LCA OF DRYING SEGREGATED BIOWASTE AT SOURCE: THE CASE STUDY OF PAPAGOS - CHOLARGOS MUNICIPALITY, GREECE.

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Introduction (1/2)

✓Main goal of DRYWASTE project was to develop and demonstrate an **innovative household dryer** for the drying of bio-waste at household level (by effectively removing the moisture content), in order to significantly reduce its volume at source.

✓In particular MSW collection and transportation, is the most fuel-intensive step in waste management and accounts for **40–60% of the total MSW management budget.**

✓Furthermore, the average moisture content of food waste ranges from 75 to 95 % by weight. Considering the above, bio-waste moisture content removal at source would significantly reduce its quantity and hence waste collection density.

Introduction (1/2)

Based on that simple principle, a new approach on bio-waste management was developed.

This approach involves the application of an innovative household drier for the dehydration of bio-waste at source, in order to significantly **reduce its mass** and volume at household level, **and hence the collection frequency**.

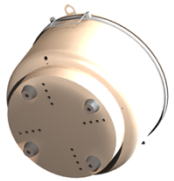
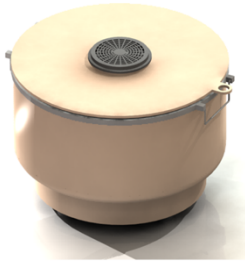
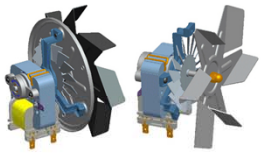
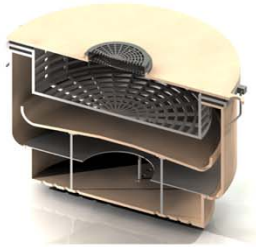
Objectives

Main objective of this work is to assess the environmental performance and **potential environmental impacts** of the system under examination, which involves the household drier use and kerbside collection of the residues, by conducting a **Life Cycle Assessment** (LCA) study.

Furthermore, a **comparison** is performed between the potential environmental impacts of system and the ones resulting from direct collection of bio-waste.

Drywaste system

The system is a ceramic in–vessel cylindrical batch reactor with a daily feeding capacity of around 4 kg of food waste.

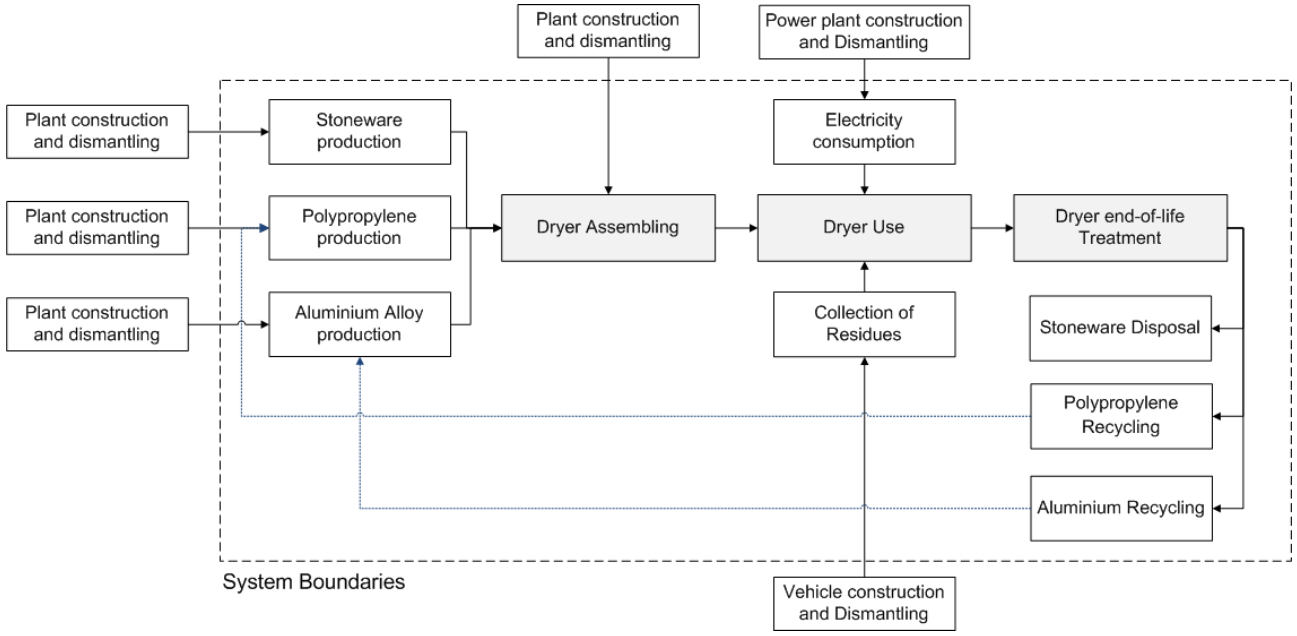
		 Household drier
(i) chamber and base	(ii) bio-waste basket	
		 Household drier (cross-section)
(iii) thermal plate	(iv) centrifugal fan	
		
