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Optimization of a hydrometallurgical LIB recycling process by recirculation of product and waste streams

Motivation

- Climate change requests E-mobility and thus requirements of raw materials
 - Recycling becomes increasingly important as a secondary resource
 - Low recycling efficiencies and purities as well as too large waste streams are problems for upscaling to industrial size
- Process must be improved!



Dominic Dittmer



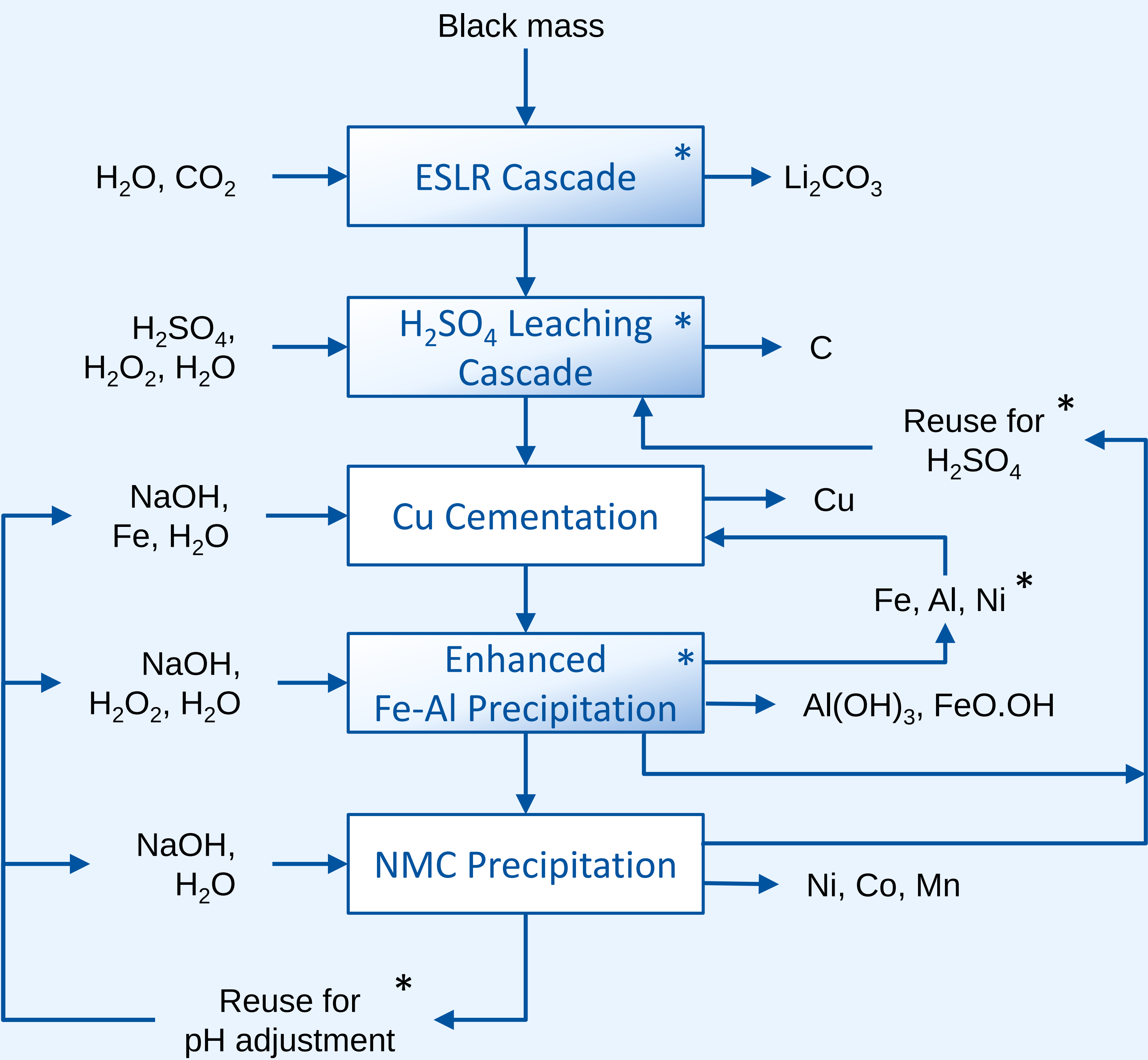
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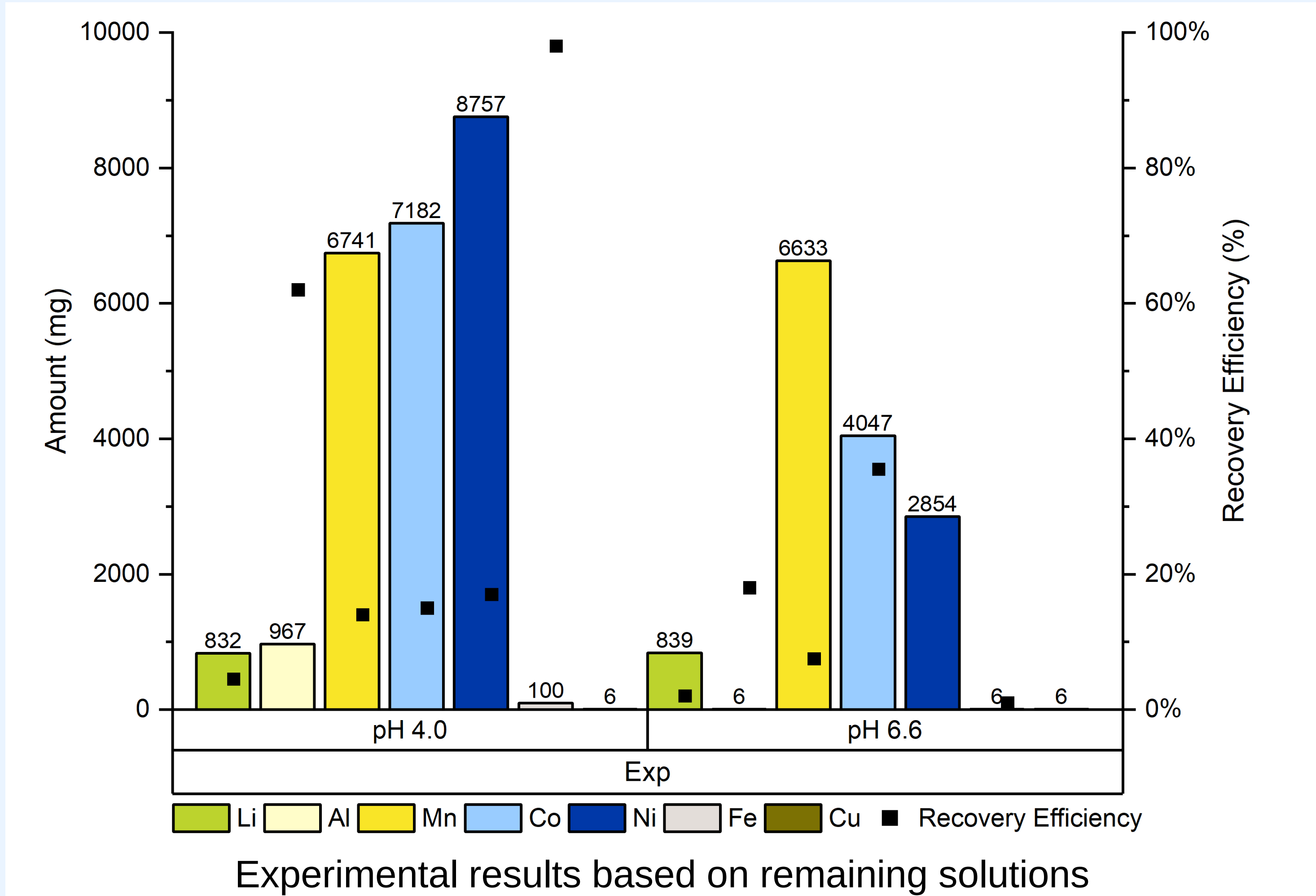
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Hydrometallurgical Process with Improvements*

