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The effect of the humidity and Oxygen on the loading rate

This leaflet describes how the three products FerroSorp® Sd, FerroSorp® Sk and FerroSorp® SP in the grain size 2 - 4 mm perform at different levels of relative humidity and depending on the availability of oxygen.
The results for the loading rate were obtained at laboratory conditions in a dynamic breakthrough simulation until < 98 % removal rate with 4,509 ppm H_2S at the inlet. At 100 ppm H_2S in the outlet, the analysis was stopped.

H_2S-concentration	ppm	4,512
O_2-concentration	ppm	19,000
Contact time	s	4.75
Superficial velocity	m/min (ft/min)	1.97 (6.46)

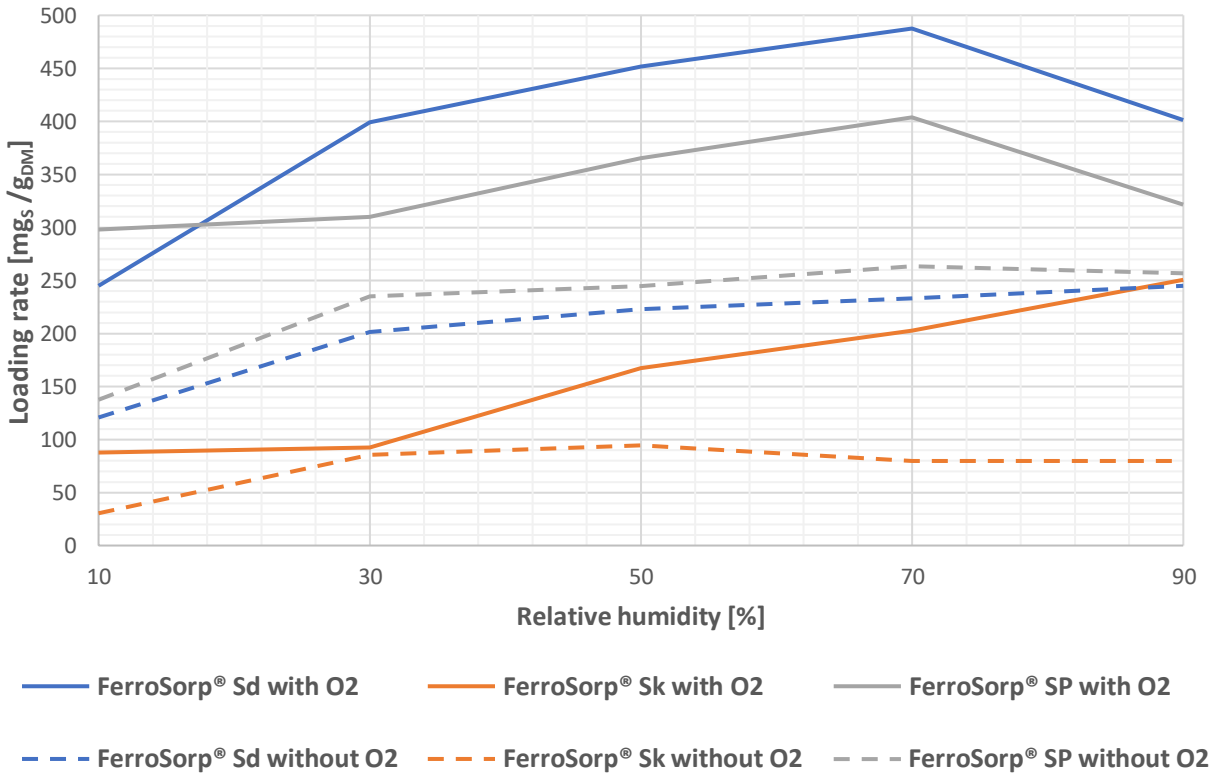

Figure (1): The loading rates of the products with and without oxygen at different relative humidity

Product	FerroSorp® Sd					FerroSorp® Sk					FerroSorp® SP				
Relative humidity (%)	**10**	**30**	**50**	**70**	**90**	**10**	**30**	**50**	**70**	**90**	**10**	**30**	**50**	**70**	**90**
With O_2	245	399	452	488	401	88	92	167	203	251	298	310	365	404	322
Without O_2	121	201	223	233	245	30	86	95	80	80	138	235	245	263	257

Table 1: The loading rates of the products with and without oxygen at different relative humidity

As shown in the graph, the three products perform better when supplied with air (oxygen). Because O2 results in the product regeneration by reacting with iron sulphate.

Reduction of iron(III) hydroxide to dissolved iron(II) hydroxide:

$$2\ Fe(OH)_3 + \ H_2S \rightarrow \ 2\ Fe(OH)_2 + S + 2\ H_2O \qquad (1)$$

Reaction of iron(II) hydroxide with hydrogen sulfide to form insoluble, black-colored iron sulfide

$$Fe(OH)_2 + H_2S \rightarrow 2\ FeS + \ 2\ H_2O \qquad (2)$$

Regeneration of iron(III) hydroxide:

$$Fe_2S_3 + \frac{3}{2}O_2 + 3\ H_2O \ \rightarrow 2\ Fe(OH)_3 + \ 3\ S \qquad (3)$$

So that means the regeneration of the product makes it more capable of reacting of H_2S. Therefore, it has higher loading rates than operating without air.

Moreover, the relative humidity plays an important role in the product performance. As shown in figure (1), the products performance is increasing with increasing the relative humidity (except for 90% relative humidity). This happens because If there is a sufficient amount of water in the gas, a thin water film is formed on the surface of the pores, which dissociates H_2S into HS^- and H^+. This process increases the diffusion rate of H_2S and therefore the reactivity.