Elution Study Procedure and Data Interpretation

An elution study can be performed by staff onsite or by a water softening company.

Tools Required:

- Salometer
- 250 mL Graduated cylinder
- Timer

Sampling points:

- Brine tank
- Regeneration drain line - waste water discharge line

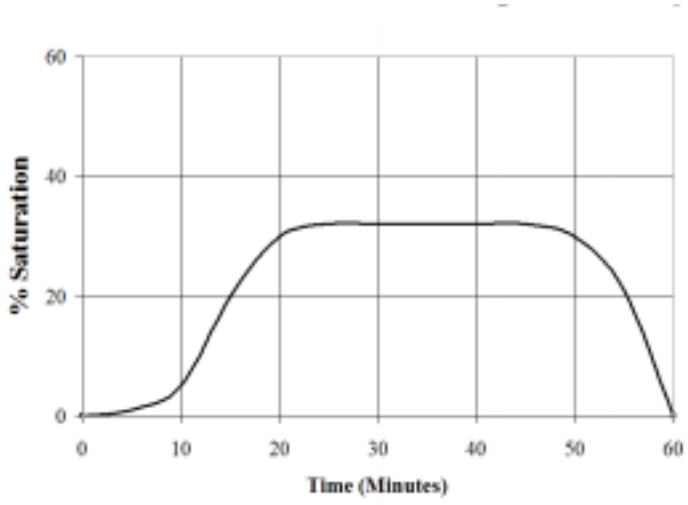
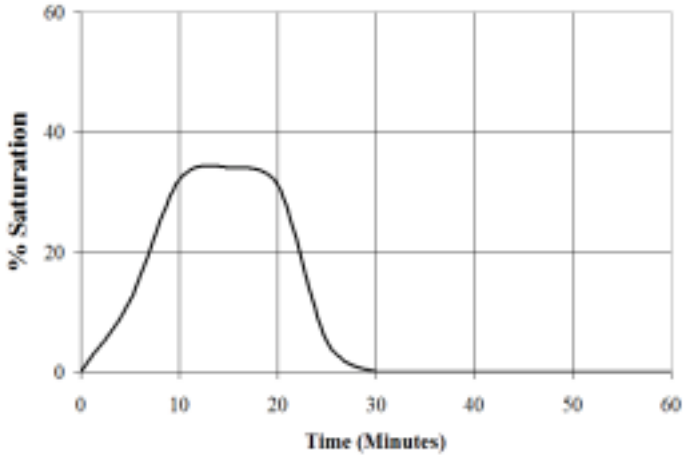
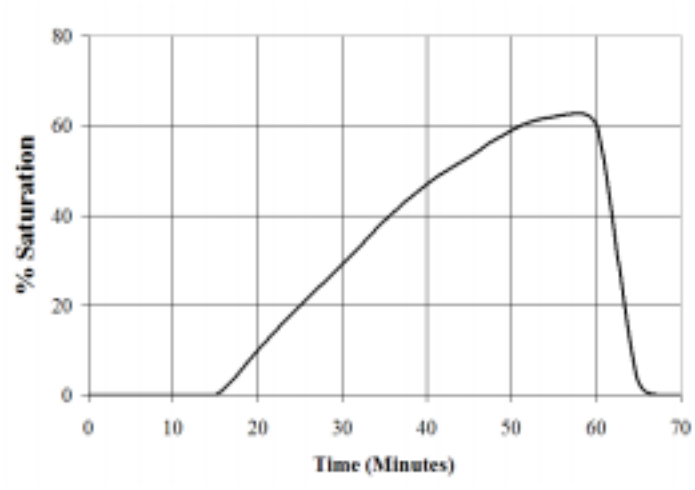
Procedure [1, 2, 3]:

