6.0	20.5
0	408.7	408.7	408.7	421.6	432.0	440.8	12.9	23.3	32.1	22.8	9.6	4.3	7.8	10.7	7.6	3.2	2.8	17.7
0.5	362.4	362.4	362.4	376.3	393.4	392.3	13.9	31.0	29.9	24.9	9.6	4.6	10.3	10.0	8.3	3.2	3.0	14.7
1	338.1	338.1	338.1	366.5	370.7	365.3	28.4	32.6	27.2	29.4	2.8	9.5	10.9	9.1	9.8	0.9	3.6	11.1
1.5	292.6	292.6	292.6	359.5	362.6	356.3	66.9	70.0	63.7	66.9	3.2	22.3	23.3	21.2	22.3	1.0	8.1	3.0
2	328.4	328.4	328.4	332.5	336.5	329.6	4.1	8.1	1.2	4.5	3.5	1.4	2.7	0.4	1.5	1.2	0.5	2.5
2.5	413.8	413.8	413.8	427.1	428.9	425.6	13.3	15.1	11.8	13.4	1.7	4.4	5.0	3.9	4.5	0.5	1.6	0.9
3	424.2	424.2	424.2	424.4	424.3	425.9	0.2	0.1	1.7	0.7	0.9	0.1	0.0	0.6	0.2	0.3	0.1	0.8
3.5	264.5	264.5	264.5	269.5	274.1	269.6	5.0	9.6	5.1	6.6	2.6	1.7	3.2	1.7	2.2	0.9	0.8	0.0
4	298.0	298.0	298.0	298.2	296.6	299.5	0.2	-1.4	1.5	0.1	1.5	0.1	-0.5	0.5	0.0	0.5	0.0	0.0

Settling velocity		Fall Distance (m): 0.6								
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	Average	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3				
-3										
-2.5	6.91	6.66	7.03	0.087	0.090	0.085	0.087	0.002	0.085	
-2	6.53	7.28	5.97	0.092	0.082	0.101	0.092	0.009	0.093	
-1.5	8.84	8.03	8.28	0.068	0.075	0.072	0.072	0.003	0.075	
-1	8.63	9.32	8.94	0.070	0.064	0.067	0.067	0.003	0.066	
-0.5	12.12	10.19	11.54	0.050	0.059	0.052	0.053	0.005	0.054	
0	15.91	16.34	16.75	0.038	0.037	0.036	0.037	0.001	0.037	
0.5	21.75	19.81	20.44	0.028	0.030	0.029	0.029	0.001	0.029	
1	34.22	33.72	35.09	0.018	0.018	0.017	0.017	0.000	0.018	
1.5	50	61.43	57.03	0.012	0.010	0.011	0.011	0.001	0.011	
2	100.94	94.15	97.49	0.006	0.006	0.006	0.006	0.000	0.007	
2.5	156.89	139.34	301.78	0.004	0.004	0.002	0.003	0.001	0.003	
3										
3.5										
4										

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	7.31	7.15	7.34	0.082	0.084	0.082	0.083	0.001
-2	6.31	6.28	6.31	0.095	0.096	0.095	0.095	0.000
-1.5	8.94	7.35	8	0.067	0.082	0.075	0.075	0.007
-1	9.88	10.03	8.1	0.061	0.060	0.074	0.065	0.008
-0.5	11	9.66	10.85	0.055	0.062	0.055	0.057	0.004
0	15.66	16.15	15.61	0.038	0.037	0.038	0.038	0.001
0.5	22.28	20.81	22.78	0.027	0.029	0.026	0.027	0.001
1	31.16	31.97	34.09	0.019	0.019	0.018	0.019	0.001
1.5	51.35	56.78	61.93	0.012	0.011	0.010	0.011	0.001
2	84.35			0.007			0.007	
2.5	180.22	156.71	198.45	0.003	0.004	0.003	0.003	0.000
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	6.25	7.13	7.75	0.096	0.084	0.077	0.086	0.009
-2	5.75	6.72	6.94	0.104	0.089	0.086	0.093	0.010
-1.5	8.3	9.49	6.07	0.072	0.063	0.099	0.078	0.019
-1	8.6	9.13	9.94	0.070	0.066	0.060	0.065	0.005
-0.5	10.59	12.06	12.68	0.057	0.050	0.047	0.051	0.005
0	15.87	17.35	14.85	0.038	0.035	0.040	0.038	0.003
0.5	23.19	18.63	20.16	0.026	0.032	0.030	0.029	0.003
1	34.12	33.93	32.9	0.018	0.018	0.018	0.018	0.000
1.5	52.16	59.47	55.15	0.012	0.010	0.011	0.011	0.001
2								
2.5								
3								
3.5								
4								

Food Type Pineapple skin Specific brand/ type (Co-op Costa Rica)

