Plastic litter cleanup operations: learnings from 4 LCAs

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Presented at
LCM 2019, 1-4 September, 2019, Poznan, Poland
SESSION T5-3 Addressing Marine Litter within Life Cycle Assessment and Management
3rd September 2019, Tuesday

GOAL: Marine debris, especially plastic litter has become a matter of serious concern. While many efforts rightly focus on prevention of plastic littering, the amount of plastics already in the environment is such that it also requires consideration. Even if plastic pollution were to be prevented now, marine plastic litter washing up on shorelines will remain a problem for years. These circumstances warrant an examination of different set-ups for plastic litter cleanup.

METHOD: LCA has beed used to evaluate different types of cleanup operations, both with regard to the environmental impacts associated with the cleanup itself and the recovery options for the collected plastics. Here, four LCA studies are presented and evaluated: 1/ arctic shoreline cleanup with volunteers (Lachmann 2016); 2/ shoreline cleanup with volunteers (Cañete Vela 2017); 3/ riverine cleanup with traps (Börling & Hein 2017); 4/ a sewerage-integrated collection with traps (Börling & Hein 2017). The explored options for plastics recovery include waste-to-energy, mechanical recycling and chemical recycling when landfilling can be avoided. The LCA studies were conducted as student projects under my supervision; the comparative evaluation is my own. Furthermore, personal experience of beach cleaning has provided a frame of reference against which LCA methodology applied to cleanup operations can be evaluated. The findings are discussed further in relation to other known cleanup operations around the world.

RESULTS: The assessments identify both negative and positive environmental impacts. Negative impacts are associated with the operative side of cleanup and collection, while positive impacts are associated with habitat improvement after cleanup or recovery of plastic material. Conventional LC impact assessment methodology was found lacking for describing the positive ecological impacts of cleanups. A combination of qualitative and quantitative site-sensitive assessment was deployed.

Based on the comparative evaluation, aspects important for planning plastic litter cleanups were identified. First, the site for a cleanup matters for what positive environmental impacts are achieved. Shoreline cleanup mainly provide habitat restoration. In contrast, riverine and sewerage-integrated traps provide the clearest possibilities for recovery of plastic material. The ecological benefits of shoreline cleanups are associated with coastal zones being feeding and breeding zones for

many animals. While gyres have become known as accumulation zones of marine plastic litter, they are relatively ‘unpopulated’ as marine life is concentrated to the coastal zones where upwelling of nutrients happens. Second, the collection technique matters for what negative environmental impacts arise. Volunteer transportation to site of beach cleanup represent a significant proportion of CO2 emissions. Working with local volunteers is important for keeping CO2 emissions down. In comparison, riverine and sewerage-integrated collection can be carried out with well-placed passive traps. As these sit passively in a water stream, emissions related to collection can be kept to a minimum. Third, the material qualities of the collected litter determine recovery possibilities. Beach litter is generally too dirty, salty, fragmented and stringy for any useful recovery — landfilling is common. Saltiness is avoided with riverine and sewer-traps. These also have the advantage of collecting more recent and less degraded litter, thereby facilitating various recovery options.