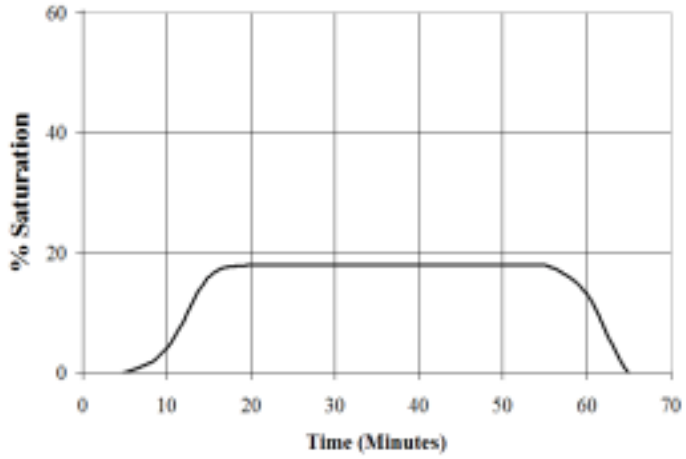
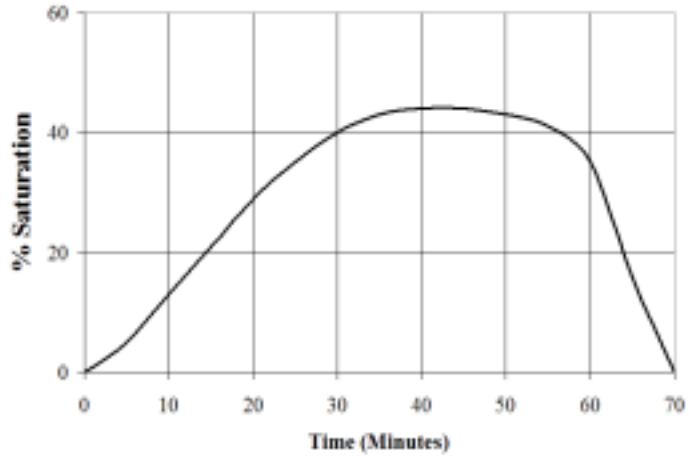
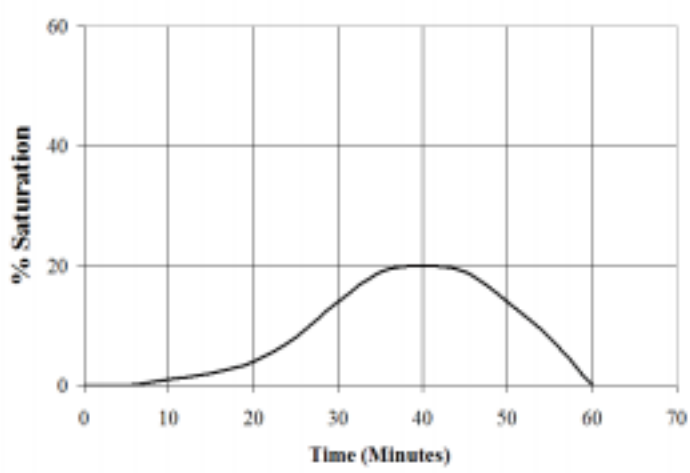
- Measure the concentration of the brine in the brine tank using the salometer.
- Once the softener has started its regeneration cycle, wait for it to complete the backwash cycle, and then note the time when the brine cycle has started.
- Once the softener switches to brine cycle, take a water sample (enough to submerge the salometer, in the graduated cylinder) at the softener discharge before the discharge mixes with the other wastewater line.
- Find the salometer reading corresponding to the sample and record, then take another sample every 2 to 3 minutes until the reading has dropped below 5°.
- Make note of the time when the brine cycle, slow rinse and rapid rinse phases are completed
- Plot the collected data with time as the independent variable and the salometer degree reading as the dependent variable.