(v) water vapour & leachate collector	(vi) lid and activated carbon filter	

The main components of the system

LCA (1/2)

Functional unit: Treatment of 1 tn of biowaste.

System boundaries: The analysis of the drier included the production of all drier's components, the drier assembling, the use and the end-of-life treatment of the unit.

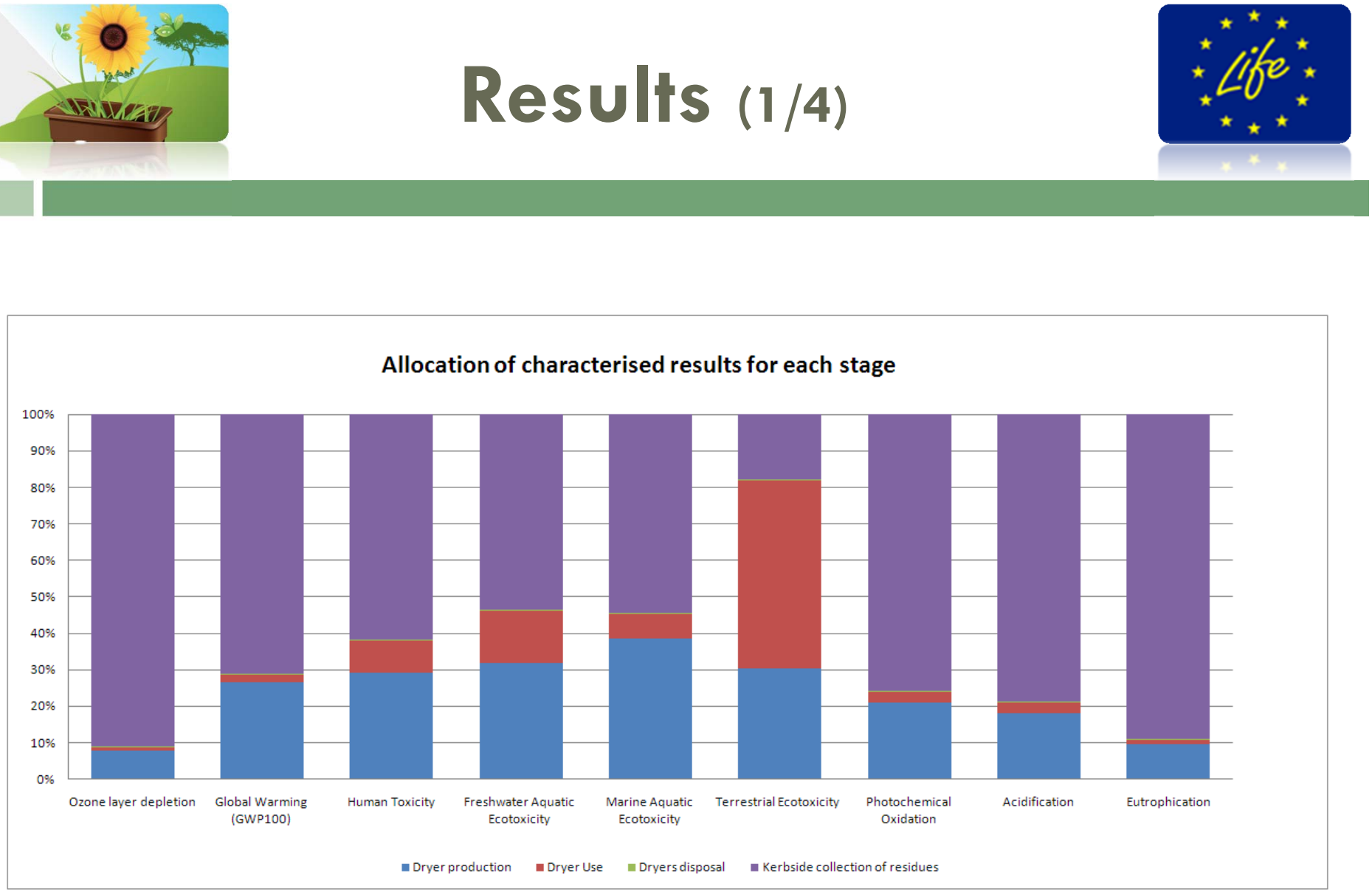


LCA (2/2)

Types, sources and quality of data: Data related to mass balances and energy consumption of the dryer, was gathered during the 