Using MgCl2 as absorbent

**Capacity/ Saturation limits:**

Theoretical:

Maximum stoichiometric capacity of the MgCl2 absorbent is assumed (conservatively) to be that given by a 1:1 molar ratio of ammonia to salt, which corresponds to a maximum absorbed concentration of 10.5 mol *NH*3/kg *MgCl*2.

*Reference: Modeling and Optimal Design of Absorbent Enhanced Ammonia Synthesis*

Estimation:

If we implement the exact absorber specifications:

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The solid phase will contain 40% salt by weight, the effective maximum absorbed concentration is 4.2 mol*NH*3 /kg*abs*.

*Reference: Modeling and Optimal Design of Absorbent Enhanced Ammonia Synthesis*

To find saturation limit:

Can either assume absorption rate is constant throughout the process

* Determine the amount of MgCl2 for the absorption tower.
* Set a saturation limit for regeneration. (e.g. Regenerate when 75% of the maximum uptake of absorbent)

Saturation point (mol) = 4.2\*mass of absorbent\* saturation limit

More advanced absorption rate model

A picture containing knife

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*Reference: Modeling and Optimal Design of Absorbent Enhanced Ammonia Synthesis*

**Product purity:**

Can’t find any purity data, but since MgCl2 only absorbs ammonia, we can assume the purity meets product specification?

**Cost analysis:**

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A close up of a logo

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A\_abs = area of the tubes = count\*L\*pi\*(D^2)/4 = 29\*1\*pi\*0.25^2=5.694m^2

Fp = 0.125\*(13.8/10)+0.875 = 0.151

Assume regeneration time is 1 hr

Weight of absorbent needed = 22340mol over 4.2 mol*NH*3 /kg*abs= 5319kg*

Capital cost = 66800+1039000\*0.151\*(5.694/100)^0.68+0.35(0.4\*5319)+61.33(0.6\*5319)^0.563

=89150+745+5759=**95004**