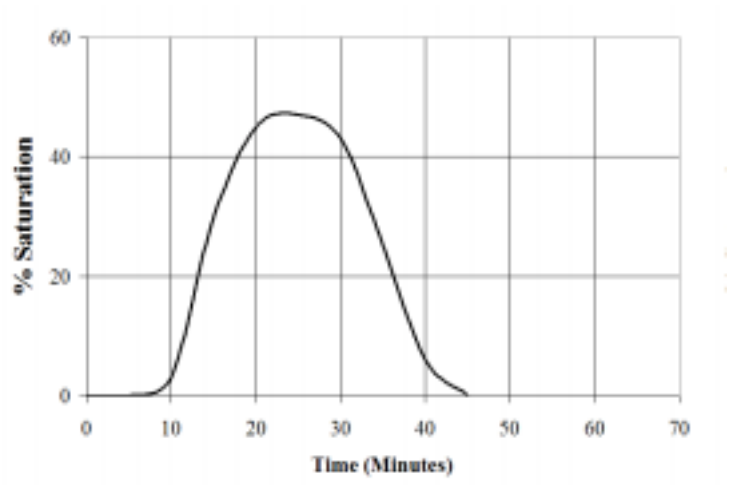
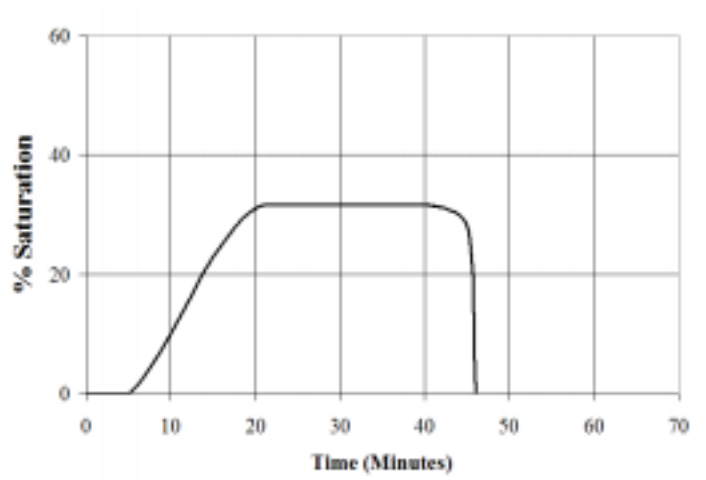
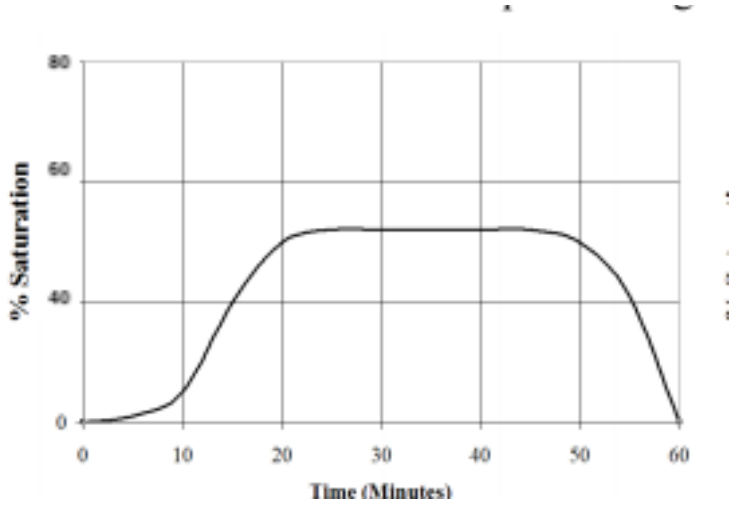
Understanding the results [1, 2, 3]:

- For an effective regeneration the constructed graph should have a salometer reading of 30° for at least 30 minutes. This translates to the resin bed having contact with an 8% salinity solution for at least 30 minutes.
- Looking at the graph from the above procedure, will give us clues as to which operational factors in the regeneration process could be optimized.
- The images shown below, from Softener Elution Study by James McDonald, show different potential elution graphs and possible problems.

Table 1. Different elution graphs and possible explanations for graphical behavior. Graphs from Softener Elution Study by James McDonald. [1, 2, 3, 4]

	Good regeneration that uses a minimal amount of salt
	Insufficient brine. Increase the brine draw time
	Using more salt than necessary. Reduce the brine draw and perhaps decrease slow rinse time

	Brine eductor, a device that uses flowing water to draw brine out of the brine tank, draws too slowly. It should be adjusted to draw brine faster
	Using more salt than necessary. Reduce brine draw to save salt
	Insufficient brine strength and contact time. Possible remedies are to increase brine draw time, decrease dilution water, and decrease slow rinse rate

	Brine eductor draws too quickly. It should be adjusted to draw brine more slowly
	Brining cycle interrupted by a premature rinse cycle.
	Regeneration using too much salt. Decrease salt dosage, too much brine draw.

An unconventional elution curve may not be able to pinpoint the exact cause of a problem, but it can confirm that a problem exists. Another elution study should be performed after any changes to confirm that the corrective measures are working.

Works Cited

[1] A. Basset, "How to Survey a Sodium Zeolite Softener," Analyst, 2001.

[2] J. N. Tanis, "Procedures of Industrial Water Treatment," Ltan Inc., 1987.

[3] J. McDonald, "Water Softener Elution Studies," Crown Solutions Customer Newsletter, 1997.

[4] A. Weber, "Why a Water Softener for Your Boiler Feed is Essential," Robert B. Hill Co., 31 March 2020. [Online]. Available: https://www.hillwater.com/blog/p-22-why-water-softener-for-boiler-is-essential.aspx. [Accessed 10 June 2021].