

A Life Cycle Assessment (LCA) of Aluminum Production Process

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Abstract : The production of aluminium alloys and ingots -starting from the processing of alumina to aluminium, and the final cast product- was studied using a Life Cycle Assessment (LCA) approach. The studied aluminium supply chain consisted of a carbon plant, a reduction plant, a casting plant, and a power plant. In the LCA model, the environmental loads of the different plants for the production of 1 ton of aluminium metal were investigated. The impact of the aluminium production was assessed in eight impact categories. The results showed that for all of the impact categories the power plant had the highest impact only in the cases of Human Toxicity Potential (HTP) the reduction plant had the highest impact and in the Marine Aquatic Ecotoxicity Potential (MAETP) the carbon plant had the highest impact. Furthermore, the impact of the carbon plant and the reduction plant combined was almost the same as the impact of the power plant in the case of the Acidification Potential (AP). The carbon plant had a positive impact on the environment when it comes to the Eutrophication Potential (EP) due to the production of clean water in the process. The natural gas based power plant used in the case study had 8.4 times less negative impact on the environment when compared to the heavy fuel based power plant and 10.7 times less negative impact when compared to the hard coal based power plant.

Keywords : life cycle assessment, aluminium production, supply chain, ecological impacts

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