SUSTAINABLE ASSESSMENT OF PRODUCTS / BIOMASS MATERIALS

Kenji Ohashi

SHISEIDO CO., LTD.

1-6-2 Higashi-shimbashi, Minatoku, Tokyo 105-8310, Japan

Keywords: CO_2 emissions; water consumption; shampoo; bio-plastics; data management

ABSTRACT

We launched new shampoo series, which bottle is made from Green-Polyethylene (sugarcane-derived PE), in Oct. 2011. In order to confirm the contribution to reduction of CO_2 emissions and increment of water consumption because of using Green-PE, we carried out life cycle CO_2 and water assessment of this shampoo and some bio-plastics. Green-PE can decrease 0.13 kg of CO_2 emissions instead of increasing 0.13 m^3 of water consumption compared to the fossil-derived PE bottle. We have to consider the increase in other environmental impacts as well as climate change issue in economic activities.

INTRODUCTION

Using the biomass materials to suppress the CO_2 emissions is now spreading all over the industries in recent years. On the other hand, it would increase other environmental burden, for example fresh water consumption, to cultivate the feedstock crops. How much water can we use in order to decrease CO_2 emissions? In this study, we carried out life cycle analysis of our product —— Super-Mild Shampoo —— and bio-plastics about CO_2 emissions and water consumption.

Figure 1. Super-Mild Series, which packaging are made from sugarcane-derived polyethylene

RESULTS

1. Life cycle CO_2 and water assessment of shampoo

We launched new shampoo series, which bottle is made from Green-PE, in Oct. 2011. We carried out calculating life cycle CO_2 emissions and water consumption of this shampoo. As a result, the shampoo emits 14.5 kg CO_2eq, and consumes 2.0 m^3 of fresh water through its life cycle. Green-PE can decrease 0.13 kg of CO_2 emissions instead of increasing 0.13 m^3 of water consumption compared to the fossil-derived PE bottle.

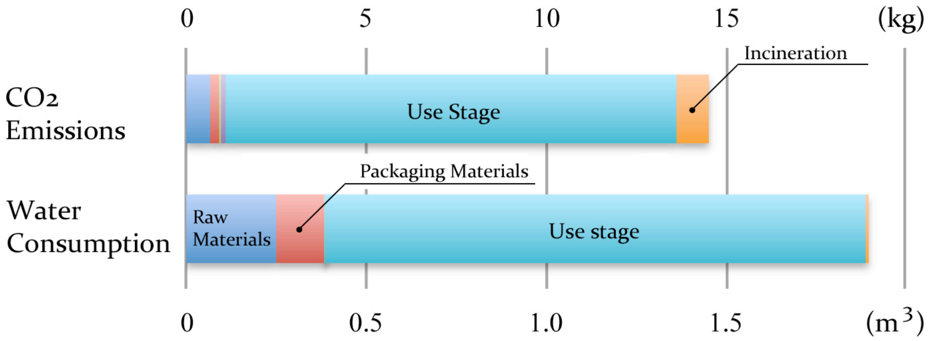

Figure 2. CO_2 emissions and water consumption of Super-Mild shampoo (600mL)

2. Life cycle CO_2 and water assessment of bio-plastics

When we use the biomass materials in order to reduce CO_2 emissions, the water consumption would increase as a trade-off. So we defined "*Water Efficiency*" as following equation and tried to estimate *Water Efficiency* of some bio-plastics, PLA (U.S., Maize, Plant ratio: 100%), PET-1 (India, Sugarcane, Plant ratio: 20%), PET-2 (Brazil, Sugarcane, Plant ratio: 20%) and PE (Brazil, Sugarcane, Plant ratio: 100%).

$$\textit{Water Efficiency} = \text{Increment of water consumption } [m^3] * \text{Water stress index}$$

$$/ \text{ Decrement of } CO_2 \text{ emissions } [kgCO_2e]$$

As a result, Green-PE which is adopted in the bottle of Super-Mild Shampoo consumes 1.0 m^3 of fresh water instead of reducing 1.0 kg of CO_2 emissions. Furthermore, the *Water Efficiency* index, that takes into account the water stress of growing area, showed the fact that there is a big difference due to the growing area even in the same kind of bio-plastic. This result indicates the importance of geographic data management on sustainable water use.

