

Life Cycle Assessment of the coffee production process in the context of energy savings and circular economy

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In the coffee industry, the high demand of energy consumption and the waste created by the processing of coffee beans have created an increasing environmental concern worldwide. The highest energy consumption is observed in the stage of roasting in which the consuming thermal energy derived from the combustion of fossil fuels in order to heat the air to a temperature of about 220°C. This hot stream is usually discharged into the atmosphere. In addition, this process produces a by-product named silverskin creating significant amount of wastes. This by-product is usually being used in fertilizers, but it has the potential to be used for energy production and for the extraction of valuable components. In the present study, energy reduction solutions related to the recycling of hot streams as well as the utilization of silverskin by-product for energy production and for the development of high-added value products were evaluated in the context of circular economy. The proposed solutions were evaluated in terms of their environmental footprint and the comparison with the conventional production line was performed. Life Cycle Assessment was implemented according to ISO 14040 & 14044, using GaBi software, utilizing ReCiPe 2016 (H)* methodology with 18 midpoints and 3 endpoints. To this end, to define the Goal of the study, Cradle-to-gate boundaries were set and the functional unit was defined as 1 kg of the produced coffee. The results of the examined cases revealed that the environmental impacts were lower with the implementation of the proposed solutions in the coffee production line compared with the conventional one. The solutions that proved to be more efficient were the use of heat pump for the recycling of hot streams from roasting process and the utilization of husks for the replacement of a part of fossil fuels and as a valuable source of bioactive compounds with high antioxidant activity (1.92 mmol Trolox/100g dw).

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