8 month pilot scale application of the unit to 30 households in Greece in 2012. Information about the production of the drier's components, the electricity production, the waste collection and the drier's end-of-life treatment, was sourced from IDEMAT 2001 and ecoinvent databases.

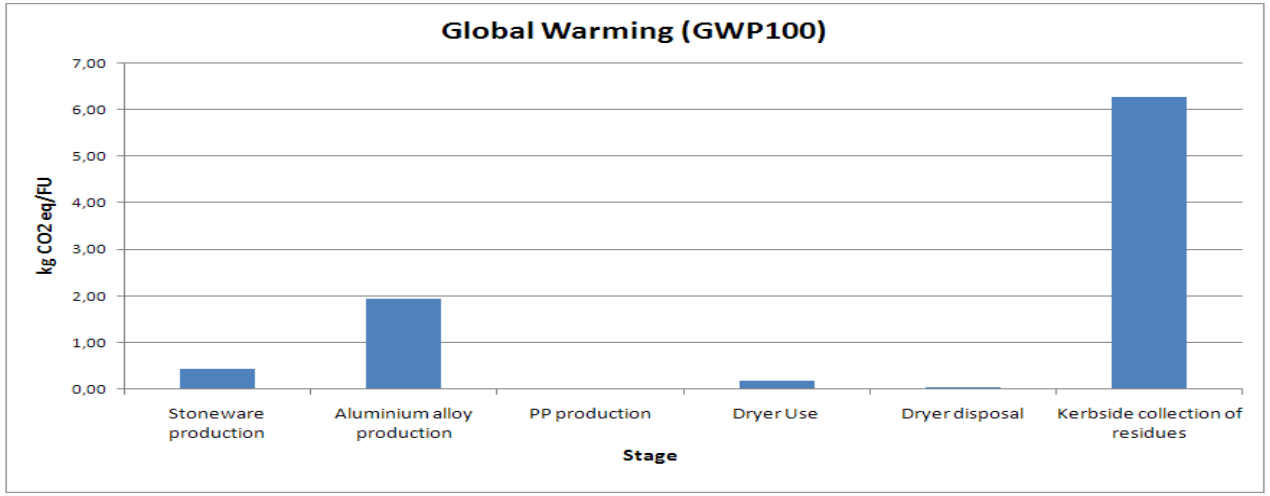
For the impact assessment analysis, **CML 2001 methodology** was used. Normalisation was also conducted in order to provide the means for a comparative analysis between different impact categories.

