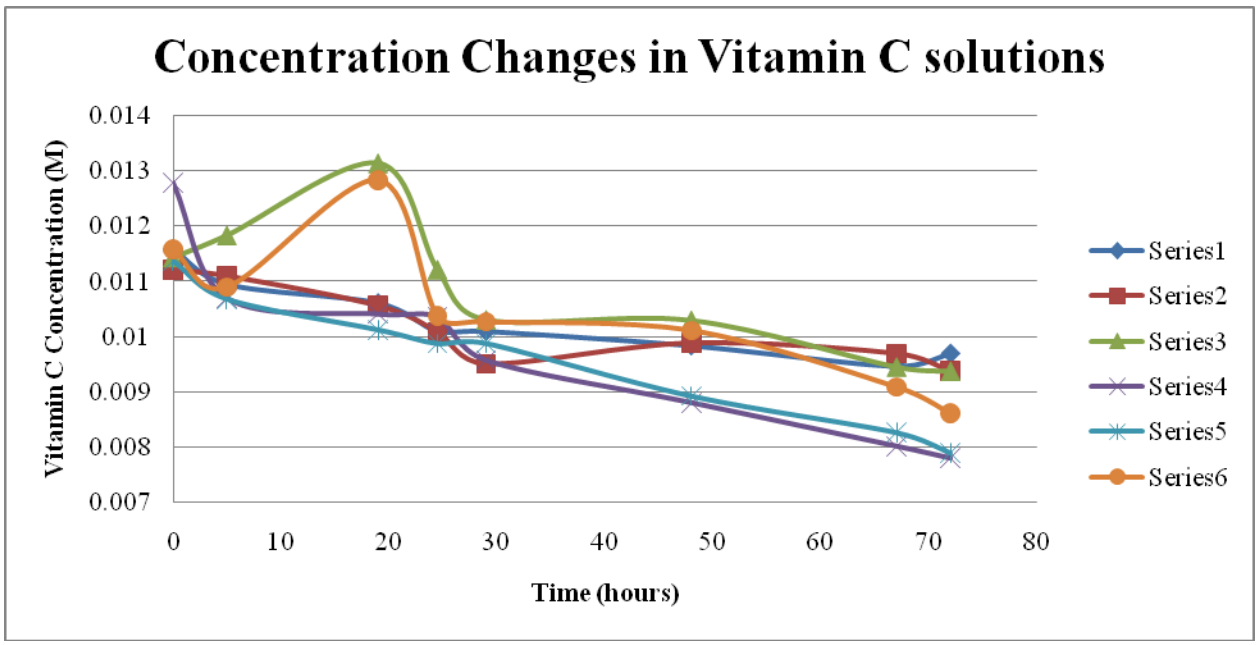
Chem 128L Laboratory B – Degradation of Vitamin C Data

Initial step was compilation of all the data for Part Three of the experiment

Table I: Vitamin C concentration vs Time

	Control	visible	UV	56	47	36
time (hr)	Soln A	Soln B	Soln C	Soln D	Soln E	Soln F
Calculated	0.011389	0.011359	0.011508	0.01139	0.011326	0.01158
0	0.01158	0.01121	0.01143	0.0128	0.011379	0.01158
5	0.01095	0.0111	0.011833	0.0107	0.010687	0.0109
19	0.01061	0.01056	0.01314	0.01041	0.01013	0.01284
24.5	0.0101	0.01008	0.01121	0.01036	0.00988	0.01037
29	0.0101	0.0095	0.0103	0.00957	0.009884	0.010271
48	0.00984	0.00988	0.01029	0.0088	0.00893	0.01011
67	0.00947	0.00969	0.009446	0.008009	0.008268	0.009086
72	0.0097	0.009368	0.009368	0.00779	0.0079	0.008607

