Hellenbrand

Salt Wise, Soft Water Training

May 5, 2016

Softening 101

Softener Components:

- Mineral Tank
- Softening Resin
- Control Valve
- Regenerant (NaCl)
- Brine Tank or Bulk Brine Storage

Softener Control Valves

- Directs the flow of water through the resin bed
- Generally accomplished by pistons and seals
- Creates the vacuum that draws the saturated salt solution into resin bed

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Water Softener Regeneration Cycles

Backwash:

- Reverses normal flow and expands the resin bed

Brine and Slow Rinse

- Uses an injector to create a vacuum that draws brine out of salt tank to recharge resin with sodium ions

Rapid Rinse

- Water flows downward to pack the resin down after backwash and brine/rinse

Brine Tank Refill

- Adds water to salt to create a saturated salt solution

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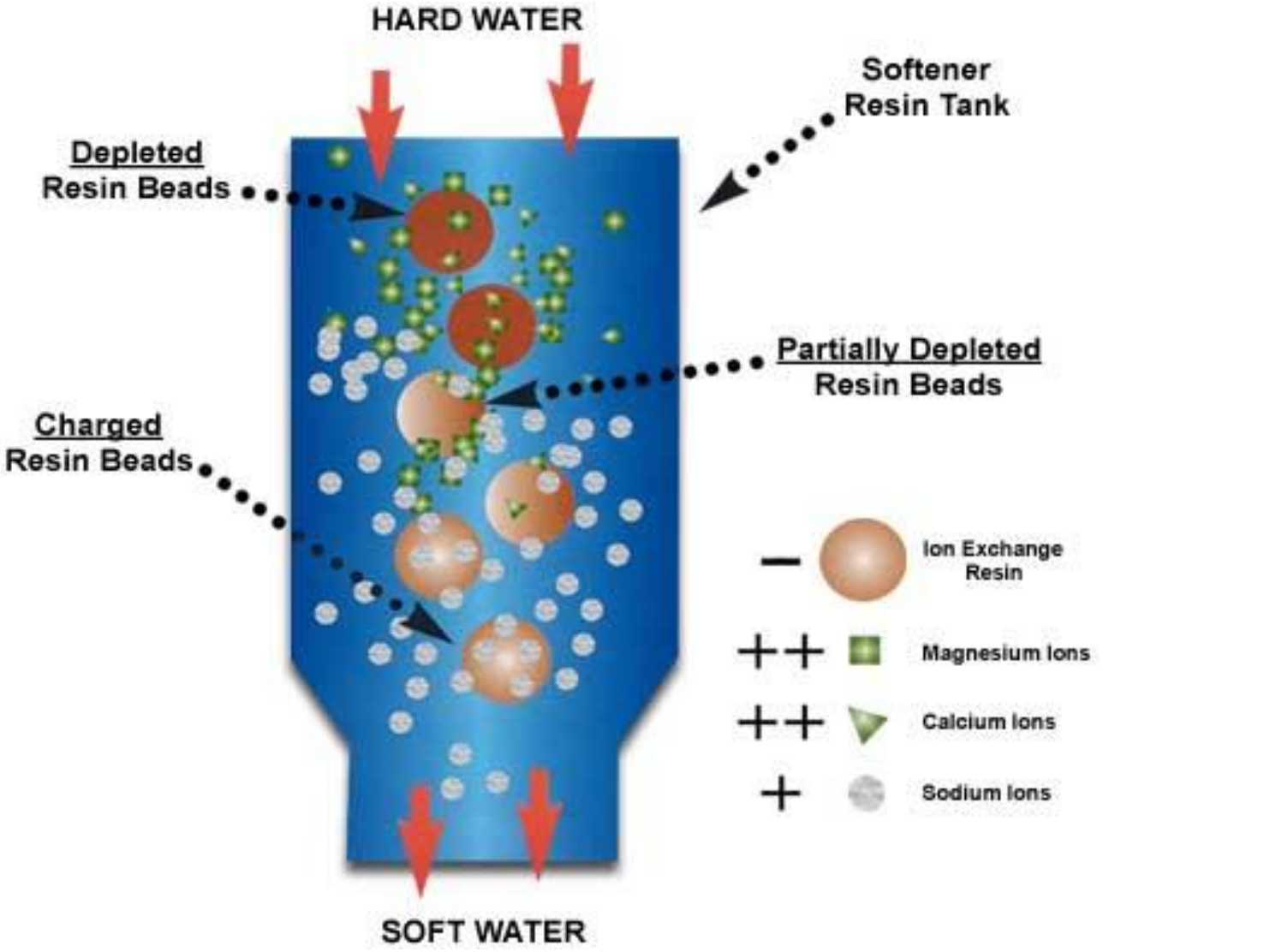