Particle Size				Total Sample Size (g)														
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
	1	2	3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3				447.9	434.5	448.6	3.4	3.2	4.2	3.60	0.53	1.08	1.05	1.33	1.15	0.16	0.00	100.00
-2.5	444.5	431.3	444.4	522	550.7	530	75.4	105.1	84.5	88.33	15.22	24.01	34.35	26.83	28.39	5.34	1.27	98.73
-2	446.6	445.6	445.5	496.5	505.5	489.8	60.8	69.7	53.9	61.47	7.92	19.36	22.78	17.11	19.75	2.85	21.72	45.78
-1.5	435.7	435.8	435.9	459	460.1	446.6	46	46.9	33.6	42.17	7.43	14.65	15.33	10.67	13.55	2.52	14.90	30.88
-1	413	413.2	413	551	552.6	555.8	27.2	31.2	34.4	30.93	3.61	8.66	10.20	10.92	9.93	1.15	10.92	19.97
-0.5	523.8	521.4	521.4	412.7	412.6	407.5	27.9	29.9	23.9	27.23	3.06	8.89	9.77	7.59	8.75	1.10	9.62	10.34
0	384.8	382.7	383.6	364.2	344	361.5	15	13	11.8	13.27	1.62	4.78	4.25	3.75	4.26	0.52	4.68	5.66
0.5	349.2	331	349.7	341.9	345.8	339.1	11.4	15.4	8.6	11.80	3.42	3.63	5.03	2.73	3.80	1.16	4.18	1.49
1	330.5	330.4	330.5	291.3	291.9	289.8	3.6	4.2	2.1	3.30	1.08	1.15	1.37	0.67	1.06	0.36	1.17	0.32
1.5	287.7	287.7	287.7	316.5	317.1	317.7	-0.1	0.9	1.6	0.80	0.85	-0.03	0.29	0.51	0.26	0.27	0.28	0.04
2	316.6	316.2	316.1	407.7	407.4		0	0.2		0.10	0.14	0.00	0.07		0.03	0.05	0.04	0.00
2.5	407.7	407.2															0.00	0.00
3																	0.00	0.00
3.5																	0.00	0.00
4																	0.00	0.00

total recovered:

Settling velocity		Fall Distance (m): 0.71								
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)		Average
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3				
-3										
-2.5	20.4	26.1	26.5	0.035	0.027	0.027	0.030	0.005		0.032
-2	25.9	22.8	24.3	0.027	0.031	0.029	0.029	0.002		0.031
-1.5	26.9	28.8	24.3	0.026	0.025	0.029	0.027	0.002		0.029
-1	28.2	26.3	28.3	0.025	0.027	0.025	0.026	0.001		0.026
-0.5	32.9	32	32.2	0.022	0.022	0.022	0.022	0.000		0.022
0	41.8	40.8	44.8	0.017	0.017	0.016	0.017	0.001		0.018
0.5	62.8	54	61.4	0.011	0.013	0.012	0.012	0.001		0.014
1	63.8	55.4	71.2	0.011	0.013	0.010	0.011	0.001		0.012
1.5	87.9	79.3	95.2	0.008	0.009	0.007	0.008	0.001		0.008
2	104.2			0.007			0.007			0.007
2.5	89.7			0.008			0.008			0.005
3										
3.5										
4										

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	20.4	21.4	23.7	0.035	0.033	0.030	0.033	0.002
-2	25.4	21.6	25.3	0.028	0.033	0.028	0.030	0.003
-1.5	23.9	25	23	0.030	0.028	0.031	0.030	0.001
-1	27.9	27.2	27	0.025	0.026	0.026	0.026	0.000
-0.5	28	35.6	32	0.025	0.020	0.022	0.022	0.003
0	38.7	35.6	41.7	0.018	0.020	0.017	0.018	0.001
0.5	46.1	44.3	43.3	0.015	0.016	0.016	0.016	0.001
1	61.8	55	61.1	0.011	0.013	0.012	0.012	0.001
1.5	76.2	99.1	73.5	0.009	0.007	0.010	0.009	0.001
2	83.3			0.009			0.009	
2.5	167.9			0.004			0.004	
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	20	19	23.1	0.036	0.037	0.031	0.035	0.003
-2	20.9	22.4	21.1	0.034	0.032	0.034	0.033	0.001
-1.5	22.7	21.6	24.4	0.031	0.033	0.029	0.031	0.002
-1	26.2	27.3	25.8	0.027	0.026	0.028	0.027	0.001
-0.5	32.4	28.8	31.6	0.022	0.025	0.022	0.023	0.001
0	37.7	44.2	39	0.019	0.016	0.018	0.018	0.001
0.5	48.5	42.3	51.3	0.015	0.017	0.014	0.015	0.002
1	60.5	63.5	57.9	0.012	0.011	0.012	0.012	0.001
1.5	93	118	90.5	0.008	0.006	0.008	0.007	0.001
2	137.5	122.9		0.005	0.006		0.005	0.000
2.5	195.6			0.004			0.004	
3								
3.5								
4								

Food Type POTATO Specific brand/ type Potato (Maris piper)

Particle Size		Total Sample Size (g)														
		506.31	513.36	501.86												
Sieve (phi)	Sieve Weight (g)	Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
		Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3																100.0
-2.5	448.7	461.5	449.6	453.5	12.8	0.9	4.8	6.2	6.1	2.5	0.2	1.0	1.2	1.2	1.1	98.9
-2	451	492.5	498.4	495.5	41.5	47.4	44.5	44.5	3.0	8.2	9.2	8.9	8.8	0.5	8.1	90.8
-1.5	442.7	528.8	564.2	525.6	86.1	121.5	82.9	96.8	21.4	17.0	23.7	16.5	19.1	4.0	17.5	73.3
-1	419.7	568.5	572.7	594.7	148.8	153.0	175.0	158.9	14.1	29.4	29.8	34.9	31.4	3.1	28.8	44.5
-0.5	409.1	530.4	525.7	494.6	121.3	116.6	85.5	107.8	19.5	24.0	22.7	17.0	21.2	3.7	19.5	25.0
0	386.8	448.6	452.3	464.1	61.8	65.5	77.3	68.2	8.1	12.2	12.8	15.4	13.5	1.7	12.4	12.6
0.5	358.5	386.8	389.4	390.0	28.3	30.9	31.5	30.2	1.7	5.6	6.0	6.3	6.0	0.3	5.5	7.2
1	337.5	352.8	360.0	352.9	15.3	22.5	15.4	17.7	4.1	3.0	4.4	3.1	3.5	0.8	3.2	4.0
1.5	294.7															4.0
2	321.6	330.4	330.0	333.1	8.8	8.4	11.5	9.6	1.7	1.7	1.6	2.3	1.9	0.4	1.7	2.2
2.5	414.3															2.2
3	418.3	421.1	420.9	424.7	2.8	2.6	6.4	3.9	2.1	0.6	0.5	1.3	0.8	0.4	0.7	1.5
3.5	263.3															1.5
4	296	314.4	296.5	301.9	18.4	0.5	5.9	8.3	9.2	3.6	0.1	1.2	1.6	1.8	1.5	0.0