Plotting the data showed some initial trends and a few worrying data points



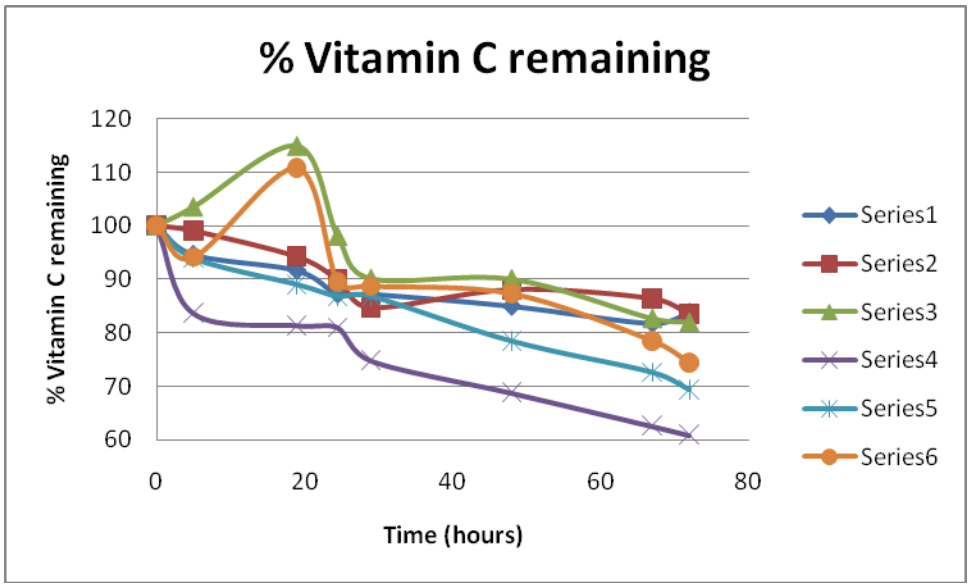
What we are illustrating here is the change in vitamin C concentration but all our solutions started somewhat different in concentration so we need to normalize this data and so we convert to % vitamin C remaining by dividing each solution by the initial concentration and multiplying by 100.

As a result, all solutions now start at equivalent vitamin C amounts of 100%

Table II: % Vitamin Remaining

	Control	visible	UV	56	47	36
time (hr)	Soln A	Soln B	Soln C	Soln D	Soln E	Soln F
Calculated	100	100	100	100	100	100
0	100	100	100	100	100	100
5	94.55959	99.01873	103.5258	83.59375	93.91862	94.12781
19	91.62349	94.20161	114.9606	81.32813	89.02364	110.8808
24.5	87.21934	89.91971	98.07524	80.9375	86.82661	89.55095
29	87.21934	84.74576	90.11374	74.76563	86.86176	88.69603
48	84.97409	88.13559	90.02625	68.75	78.4779	87.3057
67	81.77893	86.44068	82.64217	62.57031	72.66016	78.46287
72	83.76511	83.56824	81.95976	60.85938	69.42614	74.32642

This data is then plotted as well.



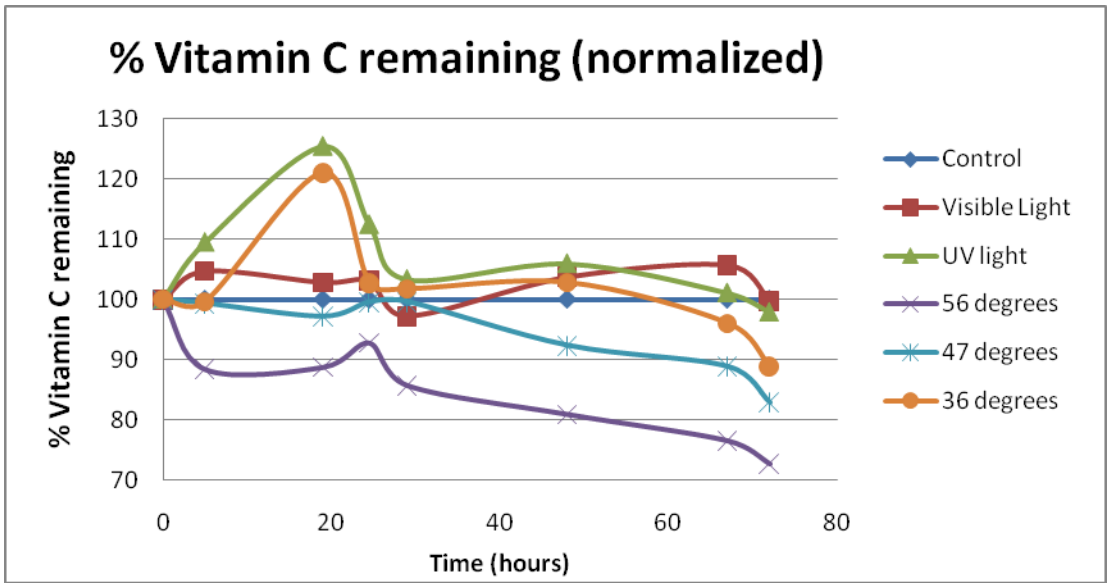
Still a couple of worrying points but the data does show an overall trend in decreasing Vitamin C concentration. Worth noting is the fact that our control does decrease over time showing degradation occurring in solution so can we factor this is to isolate how much our solutions change in concentration over and above the changes observed by the control?

We can do this by dividing each % vitamin C by the concentration at that time. This normalizes the control to 100 % concentration at a given time and the others show how much the changes are occurring over and above the control.