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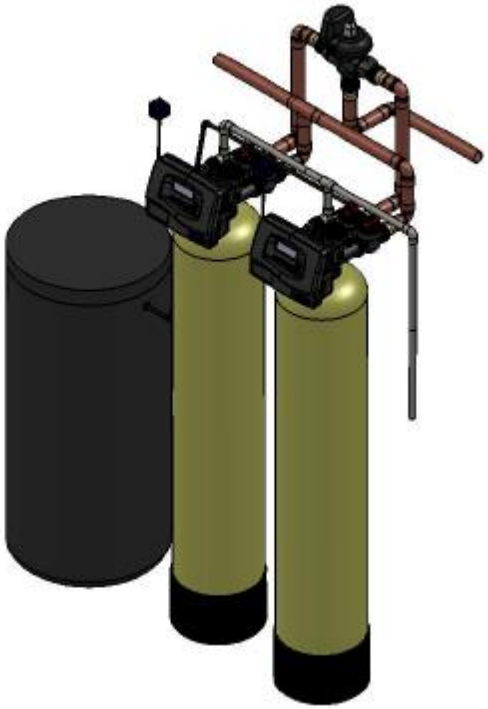
Softener Capacity: Lets Do the Numbers!

- Capacity of softeners are listed in grains
- Water hardness is commonly measured in grains per gallon

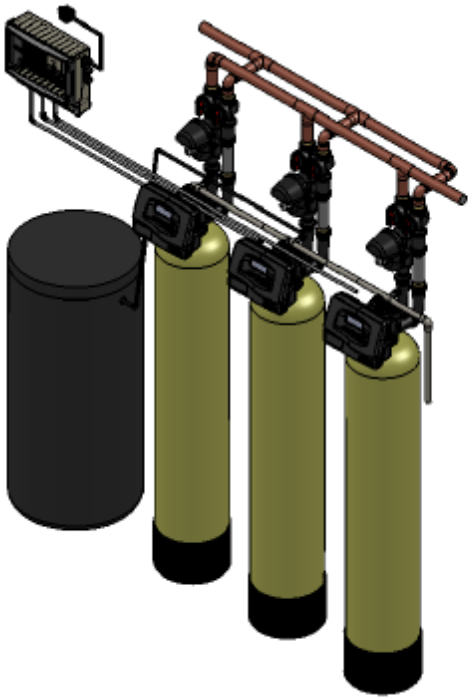
Example:

- Softener with 1 ft^3 of resin has a capacity of 32,000 grains at 15 lbs. salting.
  - Historically system sizes are based on maximum capacity.
- Softener with 5 ft^3 of resin has capacity of 160,000 grains uses 75 lbs. of salt
- Water is 20 grains per gallon (gpg) hard
- 160,000 grains/20 gpg = 8000 gallons of soft water with no reserve

Single tank



Twin Alternating



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Softener Salt Efficiency:

- Efficiency Units = grains of hardness reduced per pound of salt, like miles per gallon in your car

Example: Softener with 1 ft3 of resin has a capacity of 32,000 grains at 15 lbs. salting 32, 000 grains/15 lbs. salt = salt efficiency at 2,133 grains/lb.

- Current NSF/ANSI 44 requires a minimum salt efficiency rating of 3350 grains/lb.
- Some municipalities require softeners to have salt efficiency of 4000 grains/lb.
- MMSD to require salt efficiency of 4000 gr/lb.
- Softeners are available with efficiency > 5000 grains/lb.

PM6 EcoMax Performance Data

Model #	PM6[1] EcoMax 8	PM6[1] EcoMax 9	PM6[1] EcoMax10	PM6[1] EcoMax12	PM6* EcoMax13	PM6* EcoMax14	PM6* EcoMax16	PM6* EcoMax18
Regeneration Gallons on Factory Settings @ 35 psi	24.1	33.5	45.7	62.4	78.7	93.5	127.5	180

