Crystal Formation in Solutions of Klozur® SP and Klozur® Caustic

Combinations of Klozur® SP sodium persulfate and Klozur® Caustic (25% environmental grade sodium hydroxide solution) may form crystalline precipitates below their individual solubility limits due to common ion effects between the two salts. These precipitates may form in the bottom of mix tanks or injection wells if the two salts are mixed together prior to injection into the subsurface.

A series of solutions were prepared by combining Klozur SP and Klozur Caustic at 2°C (35.6°F) and 20°C (68°F) and monitoring for crystal formation after approximately fifteen hours. The results for the 2°C study can be found in Figure 1 and for the 20°C in Figure 2.

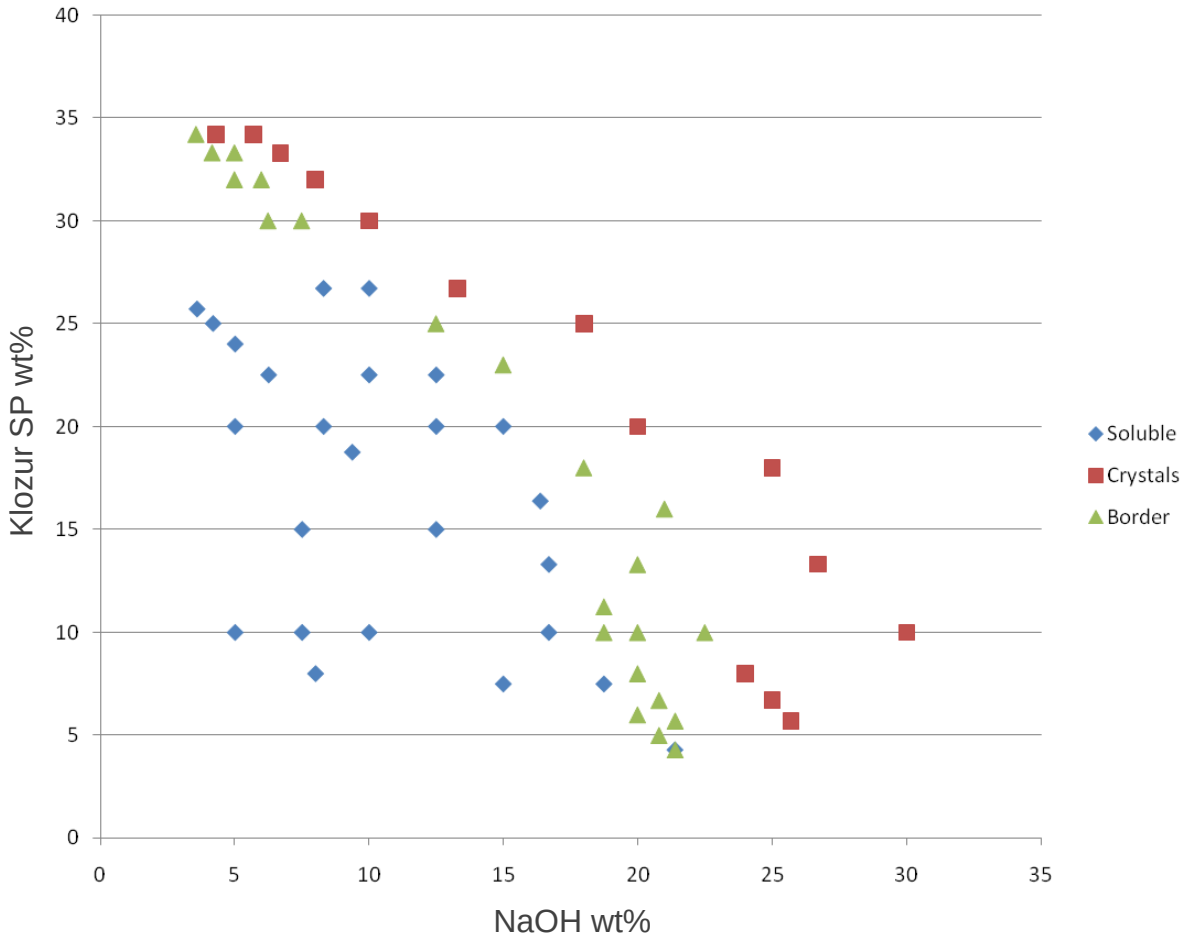

Figure 1. Solubility of NaOH - Klozur SP Solutions at 2°C

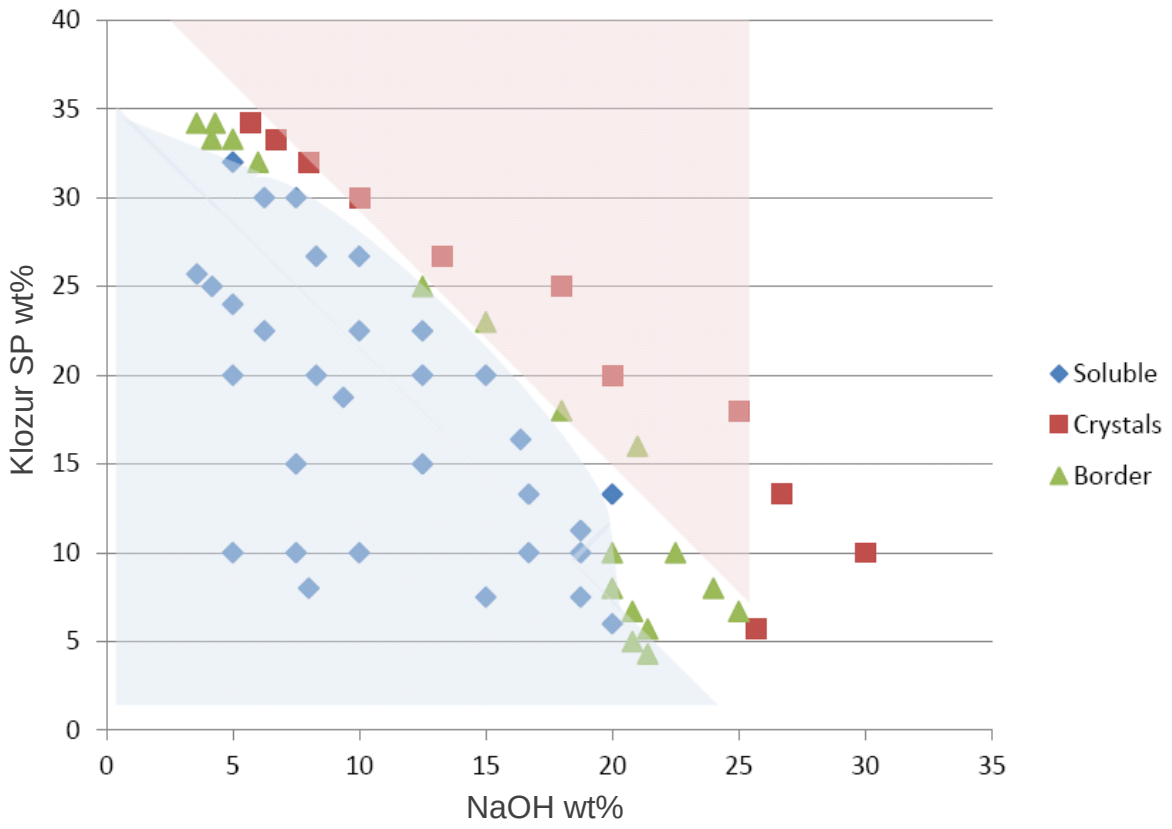

Figure 2. Solubility of NaOH - Klozur SP Solutions at 20°C

As seen in Figures 1 and 2, there is not a significant difference between the solubility diagrams at 2°C and 20°C.

PeroxyChem does not recommend pre-mixing Klozur SP and caustic prior to injection. However, based on these results, if Klozur Caustic is pre-mixed with Klozur SP in solution prior to injection in the contaminated treatment area, PeroxyChem recommends the following maximum mixing ratio guidelines to prevent crystal formation as show in Table 1. Pre-mixing Klozur SP and caustic may result in exothermic chemical reactions. PeroxyChem recommends either in-line mixing of the Klozur SP and caustic solutions just prior to injection or pulsing in the two reagents separately in the same injection location.

Klozur SP wt%	Maximum NaOH wt%	Klozur SP weight per 100 gallons of solution (lbs)	Recommended maximum gallons of Klozur Caustic per 100 gallons of solution
5	20	43.0	16.2
10	20	87.7	16.2
15	18	136.8	15.5
20	16	190.3	13.5
25	12	248.2	11.2
30	8	310.5	6.8
35	0	377.1	0

Table 1. Recommended maximum NaOH addition rates to Klozur SP solutions to prevent crystal formation.

If additional sodium hydroxide above the amounts listed in the table is needed to satisfy soil buffering or acid generation demands, it is recommended to add the additional quantity to the subsurface in a separate injection event. **NOTE:** These recommendations are based on the prevention of crystal formation and should be used in conjunction with PeroxyChem's recommendations for activating Klozur SP with a 25% sodium hydroxide solution.