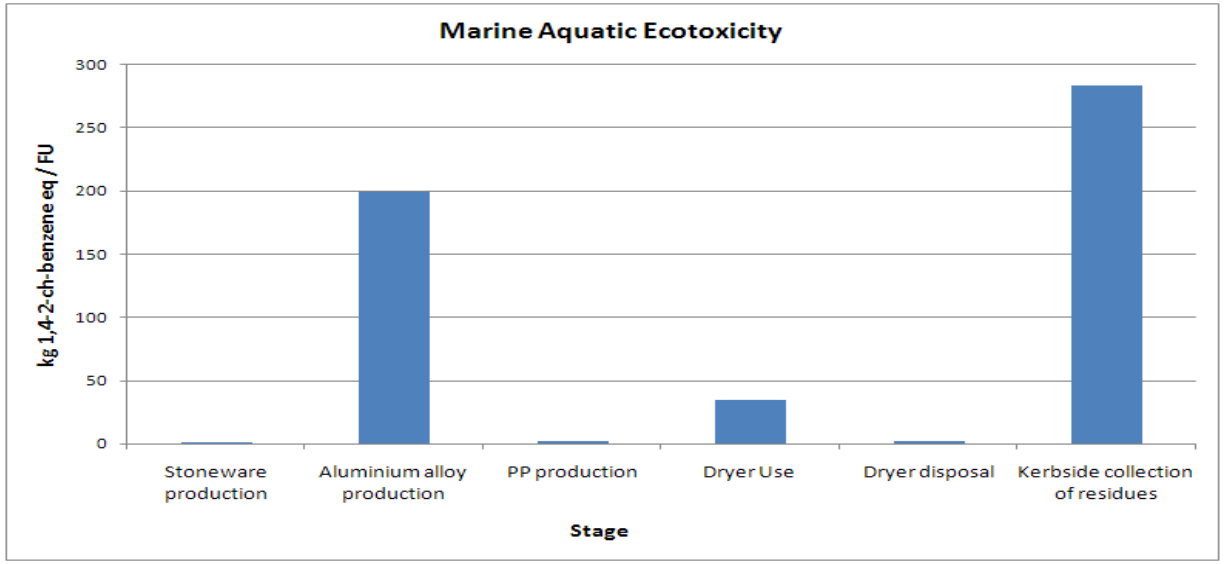
Results (1/4)


Allocation of characterised results for each stage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Ozone layer depletion
Global Warming (GWP100)
Human Toxicity
Freshwater Aquatic Ecotoxicity
Marine Aquatic Ecotoxicity
Terrestrial Ecotoxicity
Photochemical Oxidation
Acidification
Eutrophication
Dryer production
Dryer Use
Dryers disposal
Kerbside collection of residues

