Technical University of Denmark

LCIA and fate of metal-oxide engineered nanomaterials in freshwater

Miseljic, Mirko; Salieri, B.; Olsen, Stig Irving

Publication date:
2012

Citation (APA):
Miseljic, M., Salieri, B., & Olsen, S. I. (2012). LCIA and fate of metal-oxide engineered nanomaterials in freshwater. Abstract from 6th SETAC World Congress 2012, Berlin, Germany.

Conference: 6th SETAC World Congress / SETAC Europe 22nd Annual Meeting, 20-24 May 2012, Berlin, Germany

Session: RA04 - Established and emerging footprints - striving towards a valid and comprehensive support for decision-making processes – POSTER PRESENTATION

LCIA and fate of metal-oxide engineered nanomaterials in freshwater

M. Miseljic[1a], B. Salieri[2], S.I. Olsen[1]

[1]Technical University of Denmark, Department of Management Engineering (DTU-MAN), Quantitative Sustainability Section (QSA), 2800 Lyngby, Denmark
[2]Laboratory of Environmental Sciences "R. Sartori", C.I.R.S.A., University of Bologna, 48100 Ravenna, Italy
[a]E-mail contact: mirm@man.dtu.dk

Keywords: Engineered nanomaterials (ENMs), Life cycle impact assessment (LCIA), freshwater

Life cycle assessment (LCA) have in past years proven to be a valuable tool for environmental impact assessment of products and systems, but with the introduction of more new products that contain engineered nanomaterials (ENMs) the tool has experienced an obstacle in terms of performing a holistic life cycle impact assessment (LCIA) of ENMs and the engineered nanoparticles (ENPs) that these materials can release to the ecosystem. Metal-oxide ENMs are often used in consumer nanoproducts where TiO_2 and ZnO are considered industry-popular within this group, along with Ag being a widely used ENM metal in products. Today there is a limited amount of LCA case studies on ENMs published as scientific articles. To be exact these count around 13 studies and in most of those there is a focus on non-toxic impact assessment categories that mainly are related to the raw material and production stages of an ENM product life cycle. Performing a conventional LCIA of an ENM product it can be also concluded that the modelling is rather difficult due to missing inventory data and many assumptions that in the end result in cradle-to-gate processes (usually associated to bulk metal production) dominating the impact.
The metal-oxide and metal ENMs are incorporated into a polymer matrix in the performed LCA study. However, release of ENPs to the environment may still occur through e.g. aging and wear. The fate, exposure and effect of ENM has received much focus but this scientific domain still struggles with a low understanding of many of the processes affecting the fate, exposure and effect. Fate can be considered a central research area that needs better understanding and is the focus of this study. Fate modelling is performed on metal-oxide ENMs with a focus on the two important processes of aggregation and dissolution. By quantifying fate in freshwater through these two processes there is a possibility to apply a simplified model to predict the removal of metal-oxide ENPs due to aggregation followed by sedimentation, and the removal of ENPs through dissolution. Thereby concentration in the freshwater compartment can be estimated and used for improving LCIA in the assessment of particle release by linking the metal ENP concentration in freshwater to potential exposure and effects.