

Improving the Quality of LCI Data via the Laws of Thermodynamics

Heui-Seok Yi and Bhavik R. Bakshi
(Presented by Yi Zhang)

Department of Chemical and Biomolecular Engineering
The Ohio State University, Columbus, OH 43210, USA

InLCA/LCM 2006, October 4-6, 2006, Washington DC

Nature of Life Cycle Inventory Data

- Collecting good quality life cycle data is usually
 - Expensive and tedious
 - Inaccessible due to confidentiality issues
- Information often comes from **different sources**, and data are usually **aggregated**
- As a result, LCI data can be (Ayres, 1995)
 - Incomplete, inconsistent, and outdated
 - In violation of physical laws
- **However, methods for ensuring thermodynamic consistency of LCI data are not yet available**

Discrepancy in LCI of Chlor-Alkali Process

NaOH LCI from NREL

Chemicals	units	Input	Output
Coal	lb	68.1	
Natural gas	lb	178.1	
Residual oil	lb	3.8	
Salt	lb	1670.0	
Electricity	kWh	813.0	
Chlorine	lb		3.2E-04
Dissolved solids	lb		4.3E+00
Lead	lb		9.4E-07
Mercury	lb		5.4E-04
Nickel	lb		9.4E-07
Paticulates	lb		4.6E-04
Solid wastes	lb		3.1E+00
Sulfides	lb		1.5E-04
Sulfur oxides	lb		1.0E-03
Zinc	lb		9.4E-07
Caustic soda	lb		1000.0
Chlorine	lb		893.0
Hydrogen	lb		16.9
Total		1920.0	1917.3

NaOH LCI from NREL

Chemicals	units	Input	Output
Ash		10.2	7.4
Carbon	C	175.8	0.0E+00
Chlorine	Cl	1013.1	893.0
Hydrogen	H	48.9	42.1
Lead	Pb	0.0E+00	9.4E-07
Mercury	Hg	0.0E+00	5.4E-04
Nickel	Ni	0.0E+00	9.4E-07
Nitrogen	N	0.5	0.0E+00
Oxygen	O	13.7	400.0
Sodium	Na	656.9	574.8
Sulfur	S	0.9	6.4E-04
Zinc	Zn	0.0E+00	9.4E-07