Capacity	**Grains**	**Grains**	**Grains**	**Grains**	**Grains**	**Grains**	**Grains**	**Grains**
High Efficiency Salting (5427gr/lb)[2]	17,909	23,878	33,104	47,757	57,526	66,209	89,545	107,454
Refill Lbs. of Salt	3.3	4.4	6.1	8.8	10.6	12.2	16.5	19.8
Low Salting (5200 grains/lb)	**20,800**	**27,664**	**38,480**	**55,640**	**66,560**	**76,960**	**104,000**	**124,800**
Refill Lbs. of Salt	**4**	**5.32**	**7.4**	**10.68**	**12.8**	**14.8**	**20**	**24**
Service Flow Rates	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
Service Flow @ 10 psi	5.5	6.8	7.8	10.9	11.6	11.9	12.7	13.6
Max. Service Flow @ 15 psi	7.9	9	10.4	12.5	14.1	14.7	15.9	16.2
Resin Tank Size	8x44	9x48	10x54	12x52	13x54	14x65	16x65	18x65
Recommended Brine Tank*	18x40	18x40	18x40	18x40	18x40	18x40	18x40	18x40
Brine Line Size	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"
Water to drain does not exceed 5 gpm in any EcoMax model								

Factory Settings at Low Salting, 5200 grains/lb.

1. System conforms to ANSI/NSF 44 for performance claims as verified and substantiated by test data.
2. High efficiency salting is maximum efficiency system can achieve, efficiency is only valid at set salt dosage. The operational efficiency may be less than the tested efficency due to individual application factors such as water hardness, TDS, water usage or other contaminants in water supply that may reduce softener capacity.

*Larger units utilize same engineering but have not been independently tested according to NSF44.

Operating Parameters:

up to 40 gpg hardness	Upflow high efficiency water softeners are intended for clean water such as municipal supplies or well water
Up to 0.5 ppm Iron	

Softeners are not intended to be used for treating water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system. EcoMax softeners are demand initiated regeneration softeners which comply with specific performance specifications designed to minimize the amount of regeneration brine and water used in operation

Maximum working pressure 125 psi		Minimum working pressure 20 psi
Maximum operating temperature 110F		Minimum operating temperature 40F

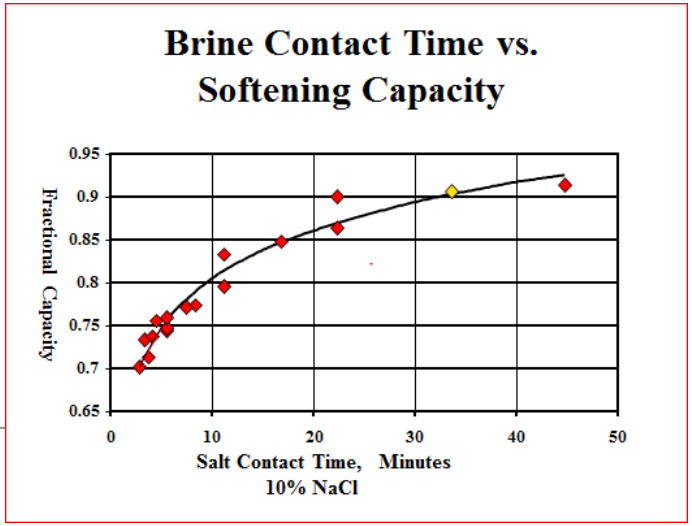
Reduction Capabilites for the following contaminants have also been verified by test data:
When hardness is reduced to less than 1gpg, radium & barium will be effectively reduced

US EPA Max Contaminant Level	
Barium	2 mg/L
Radium	5 piC/L

WATER SOFTENER EFFICIENCY

What Factors Increase Efficiency?

- Dosage, lower salting levels increase grains/lb.
  - 10 lbs./1 ft3 = 28,060 grains or 2806 grains of hardness reduced/lb.
  - 6 lbs./1 ft3 = 22,926 grains or 3821 grains of hardness reduced/lb.
  - 4 lbs./ft3 = 20,800 grains or 5200 grains of hardness reduced/lb.
- Countercurrent Regeneration,
  - Upflow brining VS downflow service, upflow = water leaving tank passes through most highly regenerated resin last.
- Contact Time, increase contact time, increase capacity
- Twin Alternating or Demand Recall Configuration = No Reserve



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2011 Hellenbrand changed from factory setting of 10 lbs. salting/ft^3 to 6 lbs. salting per ft^3

	PM6-032-10 lbs. salt	PM6-032-6 lbs. salt
Resin Volume (Ft^3)	1	1
Salt Used per Regeneration	10	6
Water Used per Regeneration	40	38.6
Grains Reduced per LB. of Salt	2806	3821
Capacity minus 10% reserve	28,060-2806=25,254	22,926-2293=20,633

Family of 4 = 200 GPD(365) = 73,000 gallons annually x 20 grains hardness= 1,460,000 grains of hardness reduction needed annually

1,460,000 grains/25,254 grains = 58 regenerations x 10 lbs./regen. = 580 lbs. of salt annually(60.6%) = 351 lbs. of chlorides
1,460,000 grains/20,633 grains = 71 regenerations x 6 lbs./regen. = 426 lbs. of salt annually(60.6%) = 258 lbs. of chlorides
One household reduces its salt by 154 lbs. & chloride discharge by 93 pounds.

