

Grinders Mass Flow Experiments

Mass flow equation:

$$\text{Mass flow (g/min)} = \text{Concentration (g/L)} * \text{Fluid flow (L/min)}$$

Set concentration at 0.5 g/L

Concentration error < 15% = 75 mg/L

$$C = 0.575 \text{ g/L}$$

$$\dot{V} = x \text{ (gal/min)} * 0.264 \text{ (L/gal)}$$

$$\dot{m} = 0.575 * \dot{V}$$

with \dot{V} as variable input in L/min and \dot{m} as a calibrated output in RPM

Metering Range:

$$\text{Influent flow} = 6 - 15 \text{ gal/min} = 22.7 - 56.8 \text{ L/min}$$

$$0.575 \text{ g/L} * 22.7 \text{ L/min} = 13.1 \text{ g/min}$$

$$0.575 \text{ g/L} * 56.8 \text{ L/min} = 32.7 \text{ g/min}$$

Calibrate motor:

Weigh mass after 30 seconds

RPM	Mass (g)	Flow rate (g/min)
		0
		0
		0
		0
		0
		0
		0
		0
		0

* graph and get equation

Error:

Weigh mass metered after 1 min at RPM for 6 gal/min

Weigh mass metered after 1 min at RPM for 10 gal/min

Weigh mass metered after 1 min at RPM for 15 gal/min

$$C \text{ (g/L)} = \dot{m} \text{ (g/min)} / \dot{V} \text{ (L/min)}$$

Volumetric fluid flow

22.7 (L/min)

37.9 (L/min)

56.8 (L/min)

RPM	Mass (g)	Flow rate (g/min)	Concentration (g/L)
6*		0	0
6*		0	0
6*		0	0
10*		0	0
10*		0	0
10*		0	0

15*		0	0
15*		0	0
15*		0	0

Red = concentration was underdosed below minimum, 0.5 g/L

Yellow = dosed below 15% targeted overdose, 0.575 g/L

Does higher/lower RPM change average error?

Is the metering accurate enough to lower the 15% overdose to increase efficiency?

Minimum dose rate	15% concentration overdose
11.4 g/min	13.1 g/min
18.9 g/min	21.7 g/min
28.4 g/min	32.7 g/min