Reactor cart pumps

The idea is to verify the RPM to flow correlations included in the lab report worksheets from last year, since the carts have been modified to include diverters and backflow preventers, as well as a drain line from the sample pump
I will also be adding a correlation for the sample pump drain line to include in the reactor cart user manual, so that the sample pump can be used more effectively to keep the level in the reactor steady during continuous flow.

In order to determine the correlation between pump RPM and flow rates, I will need to measure pump throughput at atleast four different RPMs and perform linear regression on the plot of RPMs vs flowrate.
This will be done by pumping water using the pumps through the pfr tubing and draining it into a graduated cylinder, timing how long it takes from the first drop to reach 10, 20, 30, 40 and 50 ml, respectively.
I am unsure whether the added flow resistance of the PFR tubing will affect the flow rate significantly, or if I will need to have separate correlations for the PFR vs Tank. The sample pump flow correlation will not need to be measured for the tank regardless.
I may possibly repeat the tests on each of the carts and come up with correlations for each cart individually.

Cart 1 **PFR**

	NaClO	Time, sec					Avg Flowrate	
	Volume, ml:	10	20	30	40	50	ml/sec	ml/min
Set RPMs:	25	25	53	81	106	133	0.38020544	22.81233
	50	14	26	40	53	67	0.746900424	44.81403
	75	8	17	26	35	45	1.166856999	70.01142
	100	6	13	20	27	34	1.531439584	91.88638
	125	5	11	16	22	27	1.872643098	112.3586
	150	5	9	14	19	23	2.128851113	127.7311

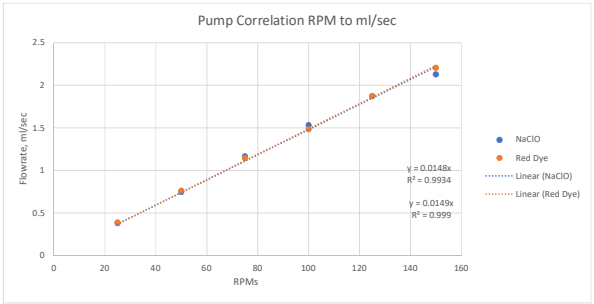
	Red Dye	Time, sec					Avg Flowrate	
	Volume, ml:	10	20	30	40	50	ml/sec	ml/min
Set RPMs:	25	25	52	77	103	130	0.389438135	23.36629
	50	13	26	39	53	66	0.763997009	45.83982
	75	9	17	26	35	44	1.144129726	68.64778
	100	7	13	20	27	34	1.483820537	89.02923
	125	5	11	16	22	27	1.872643098	112.3586
	150	5	9	13	18	22	2.204972805	132.2984

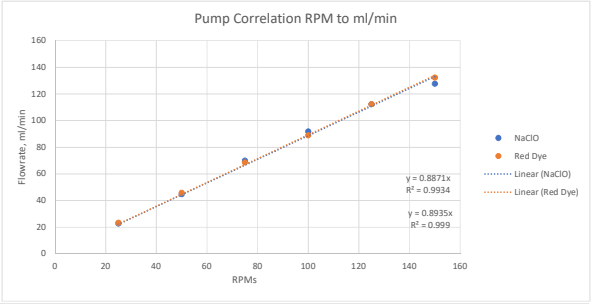
	Sample	Time, sec					Avg Flowrate	
	Volume, ml:	10	20	30	40	50	ml/sec	ml/min
Set RPMs:	25	13	27	42	55	69	0.735233527	44.11401
	50	6	12	19	25	32	1.61495614	96.89737
	75	4	8	12	17	21	2.446778711	146.8067
	100	3	6	9	12	15	3.333333333	200
	125	2	5	8	10	13	4.119230769	247.1538
	150	2	4	6	8	11	4.909090909	294.5455

