Supplementary Material to:

A biobased, bioactive, low CO₂ impact coating for soil improvers.

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Specifications of magnesium lignosulfonates provided by SAPPI

Appearance: Brown liquid Solid Content: 8% Ash content: 4,4% of dry basis Reducing Sugars: Below 1000mg/kg liquid Rest are lignosulfonates pH:3-4 Full Water soluble Mg and Ca content was not analysed



Effects of polymerized lignosulfonates on plant germination and growth

Figure 10: Comparison of germination rate and growth development of tomato on fertile soil and fertile soil with 3.6 % v/v polymerized lignosulfonates added.



Figure 11: Comparison of germination rate and growth development of corn on fertile soil and fertile soil with 3.6 % v/v polymerized lignosulfonates added.



Figure 12: Comparison of germination rate and growth development of wheat on fertile soil and fertile soil with 3.6 % v/v polymerized lignosulfonates added.

Life cycle inventory

Table 1 shows the processes and their emissions used for modelling CO_2 -eq. emissions. Table 2 indicates the amounts of products used to produce 1 kg of LS. Min and max value show the expected efficiencies that can be realized at an industrial scale in an optimized (min) and a not fully optimized (max) scenario.

Table 1: Life cycle processes used

| Ecolnvent 3.4 process or reference | Motivation for selection and reference | Value | Unit |
|---------------------------------------------|----------------------------------------|---------|------------------------------|
| | | GWP100a | |
| Heat, in chemical industry {RER} steam | Proxy for marginal heat demand | | |
| production in chemical industry Conseq, | | | kg CO ₂ -eq./ kWh |
| U | | 0.27 | heat |
| Electricity, low voltage market for | | | kg CO ₂ -eq./ kWh |
| Conseq, U | | 1.12 | el |
| Polyurethane, flexible foam market for | Proxy for current state-of-the-art | | |
| Conseq, S | coating (Azeem et al. 2014) | 5.12 | kg CO ₂ -eq./kg |
| Polyethylene, linear low density, granulate | Proxy for current state-of-the-art | | |
| market for Conseq, U | coating | | |
| | | 1.92 | kg CO ₂ -eq./kg |
| Xylitol | Plasticizer (Dasgupta et al. 2021) | 17.29 | kg CO ₂ -eq./kg |
| Glycerine market for Conseq, U | Plasticizer | 2.26 | kgCO₂ eq/kg |
| Maize starch production Conseq, U | Plasticizer | 0.721 | kgCO ₂ eq/kg |

Table 2: Inventory of processes used for production of 1kg of LS coatings.

| | min | max | Unit |
|-----------------------------------------------------------------------------------|------|------|------|
| Heat, in chemical industry {RER} steam production in chemical | | | |
| industry Conseq, U | 1.27 | 9.11 | kWh |
| Electricity, low voltage {AU} market for Conseq, U - purification | 0.19 | 0.30 | kWh |
| Electricity, low voltage {AU} market for Conseq, U – polymerization | | | |
| [value max value current aeration energy demand in paper with a fine | | | |
| bubble aeration efficiency of 15.64 m ³ air /kWh, min scenario assumes | | | |
| 20% efficiency gain to full scale) | 0.3 | 0.38 | kWh |
| Xylitol, Glycerine | 0.33 | 0.33 | kg |
| Lignosulfonate | 0.66 | 0.66 | kg |

References

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