Adjusted for missing sieves %	% smaller than
0.0	100.0
1.1	98.9
8.1	90.8
17.5	73.3
28.8	44.5
19.5	25.0
12.4	12.6
5.5	7.2
3.2	4.0
0.9	3.1
0.9	2.2
0.4	1.9
0.4	1.5
0.8	0.8
0.8	0.0

Settling velocity		Fall Distance (m):		0.6							
Run 1											
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)		Average	
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3					
-3											
-2.5	20.62	15.56	19.87	0.029	0.039	0.030	0.033	0.005		0.035	
-2	12.19	12.44	12.19	0.049	0.048	0.049	0.049	0.001		0.048	
-1.5	12.32	14.03	13.38	0.049	0.043	0.045	0.045	0.003		0.047	
-1	15.53	15.19	15.84	0.039	0.039	0.038	0.039	0.001		0.041	
-0.5	19.4	19.6	19.94	0.031	0.031	0.030	0.031	0.000		0.032	
0	24.38	22.81	25.94	0.025	0.026	0.023	0.025	0.002		0.023	
0.5	36.06	44.34	37.25	0.017	0.014	0.016	0.015	0.002		0.016	
1	51.03	54.41	63.35	0.012	0.011	0.009	0.011	0.001		0.011	
1.5											
2											
2.5											
3											
3.5											
4											

Settling velocity Run 2		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3		
-3								
-2.5	14.12	19.41	21.87	0.042	0.031	0.027	0.034	0.008
-2	11.75	12.22	11.75	0.051	0.049	0.051	0.050	0.001
-1.5	14	12.25	12.53	0.043	0.049	0.048	0.047	0.003
-1	14.69	13.9	14.72	0.041	0.043	0.041	0.042	0.001
-0.5	19.47	19.12	17.02	0.031	0.031	0.035	0.032	0.002
0	27.09	28.16	25.75	0.022	0.021	0.023	0.022	0.001
0.5	35.22	34.85	35.16	0.017	0.017	0.017	0.017	0.000
1	48.69	59.31	49.04	0.012	0.010	0.012	0.012	0.001
1.5								
2								
2.5								
3								
3.5								
4								

Settling velocity Run 3		Fall Distance (m): 0.6						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3		
-3								
-2.5	14.69	21.65	13.75	0.041	0.028	0.044	0.037	0.009
-2	13.81	14.07	13.29	0.043	0.043	0.045	0.044	0.001
-1.5	13.37	10.6	13.44	0.045	0.057	0.045	0.049	0.007
-1	13.5	14.62	15.31	0.044	0.041	0.039	0.042	0.003
-0.5	18.84	18.75	18.21	0.032	0.032	0.033	0.032	0.001
0	26.4	26.34	25.03	0.023	0.023	0.024	0.023	0.001
0.5	34.87	38.27	40.34	0.017	0.016	0.015	0.016	0.001
1	52.94	44.28	56.37	0.011	0.014	0.011	0.012	0.002
1.5								
2								
2.5								
3								
3.5								
4								

Food Type **RICE** Specific brand/ type [Rice \(Tilda basmati pouch\)](#)

Particle Size		Total Sample Size (g)																
		498.5	499.2	499.8														
Sieve (phi)	Sieve Weight (g)	Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than		
		Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3						
-3										0.0	0.0	0.0	0.0	0.0	0.0	100.0		
-2.5	448.7									0.0	0.0	0.0	0.0	0.0	0.0	100.0		
-2	451	455.4	452.1	451.3	4.4	1.1	0.3	1.9	2.2	0.9	0.2	0.1	0.4	0.4	0.3	99.7		
-1.5	442.7	445.8	444.3	445.8	3.1	1.6	3.1	2.6	0.9	0.6	0.3	0.6	0.5	0.2	0.5	99.2		
-1	419.7	870.3	856.4	880.6	450.6	436.7	460.9	449.4	12.1	90.4	87.5	92.2	90.0	2.4	78.2	21.0		
-0.5	409.1	486.6	472.0	466.8	77.5	62.9	57.7	66.0	10.3	15.5	12.6	11.5	13.2	2.1	11.5	9.5		
0	386.8	422.3	414.1	404.1	35.5	27.3	17.3	26.7	9.1	7.1	5.5	3.5	5.4	1.8	4.6	4.9		
0.5	358.5	360.2	362.6	365.5	1.7	4.1	7.0	4.3	2.7	0.3	0.8	1.4	0.9	0.5	0.7	4.1		
1	337.5	344.4	343.3	342.6	6.9	5.8	5.1	5.9	0.9	1.4	1.2	1.0	1.2	0.2	1.0	3.1		
1.5	294.7	297.3	297.0	298.5	2.6	2.3	3.8	2.9	0.8	0.5	0.5	0.8	0.6	0.2	0.5	2.6		
2	321.6	326.2	327.8	324.2	4.6	6.2	2.6	4.5	1.8	0.9	1.2	0.5	0.9	0.4	0.8	1.8		
2.5	414.3	419.2	415.0	417.3	4.9	0.7	3.0	2.9	2.1	1.0	0.1	0.6	0.6	0.4	0.5	1.3		
3	418.3	423.7	421.0	422.2	5.4	2.7	3.9	4.0	1.4	1.1	0.5	0.8	0.8	0.3	0.7	0.6		
3.5	263.3	265.8	265.0	265.7	2.5	1.7	2.4	2.2	0.4	0.5	0.3	0.5	0.4	0.1	0.4	0.2		
4	296	297.3	296.3	298.4	1.3	0.3	2.4	1.3	1.1	0.3	0.1	0.5	0.3	0.2	0.2	0.0		