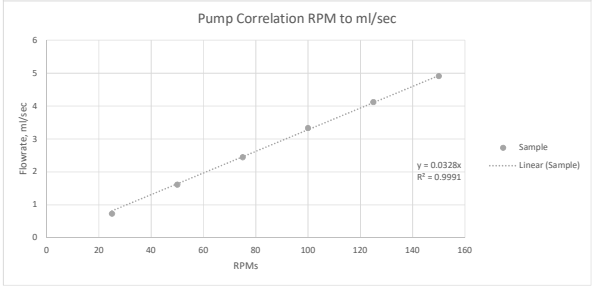
Vessel

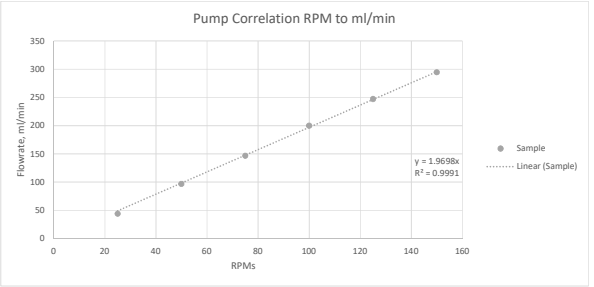
	Red dye	Time, sec					Avg Flowrate	
	Volume, ml:	10	20	30	40	50	ml/sec	ml/min
Set RPMs:	25	18	44	72	99	118	0.450907379	27.05444
	50	10	23	36	51	64.5	0.852481215	51.14887
	75	8	17	28	38	48	1.118439481	67.10637
	100	7	15	24	33	41	1.288707634	77.32246
	125	5	11	16	22	28	1.859415584	111.5649
	150	4	9	14	19	24	2.210735171	132.6441

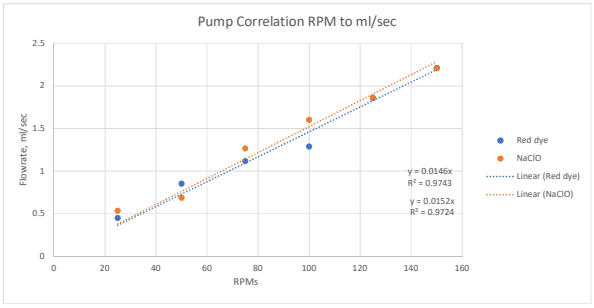
	NaClO	Time, sec					Avg Flowrate	
	Volume, ml:	10	20	30	40	50	ml/sec	ml/min
Set RPMs:	25	17	39	55	77	97	0.536290958	32.17746
	50	13	30	45	60	75	0.687179487	41.23077
	75	7	15	23	34	46	1.26593594	75.95616
	100	6	12	19	26	32	1.602648448	96.15891
	125	5	11	16	22	28	1.859415584	111.5649
	150	5	9	13	18	22	2.204972805	132.2984

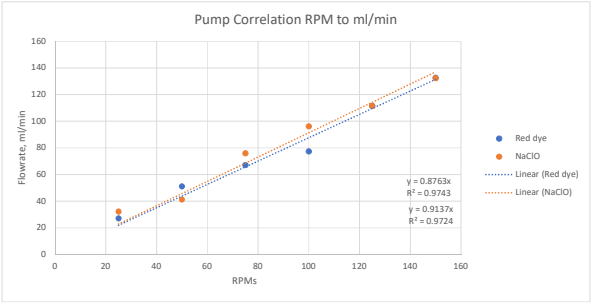












Looking at the results of the flow tests running fluid through the reactor vessel vs. the PFR tubing;
it seems apparent that the overall flowrates stay the same, but there seems to be more randomness in measurement of the flow rates through the reactor vessel. Some of this may be due to systemic error in that I was not aware of all of the variables that would need to be controlled when starting, but even so, there was a lot more variation between measurements this way than before. But, the conclusion I have come to as a result of this test, is that the pump flow correlations for the PFR can also reasonably be applied to the CSTR flow.