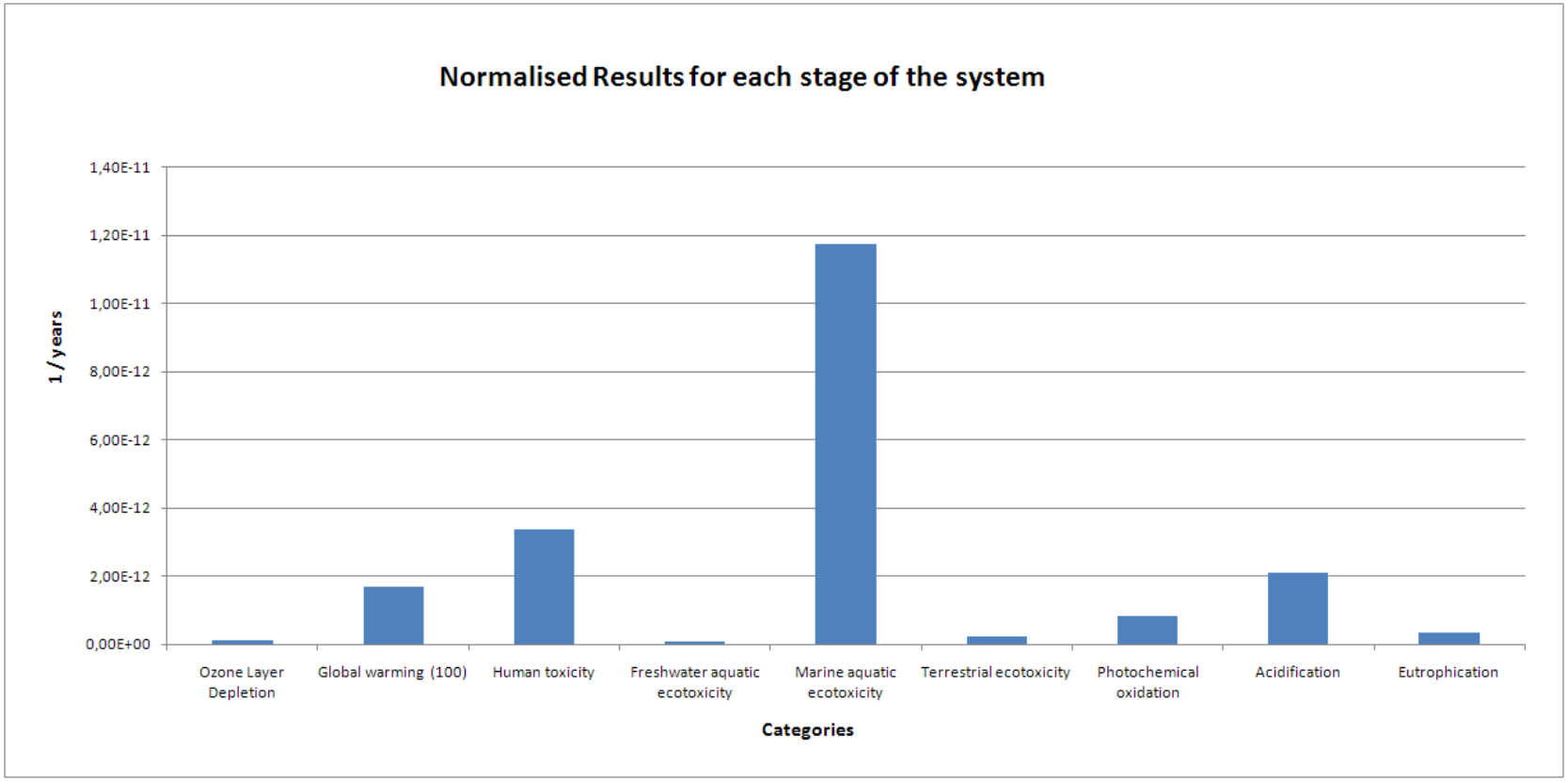
Results (2/4)