High Efficiency Softener

Same Example, family of 4 needs 1,460,000 grains of hardness reduction annually

- 6lbs salting: 426 lbs. of salt annually(60.6%) = 426 lbs. of chlorides and 426(.606) = 258 lbs. of chlorides discharged

High Efficiency Softener: 3.3 lbs. salting:

1,460,000 grains/17,909 grains = 82 regenerations x 3.3lbs =271 lbs.

of salt used annually.

271 lbs (.606) = 164 lbs. of chlorides discharged annually

Installation Considerations:

- Avoid overhead drain lines - back pressure on injector
- Avoid excessive drain lengths - back pressure on injector
- Water pressure- minimum of 25 psi in most cases for injector
- Consider injector sizing with high pressures, >65 psi
- Surge protection recommended for processor-controlled valves

Preventative Maintenance:

- Pistons
- Seals
- Injectors
- Brine Tanks clean/ Shut-off functioning
- Resin Cleaner
- Resin Replacement

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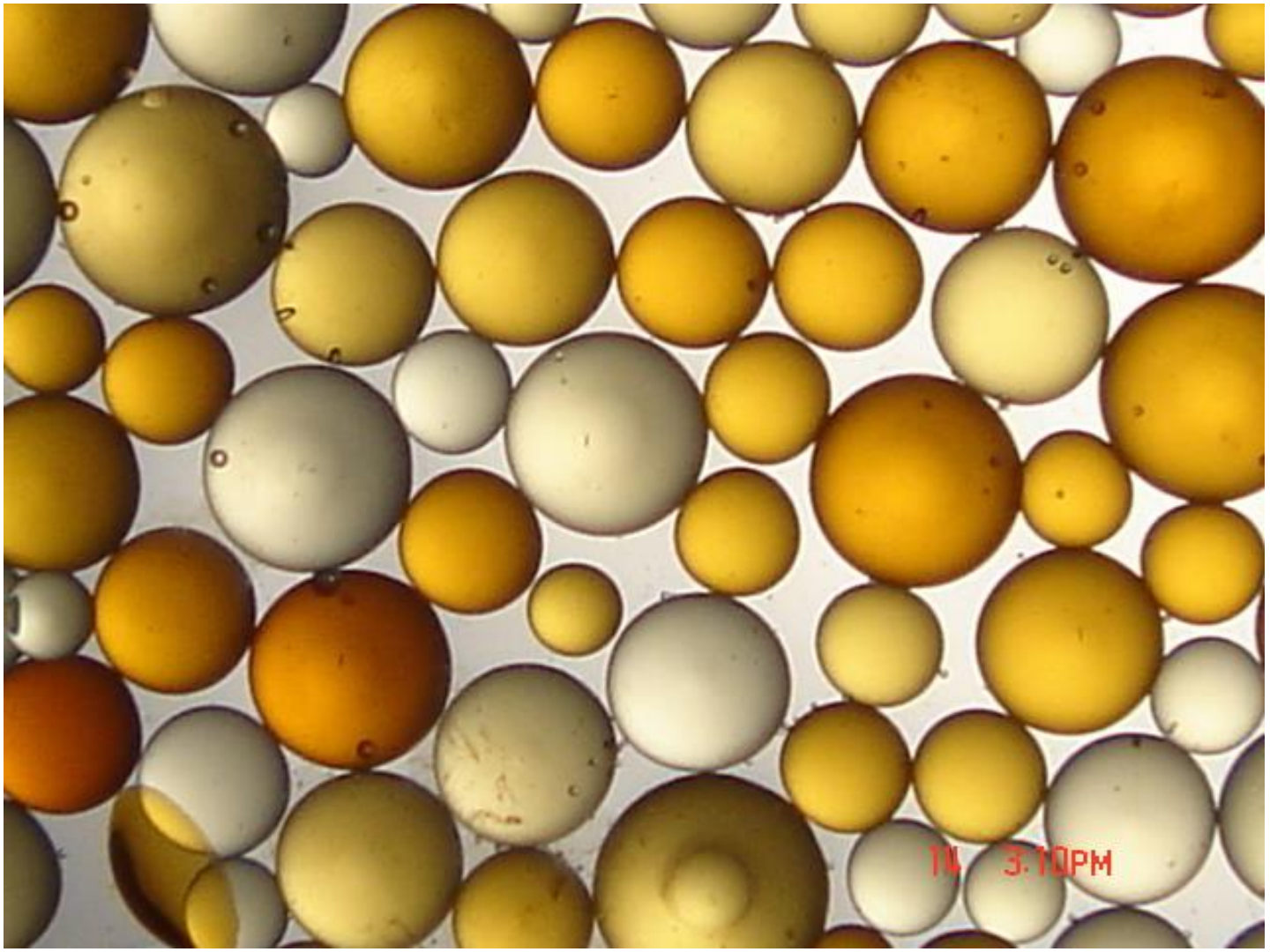