All mix tanks and hoses should be flushed with water after use with Klozur SP and Klozur caustic to prevent residual persulfate from remaining within the equipment.

FREEZING POINT OF KLOZUR CAUSTIC

Klozur Caustic solution is 25% NaOH by weight. The freezing point of Klozur Caustic is -12°C (10.4°F) as seen in Figure 3.

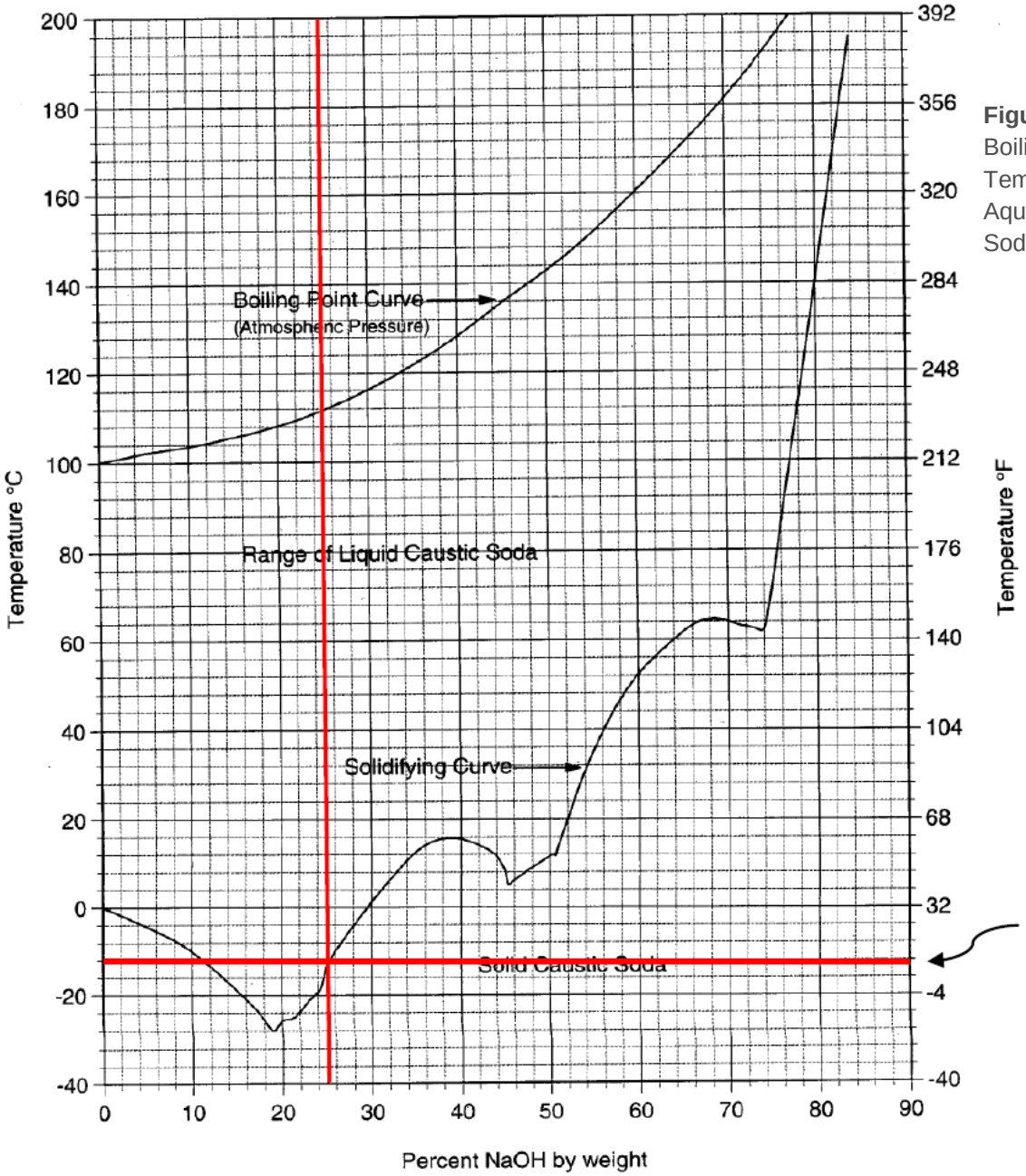

Figure 3.
Boiling and Solidifying Temperatures of Aqueous Caustic Soda Solutions