Settling velocity Run 1		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3		
-3								
-2.5								
-2	10.44	10.54	11.06	0.068	0.067	0.064	0.067	0.002
-1.5	11	11.47	10.84	0.065	0.062	0.065	0.064	0.002
-1	10.85	10.13	9.75	0.065	0.070	0.073	0.069	0.004
-0.5	10.88	11.09	10.00	0.065	0.064	0.071	0.067	0.004
0	16.75	17.5	16.41	0.042	0.041	0.043	0.042	0.001
0.5	22.47	22.53	24.13	0.032	0.032	0.029	0.031	0.001
1	32.25	35.07	33.97	0.022	0.020	0.021	0.021	0.001
1.5	55.9	61.09	62.81	0.013	0.012	0.011	0.012	0.001
2	102.8	88.4	89.8	0.007	0.008	0.008	0.008	0.001
2.5								
3								
3.5								
4								

Average Average
0.065
0.065
0.069
0.066
0.044
0.032
0.022
0.013
0.008

Settling velocity		Fall Distance (m):						
Run 2		0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3		
-3								
-2.5								
-2	10.72	10.94	10.94	0.066	0.065	0.065	0.065	0.001
-1.5	10.59	10.63	11.13	0.067	0.067	0.064	0.066	0.002
-1	10.13	10.16	10.59	0.070	0.070	0.067	0.069	0.002
-0.5	10.53	10.75	10.65	0.067	0.066	0.067	0.067	0.001
0	14.78	17.13	17.94	0.048	0.041	0.040	0.043	0.004
0.5	22.44	20.5	21.47	0.032	0.035	0.033	0.033	0.001
1	32.8	33.4	32.6	0.022	0.021	0.022	0.022	0.000
1.5	59.09	56.34	55.21	0.012	0.013	0.013	0.012	0.000
2	88.54	84.5	91.53	0.008	0.008	0.008	0.008	0.000
2.5								
3								
3.5								
4								

Settling velocity		Fall Distance (m):						
Run 3		0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3		
-3								
-2.5								
-2	10.69	10.94	11.69	0.066	0.065	0.061	0.064	0.003
-1.5	10.34	10.34	11.39	0.069	0.069	0.062	0.067	0.004
-1	10.32	10.15	10.75	0.069	0.070	0.066	0.068	0.002
-0.5	11.38	10.84	10.34	0.062	0.065	0.069	0.066	0.003
0	15.5	15.47	13.28	0.046	0.046	0.053	0.048	0.004
0.5	21.97	22.22	22.83	0.032	0.032	0.031	0.032	0.001
1	31.44	30.74	32.1	0.023	0.023	0.022	0.023	0.000
1.5	52.68	51.97	53.31	0.013	0.014	0.013	0.013	0.000
2	74.51	71.14	76.4	0.010	0.010	0.009	0.010	0.000
2.5								
3								
3.5								
4								

Food Type Sunflower Seed Specific brand/ type [Sunflower seeds \(Tesco\)](#)

Particle Size		Total Sample Size (g)														
		500	500	500.1												
Sieve (phi)	Sieve Weight (g)	Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
		Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	428.7	428.7	428.7	428.7						0.0	0.0	0.0	0.0	0.0	0.0	100.0
-2.5	446.8	446.8	446.8	446.8						0.0	0.0	0.0	0.0	0.0	0.0	100.0
-2	451.4	474.2	462.2	480.0	22.8	10.8	28.6	20.7	9.1	4.6	2.2	5.7	4.1	1.8	3.1	96.9
-1.5	440.6	647.3	566.9	625.9	206.7	126.3	185.3	172.8	41.6	41.3	25.3	37.1	34.6	8.3	25.9	70.9
-1	419.5	642.5	627.9	603.2	223.0	208.4	183.7	205.0	19.9	44.6	41.7	36.7	41.0	4.0	30.8	40.1
-0.5	531.5	661.2	654.4	676.9	129.7	122.9	145.4	132.7	11.5	25.9	24.6	29.1	26.5	2.3	19.9	20.2
0	390.4	463.7	471.2	434.9	73.3	80.8	44.5	66.2	19.2	14.7	16.2	8.9	13.2	3.8	9.9	10.3
0.5	360.4	388.1	369.8	375.9	27.7	9.4	15.5	17.5	9.3	5.5	1.9	3.1	3.5	1.9	2.6	7.6
1	336.6	343.9	339.5	339.1	7.3	2.9	2.5	4.2	2.7	1.5	0.6	0.5	0.8	0.5	0.6	7.0
1.5					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
2	325.6	370.0	352.2	349.9	44.4	26.6	24.3	31.8	11.0	8.9	5.3	4.9	6.4	2.2	4.8	2.2
2.5					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2
3	420.1	431.3	446.1	425.3	11.2	26.0	5.2	14.1	10.7	2.2	5.2	1.0	2.8	2.1	2.1	0.1
3.5					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
4	296	297.3	296.9	296.0	1.3	0.9	0.0	0.7	0.7	0.3	0.2	0.0	0.1	0.1	0.1	0.0

Adjusted for missing sieves	% smaller than
	%
0.0	100.0
0.0	100.0
3.1	96.9
25.9	70.9
30.8	40.1
19.9	20.2
9.9	10.3
2.6	7.6
0.6	7.0
2.4	4.6
2.4	2.2
1.1	1.2
1.1	0.1
0.1	0.1
0.1	0.0