Life

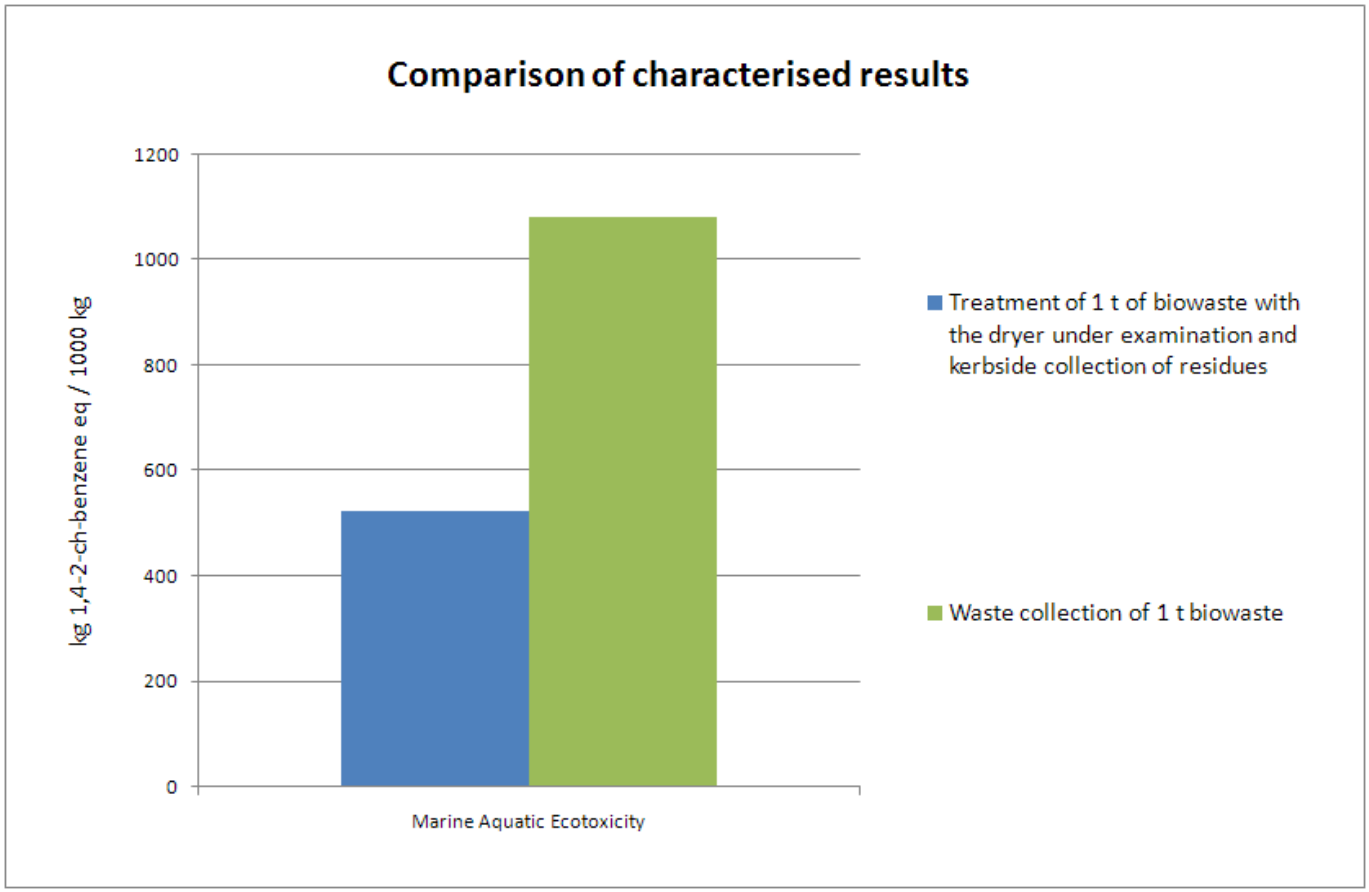

Global Warming (GWP100)
kg CO2 eq/FU
7,00
6,00
5,00
4,00
3,00
2,00
1,00
0,00
Stoneware production
Aluminium alloy production
PP production
Dryer Use
Dryer disposal
Kerbside collection of residues
Stage


Marine Aquatic Ecotoxicity
kg 1,4-2-ch-benzene eq / FU
300
250
200
150
100
50
0
Stoneware production
Aluminium alloy production
PP production
Dryer Use
Dryer disposal
Kerbside collection of residues
Stage

Results (3/4)


Normalised Results for each stage of the system
1,40E-11
1,20E-11
1,00E-11
8,00E-12
6,00E-12
4,00E-12
2,00E-12
0,00E+00
1 / years
Ozone Layer Depletion
Global warming (100)
Human toxicity
Freshwater aquatic ecotoxicity
Marine aquatic ecotoxicity
Terrestrial ecotoxicity
Photochemical oxidation
Acidification
Eutrophication
Categories

Results (3/4)


Comparison of characterised results
kg 1,4-2-ch-benzene eq / 1000 kg
1200
1000
800
600
400
200
0
Marine Aquatic Ecotoxicity
Treatment of 1 t of biowaste with the dryer under examination and kerbside collection of residues
Waste collection of 1 t biowaste

Conclusions

- System affects mainly Marine Aquatic Ecotoxicity category, following by Global Warming, Human Toxicity and Acidification.

- The high value of MAEP is associated with vanadium emissions from aluminium alloy production and barium, vanadium and barite emissions from diesel combustion during kerbside collection. However, high MAEP values appear to be a common result regarding waste collection.

- When the household drier is used the potential environmental impacts in all categories decrease significantly, with the exception of Terrestrial Ecotoxicity, which is mostly affected by emissions of chromium VI to soil during electricity production.

Thank you for your attention.

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