Table III: Normalized % Vitamin Remaining

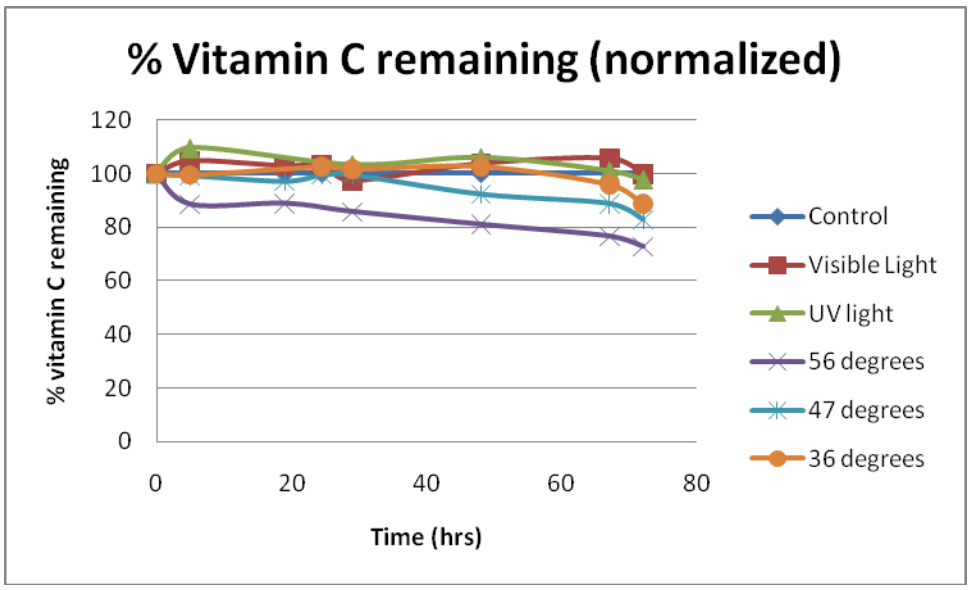
	Control	visible	UV	56	47	36
time (hr)	Soln A	Soln B	Soln C	Soln D	Soln E	Soln F
Calculated	100	100	100	100	100	100
0	100	100	100	100	100	100
5	100	104.7157	109.4821	88.40325	99.32216	99.54338
19	100	102.8138	125.4707	88.7634	97.16246	121.0179
24.5	100	103.0961	112.4467	92.79765	99.54972	102.6733
29	100	97.16395	103.3185	85.72138	99.59002	101.6931
48	100	103.7205	105.9455	80.90701	92.35509	102.7439
67	100	105.7004	101.0556	76.51153	88.84949	95.94509
72	100	99.76497	97.84474	72.6548	82.88192	88.73196

We plot this data again.

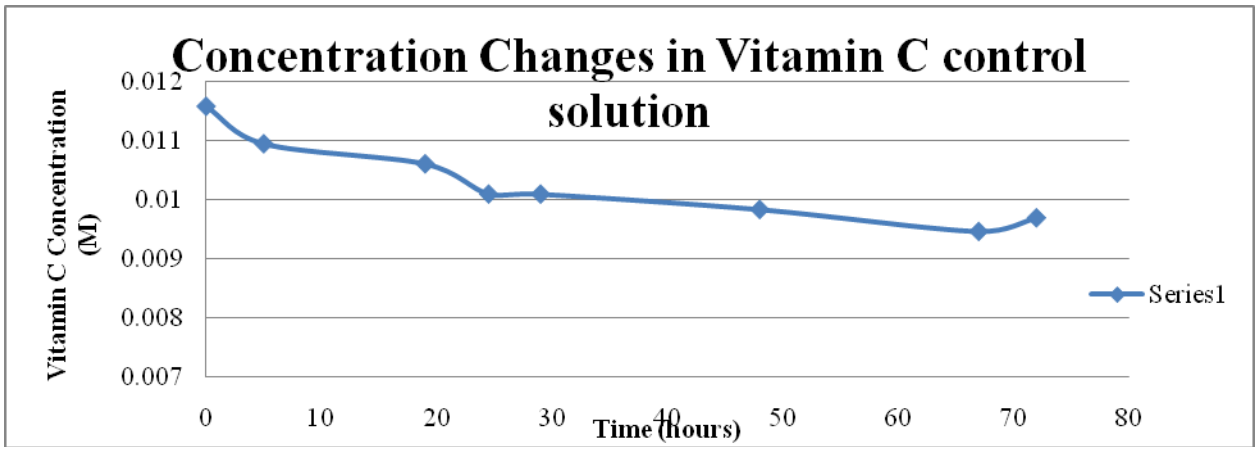


And at this we can see the control at each time remains as 100%. Now we have to try apply some judicious editing of the data removing an points that may be obviously artifactual in nature.

