How to implement the circular economy in the beer packaging sector through eco-efficiency- and eco-effectiveness- based solutions - DTU Orbit (08/11/2017)

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According to Verghese et al (2012) sustainable packaging should be: effective in delivering its functional requirements, efficient in its use of materials, energy, and water throughout its life cycle, cyclic in its use of renewable materials and recoverability at end-of-life, and safe for people and the natural environment. Companies in the packaging sector have traditionally been using the Life Cycle Assessment (LCA) methodology to fulfill these requirements. However, being inspired by the eco-efficiency principle, LCA aims to reduce the negative environmental footprint of human activities by optimizing product system individually, without considering multiple future uses of resources in continuous loops (Bjørn and Hauschild, 2013). A broader approach oriented towards product quality and innovation is the Cradle to Cradle® (C2C) design framework. C2C aims to increase the positive footprint of products by designing “eco-effective” solutions, i. e. maximizing the benefit to ecological systems. C2C is based on three key principles “waste equal food”, “use solar energy income” and “celebrate diversity” (McDonough and Braungart, 2002). The first principle calls for eliminating the concept of waste and challenges production systems to use materials in continuous loops through the “up-cycling” approach, which consists in improving the quality of materials or systems for recycling materials. From a company point of view, LCA and C2C are complementary approaches to implement the circular economy and develop sustainable and innovative solutions for packaging. We will illustrate the challenges and opportunities emerging from the case study of Carlsberg Circular Community, a cooperation platform where Carlsberg and some global partners are joining forces to reduce the reliance on raw materials, and support the circular economy by improving quality and purity of packaging. We will consider the case of aluminium cans and discuss how both approaches can be combined within the circular economy framework. From an LCA perspective, the Life Cycle Inventory of aluminium products is currently based on a pure aluminium flow, neglecting the presence of alloying elements. However an aluminium can is composed of two main components, the body and the lid, which are made of two different wrought alloys. This aspect needs to be taken into account while addressing the use of aluminium in continuous loops, even in a closed product loop recycling. Therefore, we will discuss how upcycling can be defined for aluminium cans, including both eco-efficiency- and eco-effectiveness- inspired considerations, i. e. both from a C2C and LCA point of view.

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