Settling velocity	Fall Distance (m):	0.71
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Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5								
-2	15.3	14.3	14.7	0.046	0.050	0.048	0.048	0.002
-1.5	16.4	16.6	17.1	0.043	0.043	0.042	0.043	0.001
-1	18.8	19.3	18.1	0.038	0.037	0.039	0.038	0.001
-0.5	25.1	27.1	25.7	0.028	0.026	0.028	0.027	0.001
0	32.2	33	34.6	0.022	0.022	0.021	0.021	0.001
0.5	50.9	48.1	50.3	0.014	0.015	0.014	0.014	0.000
1	75.8	73.3	78.9	0.009	0.010	0.009	0.009	0.000
1.5	186.33	187.1	190.1	0.004	0.004	0.004	0.004	0.000
2								
2.5								
3								
3.5								
4								

Average
Average
0.051
0.045
0.039
0.029
0.021
0.015
0.010
0.004
0.001
0.001

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5								
-2	14.7	14.6	13.5	0.048	0.049	0.053	0.050	0.002
-1.5	16.3	15.9	16.1	0.044	0.045	0.044	0.044	0.001
-1	19.7	20.2	19.1	0.036	0.035	0.037	0.036	0.001
-0.5	22.4	23.7	24.7	0.032	0.030	0.029	0.030	0.001
0	34.7	33.1	36.2	0.020	0.021	0.020	0.021	0.001
0.5	45.6	48.5	49.5	0.016	0.015	0.014	0.015	0.001
1	68.7	69.1	68.2	0.010	0.010	0.010	0.010	0.000
1.5	158	171	171	0.004	0.004	0.004	0.004	0.000
2			480			0.001	0.001	
2.5			360			0.001	0.001	
3								
3.5								
4								

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5								
-2	12.9	12.4	14.3	0.055	0.057	0.050	0.054	0.004
-1.5	14.7	14.1	16.1	0.048	0.050	0.044	0.048	0.003
-1	16.1	17.7	17.3	0.044	0.040	0.041	0.042	0.002
-0.5	23.8	25.8	24.7	0.030	0.028	0.029	0.029	0.001
0	34.9	34.8	34.9	0.020	0.020	0.020	0.020	0.000
0.5	48.3	45.9	47	0.015	0.015	0.015	0.015	0.000
1	63.3	61.8	63.7	0.011	0.011	0.011	0.011	0.000
1.5	164.33	172.6	173.91	0.004	0.004	0.004	0.004	0.000
2			600			0.000	0.000	
2.5			600			0.000	0.000	
3								
3.5								
4								

Food Type Bread Specific brand/ type [White bread \(Warburton's toastie\)](#)

Particle Size				Total Sample Size (g)														
				300	300.1	300												
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)		Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	427.3	427.3	427.3	427.3	427.3	427.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
-2.5	448.5	444.3	445.2	448.7	445.5	446.4	0.2	1.2	1.2	0.9	0.6	0.1	0.4	0.4	0.3	0.2	0.2	99.8
-2	446.5	447.0	446.9	452.1	449.2	449.1	5.6	2.2	2.2	3.3	2.0	1.9	0.7	0.7	1.1	0.7	0.9	98.9
-1.5	436.8	438.3	438.3	444.5	444.5	448.3	7.7	6.2	10.0	8.0	1.9	2.6	2.1	3.3	2.7	0.6	2.0	96.9
-1	415.4	416.4	415.4	426.1	432.0	422.7	10.7	15.6	7.3	11.2	4.2	3.6	5.2	2.4	3.7	1.4	2.9	94.0
-0.5	525.5	526.0	525.7	536.1	550.2	556.3	10.6	24.2	30.6	21.8	10.2	3.5	8.1	10.2	7.3	3.4	5.6	88.4
0	384.9	387.7	386.4	409.6	501.9	421.9	24.7	114.2	35.5	58.1	48.9	8.2	38.1	11.8	19.4	16.3	14.9	73.6
0.5	353.0	351.8	351.9	368.5	480.4	400.9	15.5	128.6	49.0	64.4	58.1	5.2	42.9	16.3	21.5	19.4	16.5	57.1
1	334.4	333.7	333.3	392.3	425.5	412.7	57.9	91.8	79.4	76.4	17.2	19.3	30.6	26.5	25.5	5.7	19.5	37.5
1.5	290.7	295.3	289.7	329.8	337.6	354.8	39.1	42.3	65.1	48.8	14.2	13.0	14.1	21.7	16.3	4.7	12.5	25.0
2	318.9	315.7	318.1	388.5	346.5	351.3	69.6	30.8	33.2	44.5	21.7	23.2	10.3	11.1	14.8	7.2	11.4	13.7
2.5	413.0	411.6	411.9	440.2	420.0	426.9	27.2	8.4	15.0	16.9	9.5	9.1	2.8	5.0	5.6	3.2	4.3	9.3
3	418.3	416.9	417.1	443.7	421.6	422.6	25.4	4.7	5.5	11.9	11.7	8.5	1.6	1.8	4.0	3.9	3.0	6.3
3.5	261.7	260.0	261.7	276.7	260.0	262.8	15.0	0.0	1.1	5.4	8.4	5.0	0.0	0.4	1.8	2.8	1.4	4.9
4	295.3	293.0	292.2	342.4	299.3	296.5	47.1	6.3	4.3	19.2	24.2	15.7	2.1	1.4	6.4	8.1	4.9	0.0