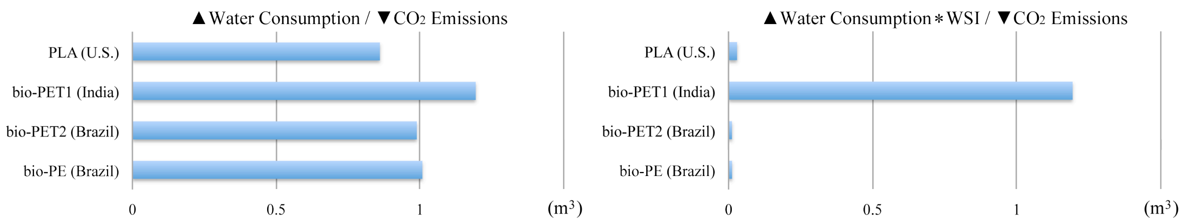

Figure 3. Increment of water consumption and *Water Efficiency* of bio-plastics

DISCUSSION

Using the biomass materials can suppress the CO_2 emissions effectively. However, it leads to an increase in fresh water consumption as a trade-off. We defined a new environmental indicator, *Water Efficiency*, and tried a comparative study about some kinds of plant-derived plastics. As a result, the fact that there is a significant difference in *Water Efficiency* score depends on its cultivation area has come out. This indicator suggests the importance of geographic data management, and it can be easier for us to select more environmental-friendly materials. We will apply it in developing the environmental-friendly products. However, environmental impact that increases as a trade-off to reduce CO_2 emissions is not limited to water consumption. We should consider whether we choose other environmental categories depending on the purpose of the assessment.

Meanwhile, it's necessary to have a sophisticated data management method to calculate the product life cycle environmental burden. Therefore, we designed a new relational database, named CLIC (Calculator of Life cycle Inventory for Cosmetics), on FileMaker Pro. CLIC can powerfully support us not only product life cycle analysis but also corporate value-chain analysis, with only a few clicks. In these years, the global standards based on LCA method, have been vigorously discussed and developed against the backdrop of heightened concerns over global environmental problems. It's an essential requirement for all companies to collect, measure, manage and disclose the environmental information. We should accumulate the knowledge and experience about product sustainability assessment, and seek for a way to make a sustainable society.

CONCLUSIONS

In economic activities, it is necessary to consider also the increase in other environmental impacts as well as climate change issue. In addition, we should aim balanced and optimized environmental performance of products. To reach for this goal, it would be extremely important to have an efficient and laborsaving solution for environmental data management.

REFERENCES

Erwin T.H. Vink *et al.* (2003) Applications of life cycle assessment to NatureWorks polylactide (PLA) production: *Polymer Degradation and Stability*, 80, 403-419

Satomi Yagihashi, *et al.* (2012) LCA of polyethylene terephthalate from biomass: The 7th Meeting of the Institute of Life cycle Assessment, Japan

Stephan Pfister *et al.* (2009) Assessing the environmental impacts of freshwater consumption in LCA: *Environ. Sci. Tech.*, 43 (11) 4098-4104

Winnie Gerbens-Leenesa et al. (2009) The water footprint of bioenergy: *Proc. Natl. Acad. Sci. USA*, 106 (25): 10219-23

Yasunori Kikuchi, *et al.* (2011) Life cycle Assessment of Biomass-Derived Polyethylene: The 6th Meeting of the Institute of Life cycle Assessment, Japan

Yuya ONO *et al.* (2013) Development of Water Footprint Inventory Database Using input-output Analysis in Japan: *Journal of Life cycle Assessment, Japan*, Vol.9 (2) 108-115