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Risk Assessment on New Bio-Composite Materials Made from Water Resource Recovery

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Abstract : Bio-composite materials are becoming increasingly popular in various applications, such as the automotive industry. Usually, bio-composite materials are made from natural resources recovered from plants, now, a new type of bio-composite material has begun to be produced in the Netherlands. This material is made from resources recovered from drinking water treatments (calcite), wastewater treatment (cellulose), and material from surface water management (aquatic plants). Surface water, raw drinking water, and wastewater can be contaminated with pathogens and chemical compounds. Therefore, it would be valuable to develop a framework to assess, monitor, and control the potential risks. Indeed, the goal is to define the major risks in terms of human health, quality of materials, and environment associated with the production and application of these new materials. This study describes the general risk assessment framework, starting with a qualitative risk assessment. The qualitative risk analysis was carried out by using the HAZOP methodology for the hazard identification phase. The HAZOP methodology is logical and structured and able to identify the hazards in the first stage of the design when hazards and associated risks are not well known. The identified hazards were analyzed to define the potential associated risks, and then these were evaluated by using the qualitative Event Tree Analysis. ETA is a logical methodology used to define the consequences for a specific hazardous incidents, evaluating the failure modes of safety barriers and dangerous intermediate events that lead to the final scenario (risk). This paper shows the effectiveness of combining of HAZOP and qualitative ETA methodologies for hazard identification and risk mapping. Then, key risks were identified, and a quantitative framework was developed based on the type of risks identified, such as QMRA and QCRA. These two models were applied to assess human health risks due to the presence of pathogens and chemical compounds such as heavy metals into the bio-composite materials. Thus, due to these contaminations, the bio-composite product, during its application, might release toxic substances into the environment leading to a negative environmental impact. Therefore, leaching tests are going to be planned to simulate the application of these materials into the environment and evaluate the potential leaching of inorganic substances, assessing environmental risk.

Keywords : bio-composite, risk assessment, water reuse, resource recovery
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