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ENVIRONMENTAL PERFORMANCE EVALUATION OF A DRINKING WATER TREATMENT PLANT: A LIFE CYCLE ASSESSMENT PERSPECTIVE

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Abstract

Drinking water treatment aims to avoid or minimize some risks to human health and to provide adequate water quality by removing physical, chemical and biological contaminants. However, treatment processes require increasing efforts in terms of technology, chemicals and energy inputs, which generate increased secondary environmental impacts and added water production costs. The objective of this study is to evaluate the drinking water treatment plant (DWTP) in Iasi City (Romania) by life cycle assessment (LCA) and to identify and characterize its environmental impacts. Iasi DWTP involves the following scheme: pre-oxidation (chlorine dioxide), coagulation/flocculation, sedimentation, pH correction (calcium hydroxide), rapid sand filtration, granular activated carbon filtration and disinfection (chlorine gas). LCA was performed according to the ISO 14040 standard with the support of SimaPro 8.3. software and Eco-invent 3.3 data base. Life cycle impact assessment has been performed with Recipe 1.13. Midpoint method. The life cycle inventory included the construction and operational phases. The novelty of this study was to define two additional functional units related to removing contaminants besides the traditional 1 m³ of treated water. The main contributors to impact in most categories were: the electricity consumption (25 – 95% depending on impact category) and the ferric chloride used in coagulation/flocculation (35 – 100%, depending on impact category). Life cycle impact assessment showed that the lower the pollutant concentration, the higher the specific environmental impacts will be, which prompts for further detailed analysis of water treatment plant environmental performance in at least two directions: removal of emerging contaminants (present in very low concentrations) and a more detailed analysis on the individual performance of each treatment stage.

Keywords: drinking water, environmental impacts, life cycle assessment, operation

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