

## Life cycle assessment of sugar palm fiber reinforced-sago biopolymer composite takeout food container

### ABSTRACT

In the development of packaging products, the considerations are not limited to the food shelf-life, safety, and practicality, but also environmental sustainability. This paper reports a life cycle assessment (LCA) analysis of a proposed natural fiber-reinforced biopolymer composite takeout food container. The study focuses on the damage assessment of the whole product system, including disposal scenarios of the thermoformed sugar palm fiber (SPF)-reinforced sago starch composite takeout food container. The analysis performed was to anticipate the environmental impact of the cradle-to-grave approach. The results exhibited the total human health damage of  $2.63 \times 10^{-5}$  DALY and ecosystem damage of  $9.46 \times 10^{-8}$  species.year per kg of containers. The main contributor was the carbon dioxide emission from fossil fuel combustion for energy generation that contributed to climate change and caused human health and the ecosystem damages with low-level metrics of  $1.3 \times 10^{-5}$  DALY and  $7.39 \times 10^{-8}$  species.yr per kg of containers, respectively. The most contributed substances in the 'Particulate matter formation' impact categories that caused respiratory diseases were from air/nitrogen oxides, air/particulates,  $<2.5 \mu\text{m}$ , and air/sulphur dioxide with the metrics of  $2.93 \times 10^{-6}$  DALY,  $2.75 \times 10^{-6}$  DALY, and  $1.9 \times 10^{-6}$  DALY per kg containers, correspondingly. Whereas, for the 'Agricultural land occupation', which contributed to ecosystem damage, almost the total contributions came from raw/occupation, forest, intensive with the metric of  $1.93 \times 10^{-9}$  species.yr per kg of containers. Nevertheless, from the results, all impact categories impacted below than 0.0001 DALY for the Human Health damage category and below 0.00001 species.yr for the ecosystem damage category. These results would provide important insights to companies and manufacturers in commercializing the fully biobased takeout food containers.

**Keyword:** Life cycle assessment; LCA; Environmental profile; Environmental impact; Food packaging; Takeout food container; Biopolymer composite