# Sustainability assessment of POSS/PA6 nano-sausage casing versus cellulose casing

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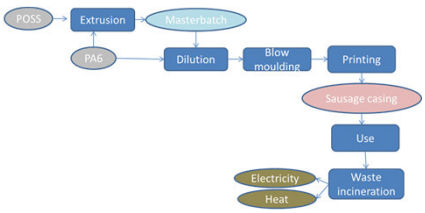
In this study, the use of a POSS-PA6 nanocomposite for sausage casing is analyzed and compared to the use of conventional sausage casing produced from cellulose. A full sustainability assessment is conducted of which the methodology has been developed in the European Prosuite project.

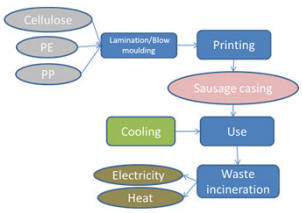
It covers the five endpoints:

**Impact on human health**
**Impact on natural environment**
**Impact on exhaustible resources**
**Impact on prosperity**
**Impact on social well-being**

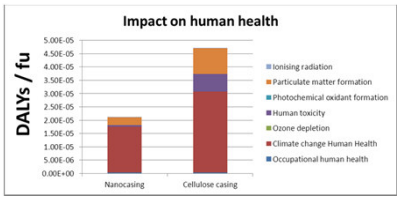


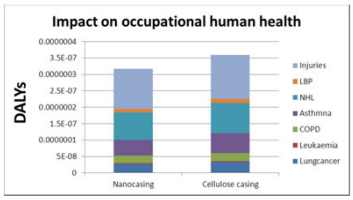

Flowchart of the nanocomposite sausage casing (cradle-to-grave)

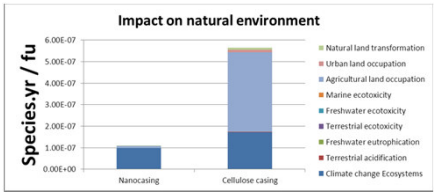
**Functional unit: "Casing for 1000 sausages of 15 cm length and 3.5 cm width to be kept fresh for at least 20 days"**

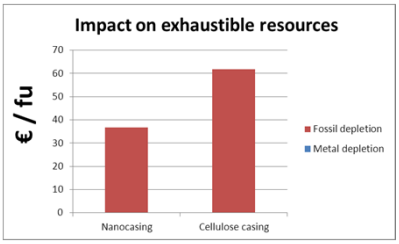



Flowchart of the life cycle of cellulose sausage casing (cradle-to-grave)

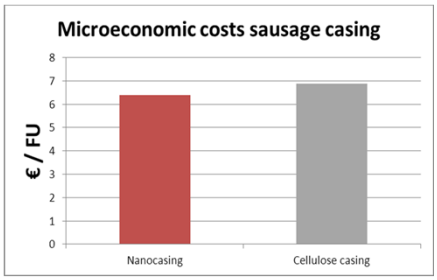


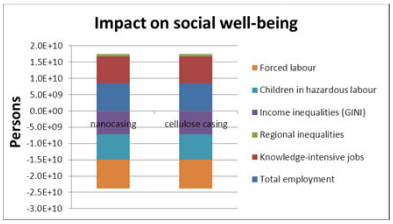



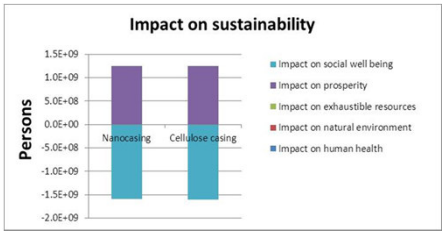




| | Nano casing | Cellulose casing |
|---|---|---|
| Production volume (€) | 3.51E+06 | 9.56E+08 |
| Production volume (functional units) | 5.98E+05 | 1.38E+08 |
| Total costs (€/fu) | 6.40 | 6.87 |
| Direct Capital Requirements (€ per FU) | 0.33 | 2.81 |
| Direct compensation of employees (€/fu) | 0.08 | 0.21 |
| Total compensation of employees (€/fu) | 2.55 | 2.76 |
| Import dependency–fu-% | 5.13 | 5.23 |
| Financial risks – fu capital costs/total costs | 5% | 41.0% |
| Total compensation of employees – full scale | 5.50747939E+13 | 5.50747941E+13 |
| Total capital compensation – full scale | 1.71689685E+13 | 1.71689693E+13 |
| Import dependency – full scale - € | 1.5966691213E+12 | 1.5966691432E+12 |
| BW linkages – full scale | 3.8001960 | 3.6798083 |
| FW linkages – full scale | 2.649803926 | 2.649803924 |
| Structural index – full scale | 467.81216459 | 467.81216454 |
| Capital productivity (€/€) | 6.74013306 | 6.74013276 |
| Labour productivity (€/€) | 2.1011632481 | 2.1011632419 |
| Labour productivity (€/hours) | 15,361,708.93 | 15,361,708.97 |
| Resource productivity | 796669.5765 | 796669.5775 |

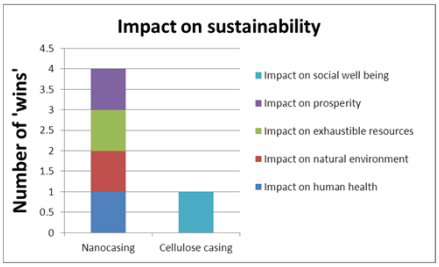



| | European GDP – full scale - € | Global GDP – full scale - € |
|---|---|---|
| Nano casing | 214170106121 90.5 | 115721133350216 |
| Cellulose casing | 214170101292 76.8 | 115721132845450 |
| Δ GDP (€) | +482914 | +504766 |
| Δ GDP (%) | +0.0000023% | +0.0000044% |




Weighted sum approach




Condorcet rule

## Conclusions:

Nanocasing shows better performance for the impact categories 'impact on human health', 'impact on natural environment', 'impact on exhaustible resources' and 'impact on prosperity'. Only for 'impact on social well-being' cellulose casing performs better. This is related to possible health risks of nanoobjects in case of the nanocasing. The condorcet rule gives a clearer picture on sustainability performance. It is preferable over the weighted sum approach.