Settling velocity		Fall Distance (m): 0.71								
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	Average	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3				
-3										
-2.5	29.2	25.8	26.6	0.024	0.028	0.027	0.026	0.002	0.038	
-2	21.7	19.4	19.6	0.033	0.037	0.036	0.035	0.002	0.035	
-1.5	12.8	15.7	14.2	0.055	0.045	0.050	0.050	0.005	0.040	
-1	12.9	13.3	14.7	0.055	0.053	0.048	0.052	0.004	0.038	
-0.5	12.9	14.5	13.2	0.055	0.049	0.054	0.053	0.003	0.036	
0	17.2	16	15.5	0.041	0.044	0.046	0.044	0.002	0.029	
0.5	17.5	19.3	15.1	0.041	0.037	0.047	0.041	0.005	0.024	
1	20	23.3	23.9	0.036	0.030	0.030	0.032	0.003	0.019	
1.5	28.3	23.5	26	0.025	0.030	0.027	0.028	0.003	0.019	
2	23.2	26.5	19.8	0.031	0.027	0.036	0.031	0.005	0.018	
2.5	18.5	24.5	27	0.038	0.029	0.026	0.031	0.006	0.019	
3	32.9	39.3	44.8	0.022	0.018	0.016	0.018	0.003	0.016	
3.5	61.7	86.2	120.1	0.012	0.008	0.006	0.009	0.003	0.011	
4	153.4	197.8	145.2	0.005	0.004	0.005	0.004	0.001	0.005	

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	32	19.5		0.022	0.036		0.029	0.010
-2	18.3	16.4		0.039	0.043		0.041	0.003
-1.5	20.7	19.8	21	0.034	0.036	0.034	0.035	0.001
-1	21.5	22.4	21.1	0.033	0.032	0.034	0.033	0.001
-0.5	26.2	27.6	25.5	0.027	0.026	0.028	0.027	0.001
0	29.3	30.4	26.5	0.024	0.023	0.027	0.025	0.002
0.5	45.1	47	42.7	0.016	0.015	0.017	0.016	0.001
1	67.4	61.9	63.6	0.011	0.011	0.011	0.011	0.000
1.5	44.9	49.1	51.4	0.016	0.014	0.014	0.015	0.001
2	67.3	71.9	52.9	0.011	0.010	0.013	0.011	0.002
2.5	50.2	54.3	51.7	0.014	0.013	0.014	0.014	0.001
3	42.1	43.8	37.8	0.017	0.016	0.019	0.017	0.001
3.5								
4	115	91	98.3	0.006	0.008	0.007	0.007	0.001

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3								
-2.5	11.9			0.060			0.060	
-2	25.7	26.2		0.028	0.027		0.027	0.000
-1.5	21.3	21.6	19.1	0.033	0.033	0.037	0.034	0.002
-1	25.5	24.1	24.2	0.028	0.029	0.029	0.029	0.001
-0.5	26.3	24.9	27.1	0.027	0.029	0.026	0.027	0.001
0	36	37.1	36.4	0.020	0.019	0.020	0.019	0.000
0.5	49.4	45.4	42.8	0.014	0.016	0.017	0.016	0.001
1	54.6	45.6	45.9	0.013	0.016	0.015	0.015	0.001
1.5	54	50.8	49.4	0.013	0.014	0.014	0.014	0.001
2	53.2	75.4	44.9	0.013	0.009	0.016	0.013	0.003
2.5	68.1	58.2	50.5	0.010	0.012	0.014	0.012	0.002
3	59.2	55.3	54.9	0.012	0.013	0.013	0.013	0.001
3.5	55.8			0.013			0.013	
4	221.8	140.3	158.1	0.003	0.005	0.004	0.004	0.001

Food Type **Mackerel** Specific brand/ type Gutted and supplied in oven bag by fishmonger, cooked in bag at 200C for 15 mins

Particle Size				Total Sample Size (g)														
Sieve (phi)	Sieve Weight (g)			Sieve and Sample (g)			Sample (g)			Average (g)	S.D. (g)	Sample (%)			Av %	SD %	%	% smaller than
	1	2	3	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3			Run 1	Run 2	Run 3				
-3	425.4	423.9	423.5	430.3	429.4	427.3	4.9	5.5	3.8	4.7	0.9	1.7	1.2	0.9	1.2	0.4	2.2	97.8
-2.5	444.5	445.4	444.3	448.9	449.7	447.8	4.4	4.3	3.5	4.1	0.5	1.5	0.9	0.8	1.1	0.4	1.9	95.9
-2	446.6	446.5	446.0	454.0	457.1	454.7	7.4	10.6	8.7	8.9	1.6	2.5	2.3	2.1	2.3	0.2	4.0	91.8
-1.5	437.8	437.8	437.7	451.8	449.4	446.9	14.0	11.6	9.2	11.6	2.4	4.7	2.5	2.2	3.1	1.4	5.6	86.3
-1	414.5	415.0	414.9	436.6	430.9	426.2	22.1	15.9	11.3	16.4	5.4	7.5	3.4	2.7	4.5	2.6	8.0	78.2
-0.5	524.2	525.2	524.7	540.8	539.6	532.6	16.6	14.4	7.9	13.0	4.5	5.6	3.1	1.9	3.5	1.9	6.3	72.0
0	382.9	382.3	383.1	427.4	410.9	395.3	44.5	28.6	12.2	28.4	16.2	15.1	6.1	2.9	8.0	6.3	14.2	57.7
0.5	351.7	351.7	352.2	386.7	386.0	376.0	35.0	34.3	23.8	31.0	6.3	11.9	7.3	5.7	8.3	3.2	14.7	43.1
1	332.4	332.7	332.3	361.1	365.4	344.1	28.7	32.7	11.8	24.4	11.1	9.7	7.0	2.8	6.5	3.5	11.5	31.5
1.5	288.7	288.9	291.2	310.3	308.7	301.1	21.6	19.8	9.9	17.1	6.3	7.3	4.2	2.4	4.6	2.5	8.2	23.3
2	317.2	319.6	317.5	335.3	343.5	331.6	18.1	23.9	14.1	18.7	4.9	6.1	5.1	3.4	4.9	1.4	8.6	14.7
2.5	410.7	411.3	410.7	421.2	428.9	418.7	10.5	17.6	8.0	12.0	5.0	3.6	3.7	1.9	3.1	1.0	5.4	9.2
3	416.4	416.8	416.8	428.0	433.5	429.5	11.6	16.7	12.7	13.7	2.7	3.9	3.6	3.0	3.5	0.5	6.2	3.0
3.5	261.7	261.0	261.2	265.0	270.7	269.2	3.3	9.7	8.0	7.0	3.3	1.1	2.1	1.9	1.7	0.5	3.0	0.0
4	293.2	293.2	293.2	293.2		293.2	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Settling velocity		Fall Distance (m): 0.71								
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)	Average	Average
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3				
-3	14.6	15.5	17.6	0.049	0.046	0.040	0.045	0.004		0.047
-2.5	12.9	12.6	12.1	0.055	0.056	0.059	0.057	0.002		0.050
-2	9.4	8.5	10.2	0.076	0.084	0.070	0.076	0.007		0.070
-1.5	12.1	13.9	10.7	0.059	0.051	0.066	0.059	0.008		0.058
-1	17.1	14.8	14.8	0.042	0.048	0.048	0.046	0.004		0.043
-0.5	16.9	14.9	19.3	0.042	0.048	0.037	0.042	0.005		0.036
0	37.7	38	37.1	0.019	0.019	0.019	0.019	0.000		0.020
0.5	37.6	36.9	37.7	0.019	0.019	0.019	0.019	0.000		0.015
1	38.4	31.8	37.9	0.018	0.022	0.019	0.020	0.002		0.016
1.5	39	33.8	34.6	0.018	0.021	0.021	0.020	0.001		0.017
2	45.5	44.7	42.1	0.016	0.016	0.017	0.016	0.001		0.017
2.5	35.6	39	36	0.020	0.018	0.020	0.019	0.001		0.017
3	39.9	37	44.5	0.018	0.019	0.016	0.018	0.002		0.017
3.5	47.3	40.5		0.015	0.018		0.016	0.002		0.015
4										