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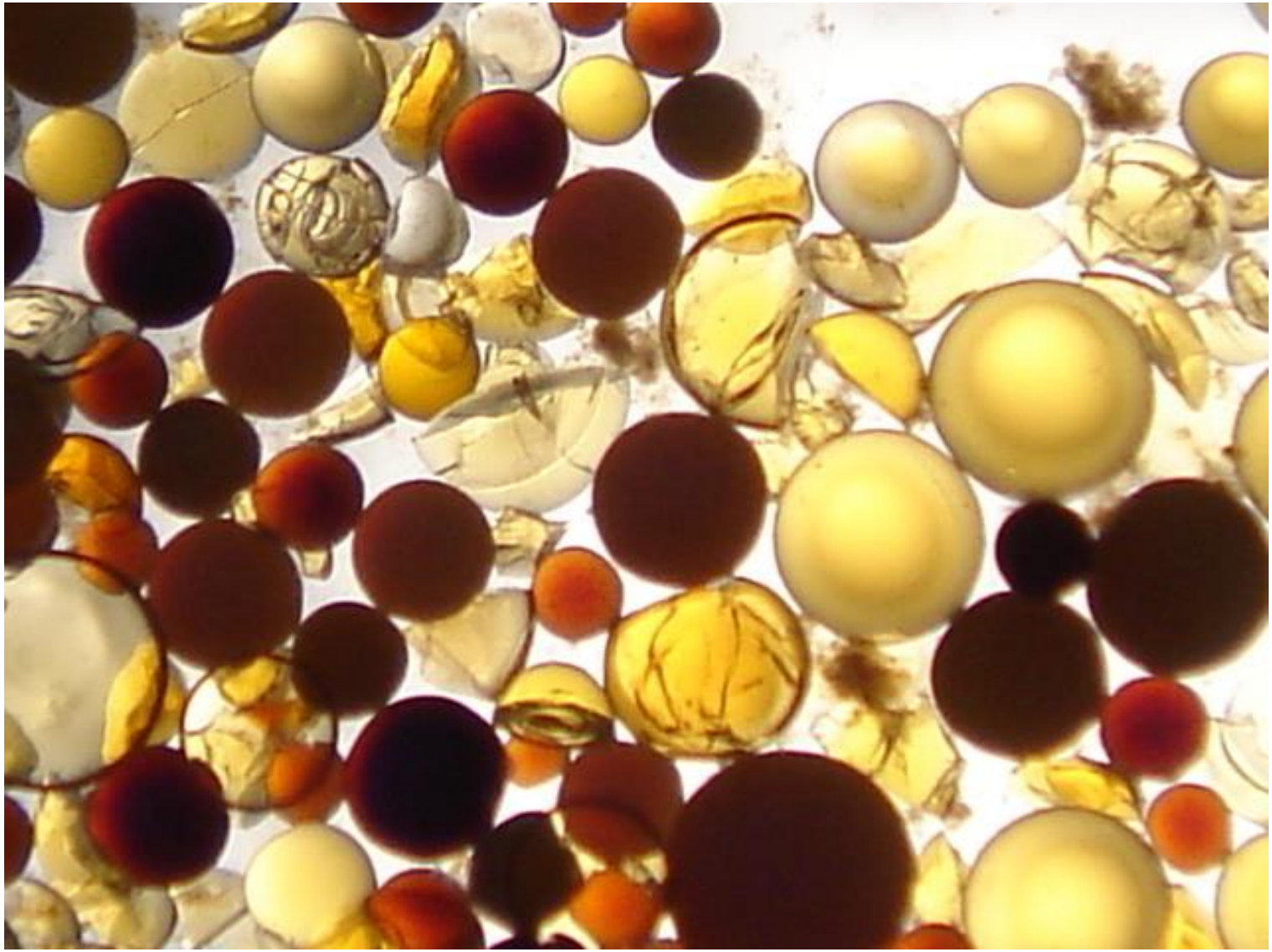

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Softener Evaluation:

Is the Water soft?

