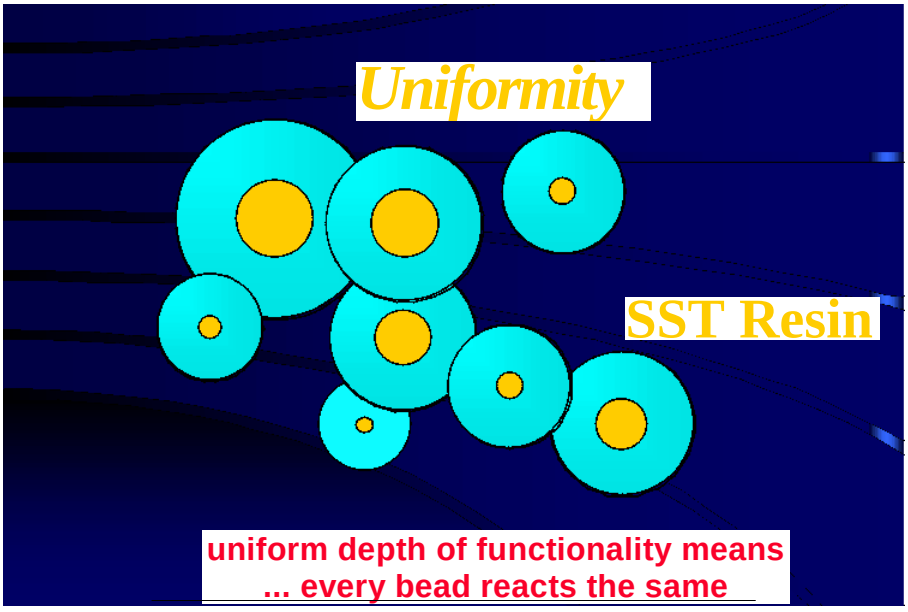
Shallow Shell Technology Resin Reduces Boiler Water Treatment Costs*

Purolite has developed a family of Shallow Shell Technology (SST) ion exchange resins that can dramatically reduce the operating costs for softening of feed water used in low to medium pressure boilers.

Softening resins remove hardness compounds such as calcium and magnesium from water by exchanging them for sodium. On exhaustion, the exchange process is reversed by regenerating the resin with salt (or sodium chloride). Even with the best operated softeners, a small amount of hardness bypasses the resin and ends up in the treated water and is measured as hardness leakage. Higher hardness leakage means higher costs for chemical treatments used in the boilers. Thus most operators try to control the hardness leakage at 1 part per million (ppm) or less. If the water to be treated has a higher level of hardness, then more salt is needed to keep the leakage under control.

Salt and rinse water sent to drain during regeneration of the softener can comprise a significant part of the overall costs of operating the softener. With SST resins, depending on the quality of water to be softened, the quantity of salt can be cut typically by 10 to 30%, while rinse water can be reduced by as much as 40 to 50%.

The advantages provided by SST resins is directly related to radical method of manufacture in which the inner core of the resin bead is left in an inert state, while the outer shell area is fully functionalized for ion exchange.



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ION EXCHANGE RESINS

Table1. below shows the typical reduction in salt usage (in pounds of salt used per cubic foot of ion exchange resin) for SST resin versus conventional resin for Philadelphia City water.

Salt Usage	SST-60 Resin	Standard Resin
lbs salt per cubic foot of resin	**Hardness Leakage ppm**	**Hardness Leakage ppm**
2	**2.1**	**3.7**
3	**1.3**	**2.1**
4	**0.9**	**1.4**
5	**0.7**	**1.2**
6	**0.6**	**1.1**
7	**0.5**	**0.9**
8	**0.4**	**0.8**
9	**0.35**	**0.7**
10	**0.30**	**0.6**

Table 1

For a desired hardness leakage of 1 ppm or less, SST resin will require only 4lbs of salt per cubic foot of resin for this water while conventional resin will require 7 pounds of salt per cubic foot of resin. When all other factors are considered, this can amount to significant reduction in the overall cost of operation, especially when savings in effluent treatment costs for rinse water are included as well.

The reason for such dramatic reduction in salt dosage can be explained in terms of the level of hardness ions left on the resin bead after regeneration, as this is what determines the level of hardness leakage during the subsequent service run of the softener. With SST, as Figure 1 shows, there is substantially less hardness left in the resin bead after regeneration than for conventional resin (typically 8% versus 28%). It is this “reservoir” of residual hardness that is largely responsible for the hardness leakage observed during the next service run. With conventional resin, the salt (or brine) solution used to regenerate the resin must diffuse to the core of the bead in order to remove the hardness present, requiring a longer time and more brine to do so. With SST resins, hardness is only located in the outer shell area and it is easily displaced by the brine.

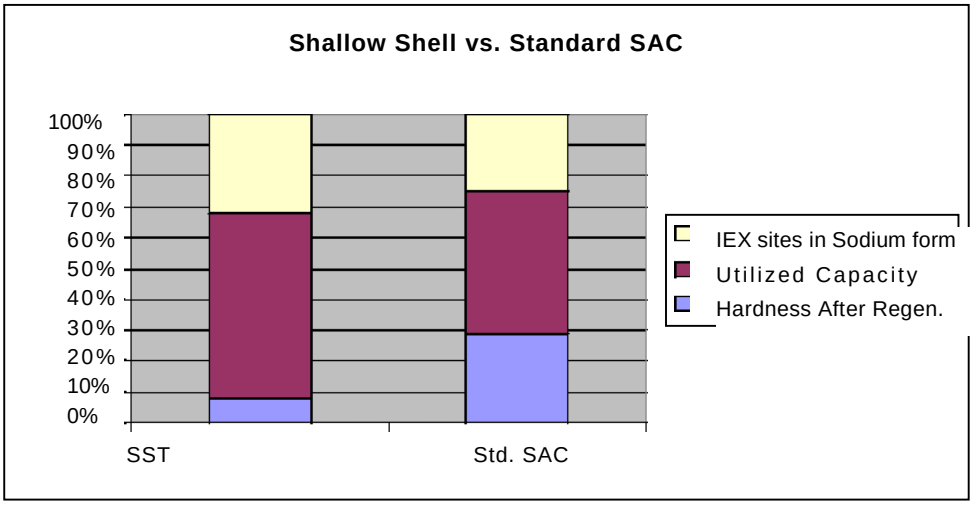

Figure 1: Residual Hardness After Regeneration

Since publication, Purolite has developed a SST60 Calculator for softening that can demonstrate the annual savings in operating costs compared to standard resin with a typical payback time of just a few months. Contact your sales representative for further information.

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