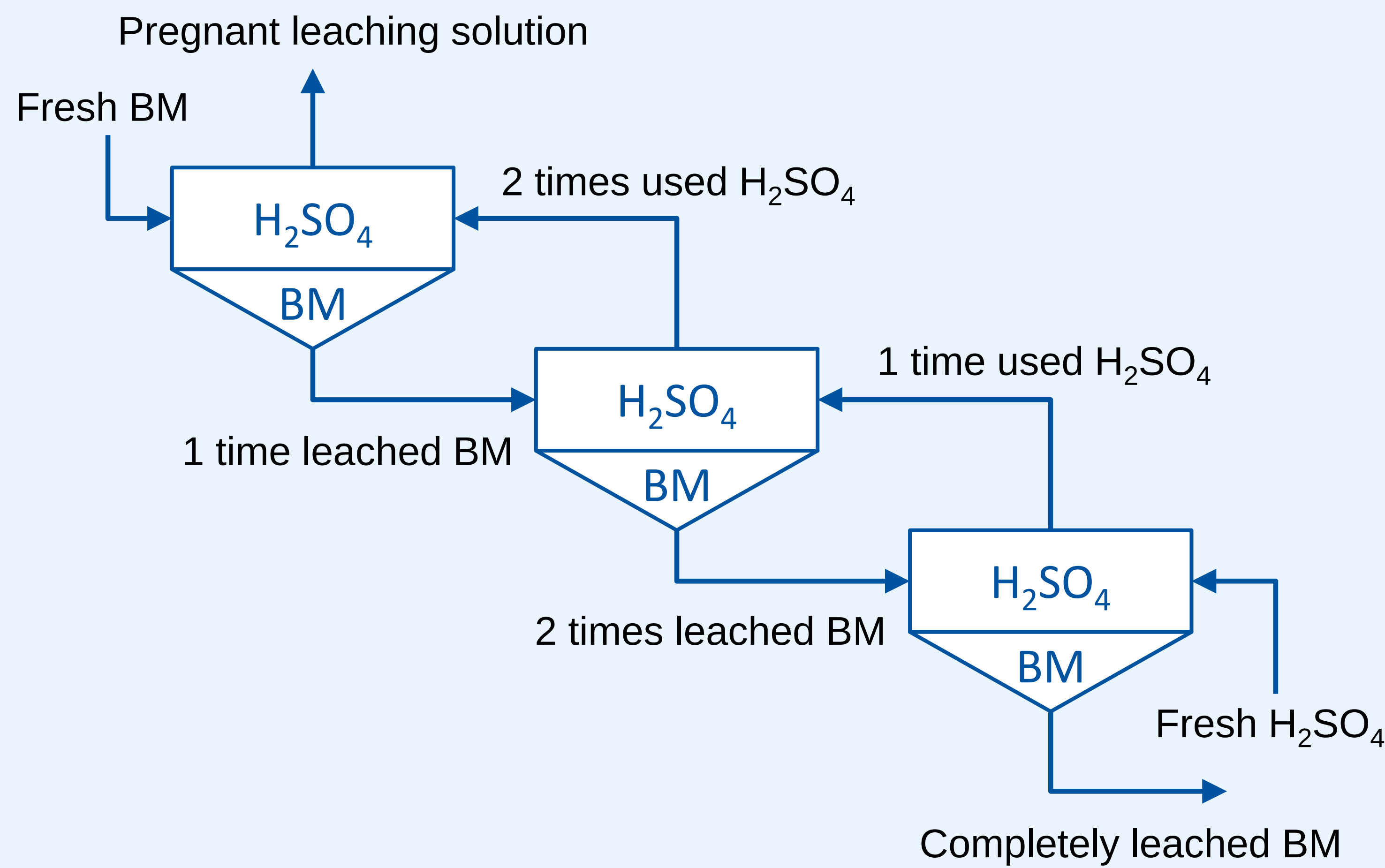


Results: Fe-Al Precipitation experimental Work

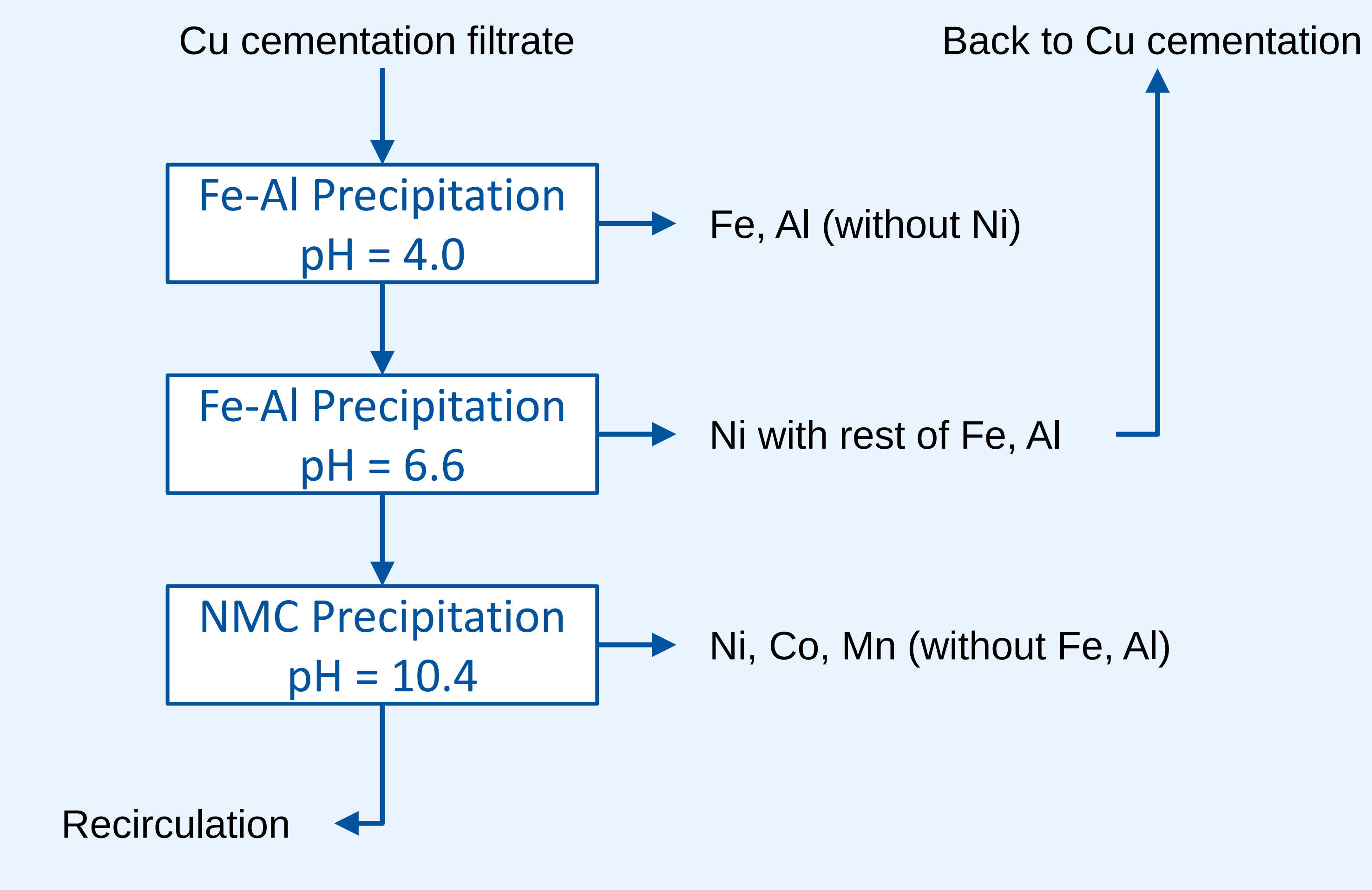


- Main part of Fe (98.1 %) and Al (61.6 %) removed at pH = 4.0
- Fe and Al are not longer detectable after pH = 6.6
- Increase of NMC purity
- Reduction of Ni loss by recirculation back to Cu cementation
- Increase of NMC and Fe-Al recoveries

Process Improvement: Leaching Cascade



Process Improvement: Enhanced Fe-Al Precipitation



Conclusion

- Reduction of water and acid
- Less losses of valuable metals due to recirculation (Li und Ni)
- Increasing of purity and recovery of Fe, Al, Li, Ni, Co and Mn

Challenges

- Increase of investment costs is an obstacle
- Accumulation of unwanted elements has to be analyzed
- Removal process step of unwanted elements has to be included