- Hardness Programmed Correctly
- Meter is Functioning
- Soft Water Between Regenerations?
- Excessive salt use?
  - Excessive Water Usage: Toilets running
  - Check refill levels and salt setting

Softener Evaluation:

Is the Softener Functioning Optimally?

Appropriate Gallons between Regenerations?

- Elution Study
- Resin Evaluation

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Elution Study

Graph the salt concentration at drain during brining cycle

- Time is X axis
- % Saturation is Y axis

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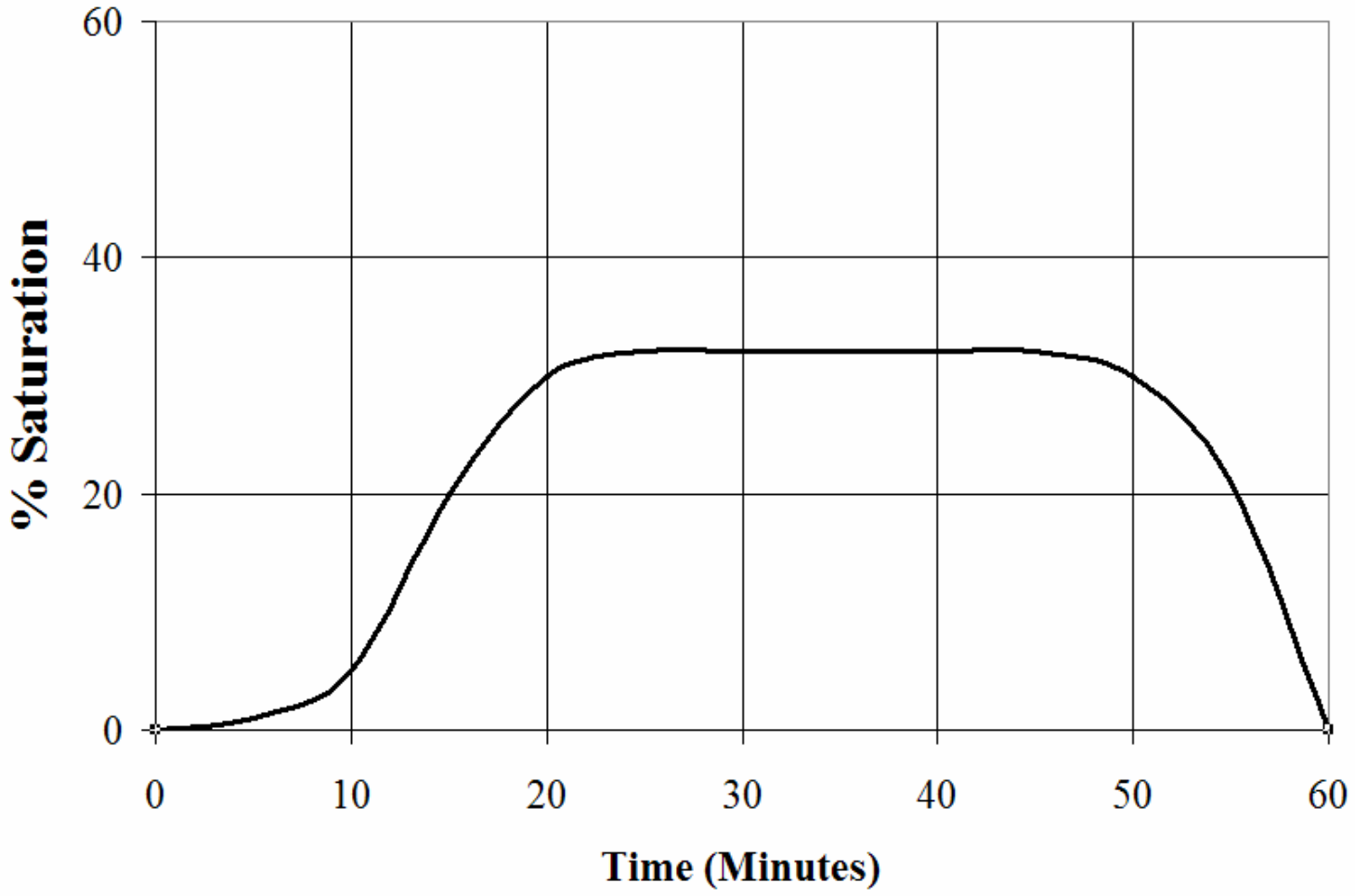
Elution Study



