

Supplementary Information for :

Life cycle assessment of the production of alkyl polyglycoside from ball-milled wheat straw compared to the conventional production based on corn-starch

Table S1. Foreground data and background data sources for the ball milling process

| Flow/Process | Quantity | Ecoinvent process (background data source) |
|---------------------|---|--|
| Straw | 679 kg | Straw {CH} wheat production, Swiss integrated production, intensive Alloc Def |
| Sulfuric acid | 67,9 kg | Sulfuric acid {GLO} market for Alloc Def |
| Fatty alcohols | 490,2 kg | Fatty alcohol {GLO} market for Alloc Def |
| Steam | 7,3 kg | Steam, in chemical industry {RER} production Alloc Def |
| Soda | 55,4 kg | Sodium hydroxide, without water, in 50% solution state {GLO} market for Alloc Def |
| Electricity | 35 kWh (grinding) 255 kWh (ball milling) 34 kWh (glycosylation) | Electricity, medium voltage {FR} market for Alloc Def |
| Lignin incineration | 115 kg | Biowaste {GLO} treatment of biowaste, municipal incineration Alloc Def |

Table S2. Foreground data and background data sources for the reference process

| Flow/Process | Quantity | Ecoinvent or GaBi process (background data source) |
|---------------|----------|---|
| Corn starch | 631 kg | Maize starch {GLO} market for Alloc Def |
| Fatty alcohol | 426 kg | Fatty alcohol {GLO} market for Alloc Def |
| Sulfuric acid | 5 kg | Sulfuric acid {GLO} market for Alloc Def |
| Electricity | 313 kWh | Electricity, medium voltage {FR} market for Alloc Def |
| Steam | 312 kg | Steam, in chemical industry {RER} production Alloc Def |

Table S3. Additional processes used for the sensitivity analysis

| Flow/Process | Ecoinvent or GaBi process (background data source) |
|--------------------------------|--|
| Fatty alcohol from coconut oil | Fatty alcohol {RER} production, from coconut oil Alloc Def |
| Fatty alcohol from palm kernel | Fatty alcohol {RER} production, from palm kernel oil Alloc Def |
| Electricity german mix | Electricity, medium voltage {DE} market for Alloc Def |
| Electricity European mix | Electricity, medium voltage {Europe without Switzerland} market group for Alloc Def |

Table S4. Absolute impact results for ball milling and reference processes (ReCiPe2016 Midpoint H) – 1 ton of APG

| Impact category | Unit | Ball milling process | Reference process |
|---|--------------------------|-----------------------------|--------------------------|
| Global warming | kg CO ₂ eq | 1870.856 | 2240.740 |
| Stratospheric ozone depletion | kg CFC11 eq | 0.005 | 0.010 |
| Ionizing radiation | kBq Co-60 eq | 236.455 | 263.685 |
| Ozone formation, Human health | kg NO _x eq | 3.803 | 4.800 |
| Fine particulate matter formation | kg PM _{2.5} eq | 2.411 | 2.748 |
| Ozone formation, Terrestrial ecosystems | kg NO _x eq | 4.138 | 5.123 |
| Terrestrial acidification | kg SO ₂ eq | 8.315 | 11.786 |
| Freshwater eutrophication | kg P eq | 0.406 | 0.554 |
| Terrestrial ecotoxicity | kg 1,4-DCB e | 0.908 | 1.333 |
| Freshwater ecotoxicity | kg 1,4-DCB e | 52.735 | 62.124 |
| Marine ecotoxicity | kg 1,4-DBC e | 54.843 | 69.254 |
| Human carcinogenic toxicity | kg 1,4-DBC e | 42.479 | 54.840 |
| Human non-carcinogenic toxicity | kg 1,4-DBC e | 41108.948 | 72891.338 |
| Land use | m ² a crop eq | 1053.839 | 1945.836 |
| Mineral resource scarcity | kg Cu eq | 4.563 | 6.407 |
| Fossil resource scarcity | kg oil eq | 493.554 | 559.275 |
| Water consumption | m ³ | 96.307 | 97.476 |