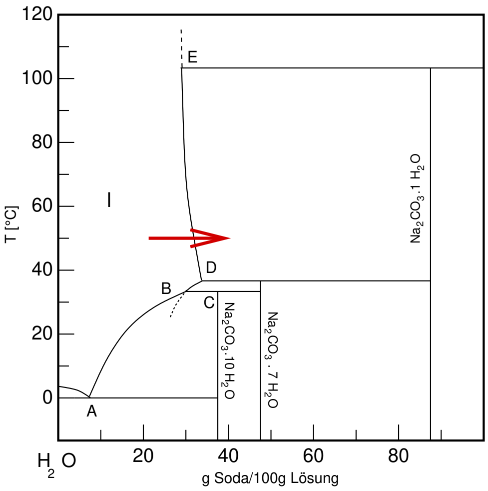
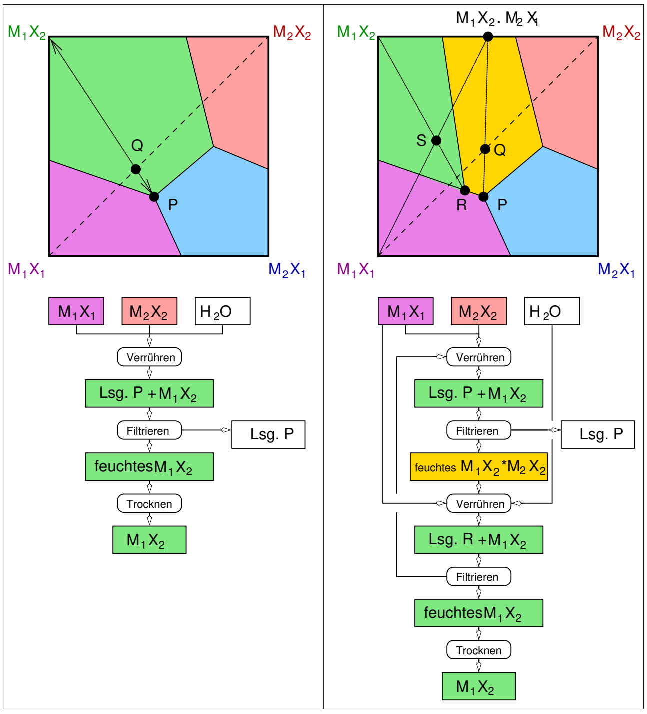
3.2. Soda (reziproke Umsetzung)

	Le-Blanc-Prozeß (veraltet)	Solvay-Prozeß (rückläufig)
1	$2NaCl + H_2SO_4 \longrightarrow 2HCl + Na_2SO_4$	$2NH_3 + 2CO_2 + 2H_2O \longleftrightarrow 2NH_4HCO_3$
2	$Na_2SO_4 + 2C \longrightarrow 2CO_2 + Na_2S$	$2NH_4HCO_3 + 2NaCl \rightarrow 2NaHCO_3\downarrow + 2NH_4Cl$
3	$Na_2S + CaCO_3 \longrightarrow Na_2CO_3 + CaS$	$2NaHCO_3 \xrightarrow{150^\circ C} Na_2CO_3 + H_2O + CO_2$
(4)	$CaS + CO_2 + H_2O \longrightarrow CaCO_3 + H_2S$	$CaCO_3 \xrightarrow{900^c} CaO + CO_2$
(5)	$H_2S + 2O_2 \longrightarrow H_2SO_4$	$2NH_4Cl + CaO \longrightarrow 2NH_3 + CaCl_2 + H_2O$
Σ 1-3	$2NaCl + CaCO_3 + H_2SO_4 + 2C \longrightarrow Na_2CO_3 + CaS + 2CO_2 + 2HCl$	$2NaCl + CaCO_3 \longrightarrow Na_2CO_3 + CaCl_2$

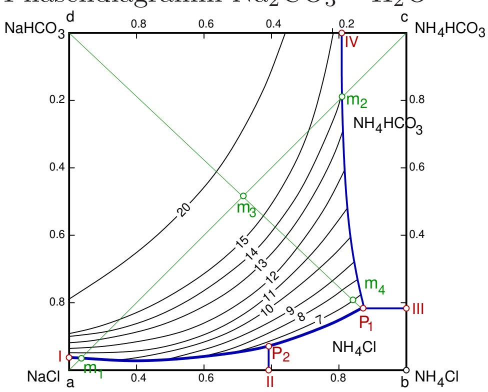
Elementarschritte der Sodaherstellung



Phasendiagramm $Na_2CO_3 - H_2O$



Gleichgewichtsdiagramme reziproker Umsetzungen (nach Jänecke)



Jänecke-Diagramm Na_2CO_3 - NH_4Cl - $NaHCO_3$ - NH_4HCO_3

Produkt	Herstellungverfahren/Reaktion	Lösungsmittel
Soda	$H_2O + NaCl + CO_2 + NH_3 \rightleftharpoons NaHCO_3 + NH_4Cl$	H_2O
	$(2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2)$	
Natriumsulfat	$MgSO_4 + 2NaCl \rightleftharpoons Na_2SO_4 + MgCl_2$	H_2O
Ammoniumsulfat	$H_2O + CaSO_4 + 2NH_3 + CO_2 \rightleftharpoons (NH_4)_2SO_4 + CaCO_3$	H_2O
Kaliumsulfat	$MgSO_4 + 2KCl \rightleftharpoons K_2SO_4 + MgCl_2$	H_2O
Kaliumnitrat	$NaNO_3 + KCl \rightleftharpoons KNO_3 + NaCl$	H_2O
Kaliumchlorat	$NaClO_3 + KCl \rightleftharpoons KClO_3 + NaCl$	H_2O
Kaliumsulfat	$MgSO_4 + 2KCl \rightleftharpoons K_2SO_4 + MgCl_2$	$H_2O/CO(NH_2)_2$
	$MgSO_4 + 2KCl \rightleftharpoons K_2SO_4 + MgCl_2$	H_2O/CH_3OH
	$Na_2SO_4 + 2KCl \rightleftharpoons K_2SO_4 + 2NaCl$	H_2O/CH_3OH
	$CaSO_4 + 2KCl \rightleftharpoons K_2SO_4 + CaCl_2$	H_2O/NH_3
Kaliumnitrat	$Ca(NO_3)_2 + 2KCl \rightleftharpoons 2KNO_3 + CaCl_2$	$H_2O/CO(NH_2)_2$

Salzherstellungen durch reziproke Umsetzungen