

Supplementary Material for “A condom’s footprint – life cycle assessment of a natural rubber condom” (DOI: 10.1007/s11367-019-01701-y)

Data Overview

phase	included	not included	data limitation	assumption / informed guesses	allocation method
natural rubber plantation	<p>maintenance: fertilizer , herbicides, pesticides (including direct greenhouse gas emissions), carbon sequestration by rubber trees</p> <p>harvesting: application of preservatives (ammonia) and stimulation (ethylene gas), byproducts (timber, seeds, field coagula)</p> <p>preparation: felling of rubber trees using machine sawing, greenhouse gas emissions from incineration of remaining biomass (e.g. roots)</p>	<p>tools (headlights, tapping knives, etc.), internal transport, seedling nursery, plantation building, infrastructure (e.g. any additional land preparation technique or road construction)</p>	<p>heavy metal emissions from agrochemicals (data on soil erosion and heavy metal uptake of rubber trees), ethylene gas emissions from stimulant, ammonia volatilization during collection</p>	<p>high range of different latex yields, amount of timber and seeds collected, water consumption for agrochemicals, frequency of applied stimulation, applied preservation</p>	<p>economic allocation, carbon content for carbon sequestration</p>
latex processing	<p>preservation (LA-TZ), DAP, energy and water consumption, wastewater treatment, byproduct (skim block rubber)</p>	<p>internal transport, office activities, machinery and building</p>	<p>ammonia volatilization (deammonification) of skim latex, hydrogen sulphide and methane emissions (wastewater treatment specific to latex processing), data on black and pond rubber production, fate of chemicals (i.e. an unspecified mass needed to be defined to keep mass balance)</p>	<p>data are mainly from Thailand, it is assumed that the technology is equal</p>	<p>economic allocation</p>
condom production	<p>energy and water consumption (production and packaging process), wastewater treatment, additives and further ingredients, packaging materials, byproducts (packaging and rubber waste sold to recycling plants)</p>	<p>internal transport, office activities, machinery and building</p>	<p>specific wastewater treatment, converting single packaging materials into multilayer compounds, no datasets for two ingredients, fate of chemicals partly unclear (i.e. an unspecified mass needed to be defined to keep mass balance)</p>		<p>economic allocation</p>

Internat. transport	transport mix via plain and ship and truck				none
einhorn's office	energy and water consumption of office and logistic activities, commuting, business travels, transport packaging waste	municipal solid waste, green electricity mix different to general German mix	no background data for different public transport options, rather old energy and water consumption data		none
retailing	retail via traditional stores and webshops, transport packaging, transport company fleet (DHL), transportation of the condom to the home of the consumer, transportation of municipal waste collection	wrapping paper and merchandise articles for sales via einhorn's webshop, retailing outside of Germany	very limited model with highest data limitations for: information on car or public transport option for freight transport, distance to customer for webshop and other online retailers, missing activities for traditional markets (e.g. energy consumption per good) and web shops (e.g. energy consumption for servers, consumers computer, failed delivery, etc.)	all customer use the car to transport their shopping goods back home, all transport processes except shopping trip are based on the company fleet of DHL, other online retailers use the same transport packaging as einhorn does, distance to customer for webshop and other online retailers	none
consumption & end-of-life	waste treatment for condom and packaging, 50% of consumers use toilet paper to discard condoms, transportation of municipal waste collection	human health issues (latex allergy, nitrosamines), no other end-of-life options despite of waste incineration for condom, end-of-life outside of Germany	waste incineration dataset for synthetic rubber is used, no data for aluminium incineration	three papers of toilet paper are used	none