A good regeneration that uses a minimum of salt

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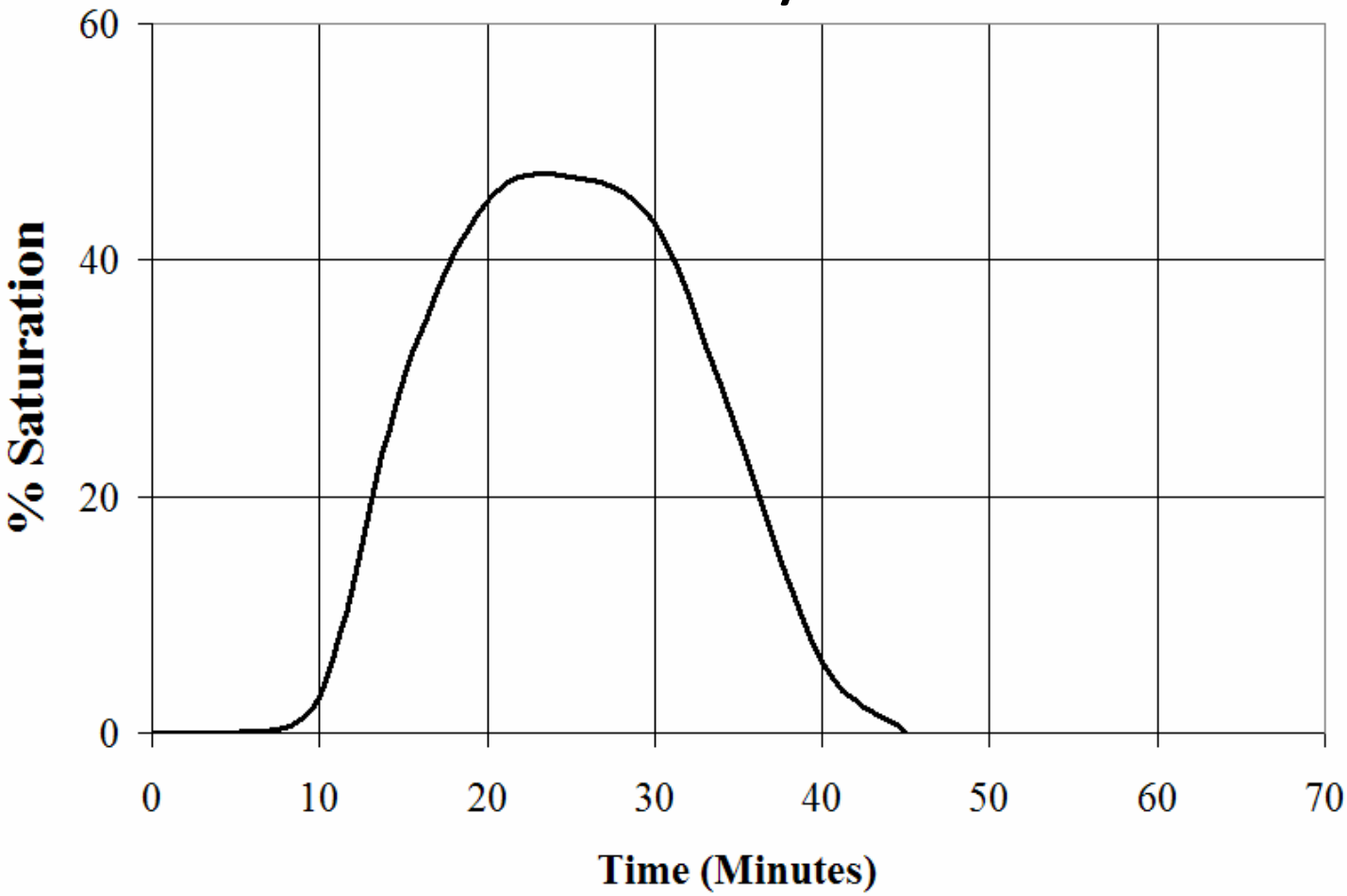
Elution Study



