Chemistry 254
Experiment 5
Adsorption

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Abstract

In this practical the adsorption of acetic acid on activated carbon was measured at various concentrations. These empirical values were then used to determine the suitability of different adsorption isotherms

Contents

1 Results

The initial and equilibrium concentrations for acetic acid are shown in table 1. The mass of acetic acid adsorbed onto the charcoal in table 2.

Figure 1 and figure 2 show the linear regressions giving parameters to the Freundlich and Langmuir isotherms.

Table 1: Acetic acid concentrations

Sample	Initial (M)	Equilibrium (M)
1	0.4052	6.93079e-5
2	0.3578	6.14219e-5
3	0.1483	2.65236e-5
4	0.1065	4.61498e-5
5	0.07732	3.40209e-5
6	0.05023	4.36507e-5
7	0.02005	1.85265e-5

Table 2: Mass of acetic acid adsorbed on charcoal

Sample	Mass adsorbed (m)
1	0.0007543
2	0.0003504
3	0.00027
4	0.0001598
5	0.0001142
6	3.871e-5
7	2.265e-5

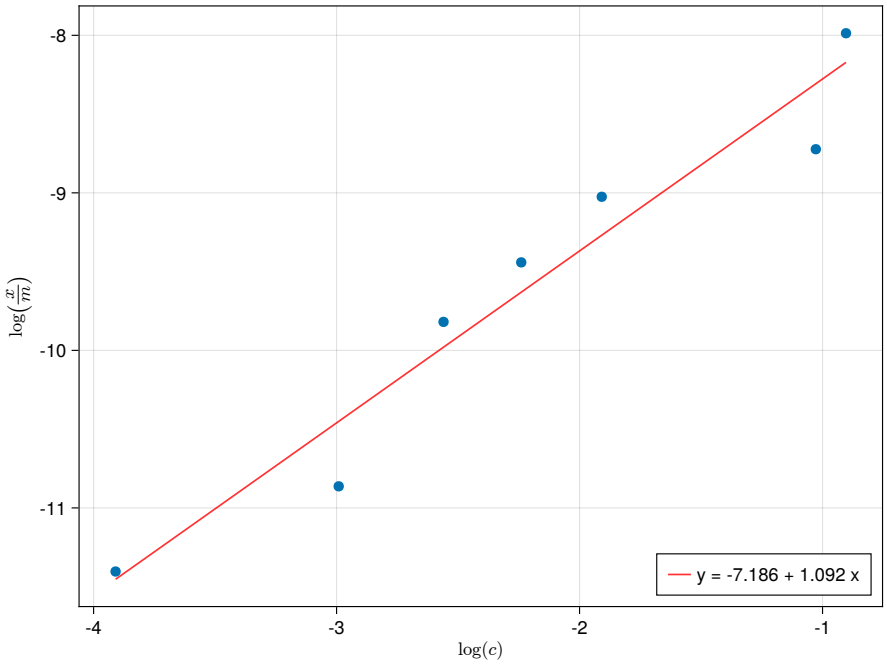

Figure 1: Freundlich isotherm

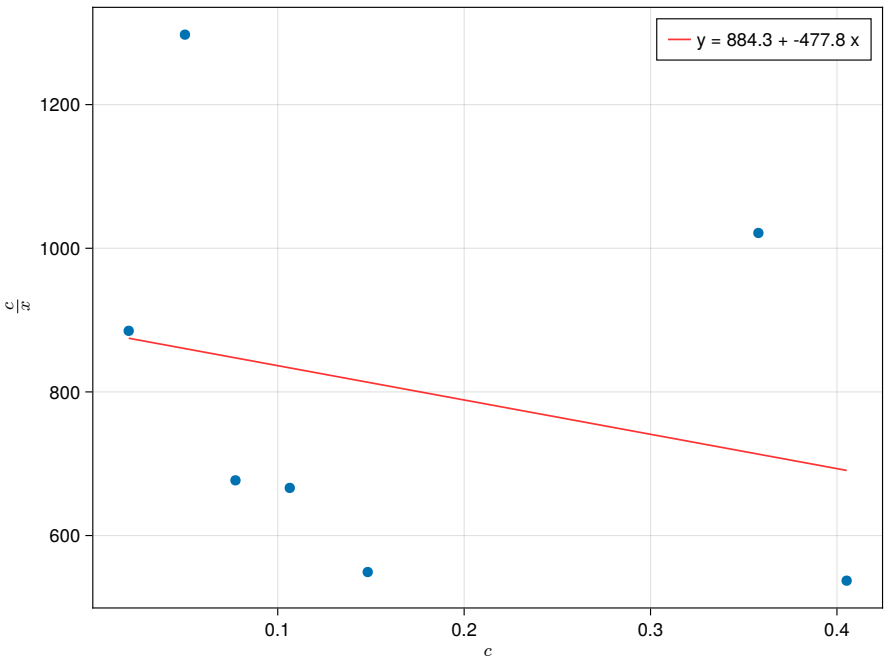

Figure 2: Langmuir isotherm

A static export of the notebook containing all analysis and figures is available at `https://adammenne.github.io/chemistry_254/practical_5/notebook.html`. With full source code available at `https://github.com/AdamMenne/chemistry_254/tree/master/practical_5`

2 Discussion

The Freundlich isotherm had a significantly better correlation coefficient with a value 0.942 of compared to 0.0684 the achieved by the Langmuir isotherm. This shows the inability of the Langmuir isotherm to account for materials in which multiple layers of adsorption can occur.

Accuracy could be increased with a larger and wider sample size, as there were notable discrepancies for samples that were titrated multiple times.

Appendix A Additional tasks

1. The Freundlich isotherm
2. That it is a physical adsorption and multiple layers are adsorbed
3. $\frac{1}{x_m} = -4.778$ and $\frac{1}{Kx_m} = 185.08$
4. It allows us to account for error due to the titrant reacting with the solvent
5. Exposure to suitably high temperatures such that all adsorbed materials will undergo volatilisation.

Appendix B MSDS

Acetic acid

- Flammable, corrosive

- causes skin burns and eye damage

- if in contact with skin or eyes wash for several minutes

Sodium hydroxide

- Corrosive

- may cause skin burns, eye damage

- if in contact with skin or eyes wash for several minutes