

Life Cycle Inventory (LCI) Comparisons for Different Adhesive Chemistries



Abstract

Life cycle inventory analyses were made comparing medium performance solvent based and medium performance water based chemistries. Although energy for drying water based adhesives is greater than for solvent based adhesives is greater, overall environmental impact for waterborne chemistry is much lower than for solvent based adhesives.

Data Sources for the LCI

- Boustead LCI Model, [Boustead Consulting Ltd.](#)
- [SRI Consulting Process Economics Program](#) reports
- National Renewable Energy Laboratory report on Soybean (Castor Oil surrogate) production
- Rohm and Haas LCI for Acrylic Acid and process data for Butyl Acrylate production
- Rohm and Haas Adhesive Product Transfer Packages

Life Cycle Inventory

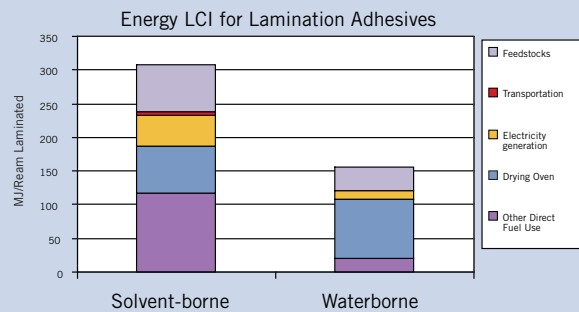
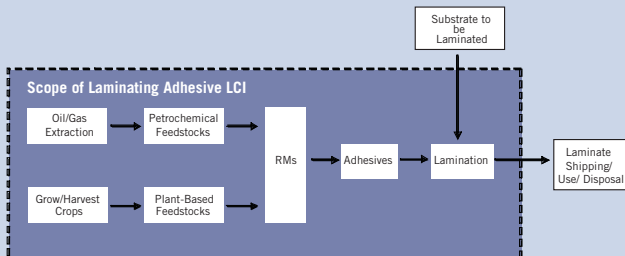
- Quantification of energy/material inputs and environmental impacts of a material or operation over its life cycle
 - Can range from mineral extraction/crop production (cradle) to ultimate disposal of discarded material (grave)
 - Common metric (megaJoules/kg) used for energy and feedstock inputs

Flexible Packaging Drying Ovens

- Potentially energy intensive operation
- Needed for solvent-borne and waterborne adhesives, but not for solvent-free
- Energy values based on Boustead data for packaging lamination
 - 20% added for additional energy needed for waterborne adhesives
 - Largest uncertainty of all energy inputs to the LCI

Adhesives LCI Scope

"Cradle-to-gate" LCI, where "gate" is the customer's shipping



LCI Adhesive Application Data

Adhesive System	Application Rate		Product % Solids		Application Ratio	
	Lbs Solids /Ream	Lbs Organics /Ream	Adhesive	Co-Reactant	Adhesive	CR
Solvent	2.25	3.72	60	75	100	4
Waterborne	1.5	1.5	45	100	100	2

LCI Results – Other Resources/ Impacts

	Resources/Ream Laminated	
	Solvent-borne	Water-borne
CO ₂ Equivalents, kg/ream	16.6	9.2
Water Consumption, L/ream	113	17
Raw Materials, kg/ream	7.5	3.6