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	11.9	11.1	16.1	0.060	0.064	0.044	0.056	0.010
-2.5	16.9	14.2	16.3	0.042	0.050	0.044	0.045	0.004
-2	13.7	10.3	10.4	0.052	0.069	0.068	0.063	0.010
-1.5	12.3	13.7	10	0.058	0.052	0.071	0.060	0.010
-1	18.3	19.3	20.1	0.039	0.037	0.035	0.037	0.002
-0.5	27.1	22.7	18.2	0.026	0.031	0.039	0.032	0.006
0	39	34.1	34.8	0.018	0.021	0.020	0.020	0.001
0.5	47.5	53.8	55.2	0.015	0.013	0.013	0.014	0.001
1	53	45.5	46.7	0.013	0.016	0.015	0.015	0.001
1.5	43.7	45.3	41.5	0.016	0.016	0.017	0.016	0.001
2	32.1	31	33.6	0.022	0.023	0.021	0.022	0.001
2.5	41.7	40.2	42.5	0.017	0.018	0.017	0.017	0.000
3	38.5	32.3	37.3	0.018	0.022	0.019	0.020	0.002
3.5	58.8	51.4	37.7	0.012	0.014	0.019	0.015	0.004
4	75.1			0.009				

Settling velocity		Fall Distance (m): 0.71						
Sieve (phi)	Fall time (s)			Settling velocity (m/s)			Average (m/s)	S.D. (m/s)
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3		
-3	20.5	18.8	13.8	0.035	0.038	0.051	0.041	0.009
-2.5	13.2	16.9	15.2	0.054	0.042	0.047	0.048	0.006
-2	10	10.8	9.5	0.071	0.066	0.075	0.070	0.005
-1.5	11.5	15.3	12.3	0.062	0.046	0.058	0.055	0.008
-1	18	15.1	13.6	0.039	0.047	0.052	0.046	0.006
-0.5	20	20.8	21.4	0.036	0.034	0.033	0.034	0.001
0	27.9	34.3	32.7	0.025	0.021	0.022	0.023	0.003
0.5	56.5	60.1	59.8	0.013	0.012	0.012	0.012	0.000
1	54.9	62.4	53.9	0.013	0.011	0.013	0.012	0.001
1.5	53.3	51.4	48.7	0.013	0.014	0.015	0.014	0.001
2	58.7	53.7	46.8	0.012	0.013	0.015	0.013	0.002
2.5	56.7	40.7	49.1	0.013	0.017	0.014	0.015	0.002
3	54.7	40	49.4	0.013	0.018	0.014	0.015	0.002
3.5	64.5	50.9	48.5	0.011	0.014	0.015	0.013	0.002
4								