Brine eductor draws too quickly, should be adjusted to draw brine slowly

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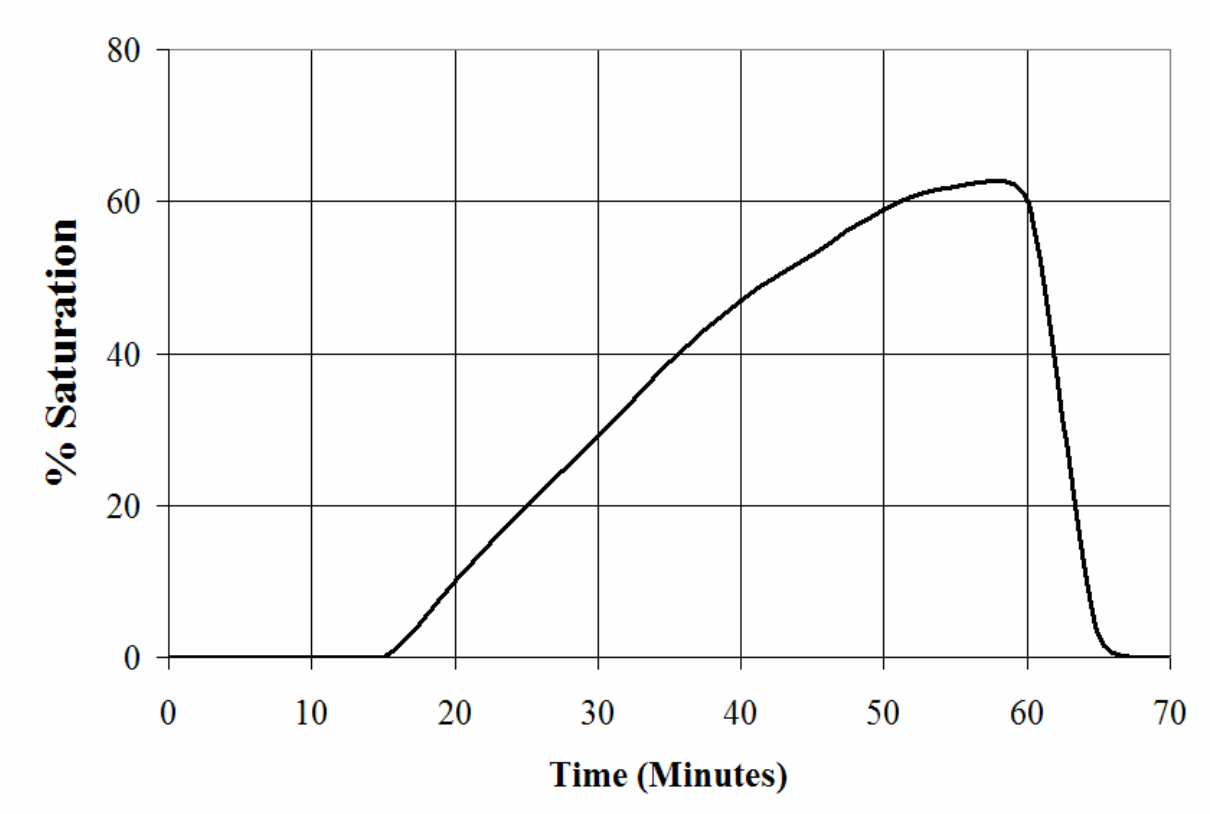
Elution Study



Using more salt than necessary, reduce brine draw & perhaps decrease slow rinse time

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Elution Study

- Operational Factors that affect Curve
  - Plugged injector
  - Channeling in resin bed
  - Unsaturated Brine in brine tank
  - Inadequate Brine draw
  - Improper Brine Slow rinse rate
  - Poor Resin Quality

Resin Evaluation

“Old Resin Never Dies, It Just Loses Efficiency”

- Structural Fatigue with Age
  - Resin Beads fracture/break and are backwashed out
- Oxidative Damage - Chlorine degrades crosslinking in resin/ Loses capacity
- Resin fouling - pre-treat water for iron and manganese reduction.
- Consider resin cleaners

Resin Evaluation

- The higher the chlorine level, the faster it degrades
- Rule of thumb: 10/free chlorine concentration=years of resin life
- Example: 10/ 1.5 ppm free chlorine = 6.7 yrs.
- Increased salt use for older resin to minimize leakage and loss of capacity

Questions