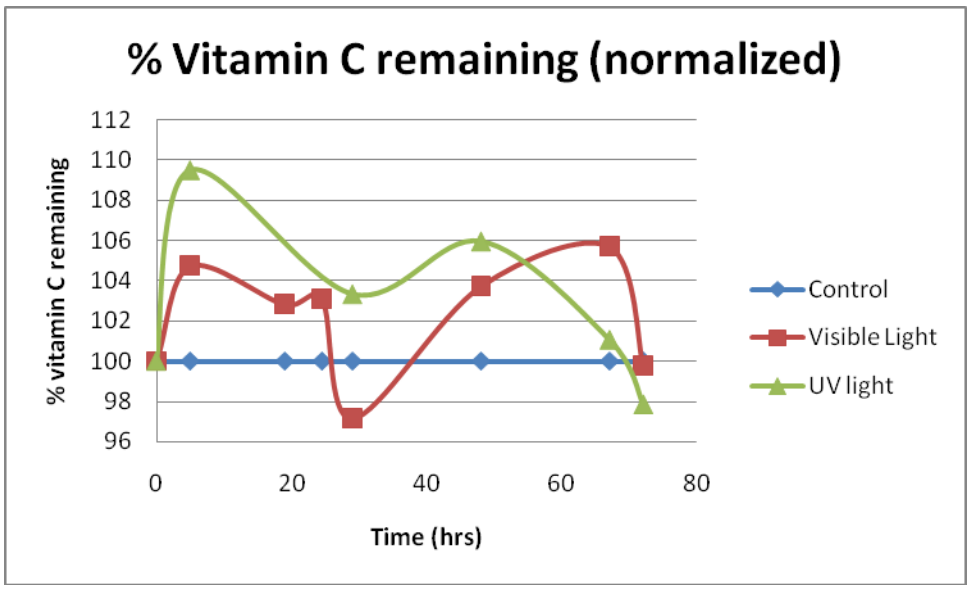
The two points at ~ 20 hours for UV light and 36 degrees are obviously anomalously high so we remove these along with the 56 degrees point at 24 hours to give us the plot shown below:



Now our data processing is over, let's consider what the data is telling us. The earlier plot showed that in the absence of light and heat, our control sample showed degradation (see example below) but how much is this degradation enhanced by light or heat?

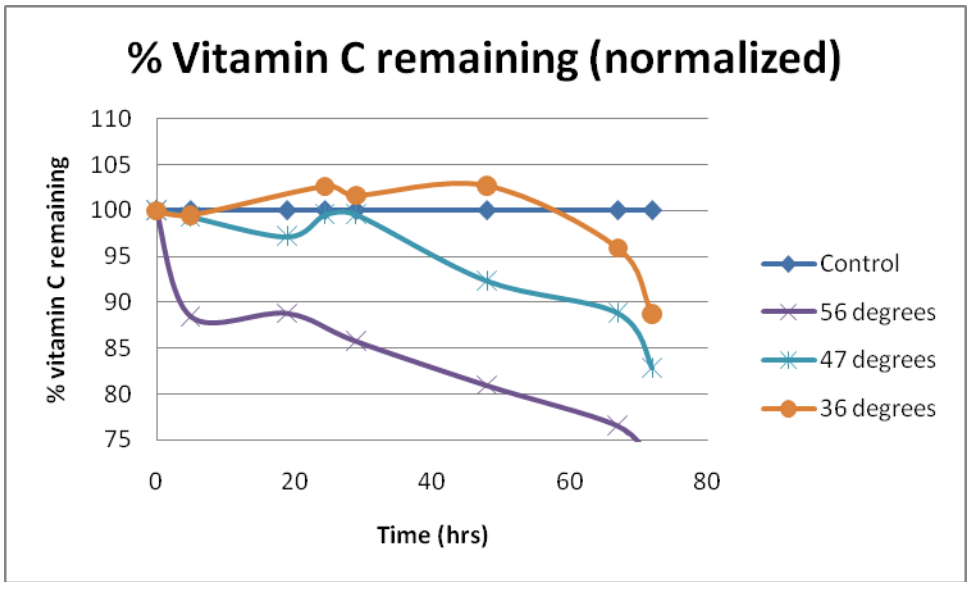


Now how much does the addition of light affect this in the data normalized for the control degradation?



Not the greatest graph and difficult to draw any conclusions, the reality is the changes in concentration are not significant and within experimental error from separate groups measuring the solutions so it is difficult to confirm or negate the hypothesis regarding light. If the initial measurement of the UV solution were incorrect, that sample does sow more of a gradual decrease which is expected with the higher intensity (energy) light

Now consider the effects of temperature:



While it does suffer from some up and down data points, there are some broad observable trends and all solutions do show decreases in concentration over time (also evident in the raw data on the first page) and the amount of decrease does increase with temperature. So it seems clear that this part of the hypothesis is feasible though would need more data to thoroughly prove.

Note all solutions did show degradation but the picture becomes complicated when attempting to factor in the control and quantify additional degradation. From looking at the untouched data, one would conclude that degradation is clearly going on but the next steps are necessary to try and quantify that.