Appendix C: Summary data

Particle Sizes

Sieve (phi)	Sieve (mm)	Apple % mass	Beef % mass	Broccoli Stem % mass	Cabbage % mass	Carrot % mass	Cheese % mass	Celery stem % mass	Chicken Carcass % mass	Cornflakes % mass	Egg Shells % mass	Orange peel % mass	Pasta % mass	Pineapple % mass	Potato % mass	Rice % mass	Sunflower Seeds % mass	White Bread % mass	Whole Mackerel % mass
-3	8.00	0.00	0.00	0.19	0.00	0.00	0.00	0.52	1.04	0.00	0.12	0.35	0.00	0.00	0.00	0.00	0.00	0.00	2.21
-2.5	5.66	5.06	5.29	1.75	13.16	0.62	0.06	1.12	3.94	0.04	0.27	7.74	13.07	1.27	1.12	0.00	0.00	0.22	1.92
-2	4.00	16.46	13.32	11.97	20.67	6.44	0.39	6.03	17.85	1.75	2.09	24.83	42.79	31.23	8.05	0.34	3.11	0.85	4.05
-1.5	2.83	42.36	27.43	18.12	23.48	15.09	1.79	12.19	15.01	5.08	7.22	14.64	9.50	21.72	17.51	0.45	25.95	2.04	5.56
-1	2.00	11.68	14.43	21.33	12.80	27.41	13.90	29.29	19.71	9.40	18.65	17.02	8.21	14.90	28.81	78.20	30.80	2.87	8.03
-0.5	1.41	7.21	19.66	16.94	9.06	23.49	22.34	22.43	13.89	15.90	31.04	14.52	5.97	10.92	19.51	11.49	19.93	5.58	6.25
0	1.00	4.02	6.87	13.33	7.15	12.04	12.29	17.00	14.72	16.99	24.22	8.87	2.75	9.62	12.36	4.65	9.94	14.88	14.24
0.5	0.71	1.35	1.03	6.93	1.66	6.72	6.36	7.94	5.75	18.89	10.62	3.88	3.02	4.68	5.48	0.74	2.63	16.47	14.69
1	0.50	2.93	2.89	5.74	3.55	4.09	8.53	3.44	4.62	15.16	3.59	4.17	3.56	4.18	3.21	1.03	0.64	19.54	11.53
1.5	0.35	7.89	7.34	1.54	6.93	1.42	15.51	0.05	0.61	6.42	0.68	2.09	8.09	1.17	0.87	0.50	2.39	12.50	8.22
2	0.25	-0.12	0.61	1.54	0.45	1.42	7.52	0.00	0.61	4.21	0.68	1.13	0.54	0.28	0.87	0.78	2.39	11.40	8.63
2.5	0.18	0.38	0.90	0.26	0.21	0.35	7.54	0.00	0.90	3.37	0.23	0.52	1.62	0.04	0.36	0.50	1.06	4.32	5.45
3	0.13	-0.13	0.00	0.26	-0.05	0.35	1.15	0.00	0.90	2.04	0.23	0.21	0.08	0.00	0.36	0.70	1.06	3.04	6.22
3.5	0.09	0.78	0.29	0.05	0.92	0.28	2.61	0.00	0.21	0.56	0.18	0.03	0.79	0.00	0.75	0.38	0.06	1.37	3.01
4	0.06	0.13	-0.04	0.05	0.00	0.28	0.01	0.00	0.21	0.19	0.18	0.00	0.01	0.00	0.75	0.23	0.06	4.92	0.00

Settling Velocities

Sieve (phi)	Sieve (mm)	Apple Set Vel (m/s)	Beef Set Vel (m/s)	Broccoli Stem Set Vel (m/s)	Cabbage Set Vel (m/s)	Carrot Set Vel (m/s)	Cheese Set Vel (m/s)	Celery stem Set Vel (m/s)	Chicken Carcass Set Vel (m/s)	Cornflakes Set Vel (m/s)	Egg Shells Set Vel (m/s)	Orange peel Set Vel (m/s)	Pasta Set Vel (m/s)	Pineapple Set Vel (m/s)	Potato Set Vel (m/s)	Rice Set Vel (m/s)	Sunflower Seeds Set Vel (m/s)	White Bread Set Vel (m/s)	Whole Mackerel Set Vel (m/s)
-3	8.00	0.0212	0.0151					0.0134	0.0511		0.0754	0.0298							0.0474
-2.5	5.66	0.0208	0.0230	0.0232	0.0358	0.0267		0.0134	0.0481	0.0403	0.0800	0.0411	0.0853	0.0323	0.0345			0.0384	0.0498
-2	4.00	0.0224	0.0235	0.0244	0.0270	0.0262	0.0109	0.0169	0.0459	0.0472	0.1020	0.0394	0.0934	0.0307	0.0477	0.0653	0.0506	0.0345	0.0699
-1.5	2.83	0.0141	0.0233	0.0194	0.0243	0.0234	0.0325	0.0145	0.0386	0.0462	0.1282	0.0362	0.0748	0.0292	0.0469	0.0655	0.0447	0.0398	0.0581
-1	2.00	0.0140	0.0250	0.0162	0.0209	0.0186	0.0307	0.0120	0.0382	0.0422	0.1177	0.0303	0.0657	0.0262	0.0406	0.0689	0.0386	0.0380	0.0430
-0.5	1.41	0.0141	0.0249	0.0145	0.0180	0.0131	0.0273	0.0095	0.0315	0.0358	0.1287	0.0239	0.0540	0.0225	0.0318	0.0663	0.0287	0.0356	0.0362
0	1.00	0.0103	0.0165	0.0099	0.0114	0.0092	0.0203	0.0074	0.0303	0.0293	0.1226	0.0169	0.0374	0.0176	0.0234	0.0445	0.0207	0.0294	0.0204
0.5	0.71	0.0105	0.0117	0.0082	0.0074	0.0073	0.0132	0.0049	0.0258	0.0214	0.1138	0.0114	0.0286	0.0143	0.0162	0.0319	0.0147	0.0243	0.0149
1	0.50	0.0088	0.0068	0.0059	0.0060		0.0079	0.0057	0.0225	0.0171	0.0955	0.0091	0.0180	0.0117	0.0114	0.0217	0.0103	0.0192	0.0157
1.5	0.35	0.0070	0.0042	0.0048	0.0039		0.0040	0.0101	0.0197	0.0087	0.0812	0.0070	0.0107	0.0080		0.0126	0.0041	0.0187	0.0167
2	0.25			0.0037	0.0025		0.0029	0.0167	0.0169	0.0070	0.0669	0.0070	0.0066	0.0069		0.0084	0.0005	0.0184	0.0172
2.5	0.18						0.0019		0.0096	0.0063	0.0503	0.0081	0.0034	0.0053			0.0005	0.0190	0.0171
3	0.13						0.0009		0.0023		0.0337	0.0075		0.0000				0.0161	0.0175
3.5	0.09										0.0309	0.0057		0.0000				0.0106	0.0148
4	0.06										0.0281			0.0000				0.0052	