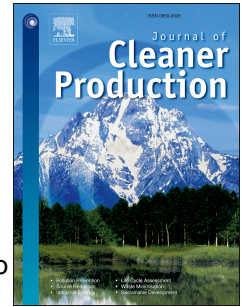


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Life Cycle Assessment in automotive sector: a case study for engine valves towards cleaner production

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Abstract

Life Cycle Assessment (LCA) is a well-established tool to analyze environmental aspects and impacts of products and processes. However, there are few studies available regarding LCA of automotive components such as the small parts used by vehicle engines, e.g., intake and exhaust valves. This paper showed a cradle-to-grave LCA of exhaust valves produced in Brazil for automotive use. Based on environmental hotspots of the case study, cleaner production scenarios were developed to reduce environmental burdens and to improve manufacturing eco-efficiency. Thirteen midpoint impact categories were evaluated and more than 90% of all the impacts were due to fuel consumption into the internal combustion engine during the valves use phase.

Regarding the valves manufacturing phase, the machining processes applied on the valve stem represented 63% of all the impacts, and they were strongly influenced by the consumption of electric energy, raw materials used in the valve stem and cutting fluid. For this reason, cleaner production scenarios were evaluated and tested in a centerless grinding process of the valve stem. The best cleaner production scenario showed a potential impact reduction up to 72% in the stand-by grinding mode followed by up to 44% less impacts in the dressing mode. Simple changes on grinding parameters produced a huge potential of minimizing environmental burdens in a life cycle perspective, especially in terms of impacts for resources (fossil and minerals) depletion (RD). A comparison between the environmental profiles before and after adopting the proposed cleaner production measures showed a significant reduction of 27% on the RD impacts. Therefore, improvements of the exhaust valve's manufacturing parameters can generate a better environmental life cycle performance towards cleaner production.

Keywords

Environmental Management; Sustainable Manufacturing; Life Cycle Management; Automotive Industry; Eco-efficiency; Brazil.

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