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Nanotoxicology as a discipline has matured significantly over the last years, from the first paper in 2004 to close to a thousand studies published today. We are therefore no longer facing a scarcity of data as severe as only a few years ago. From a regulatory standpoint, it is timely to question whether ecotoxicity testing is now able to facilitate regulatory decision-making on manufactured nanomaterials (MNs). In this paper, we review the state of aquatic ecotoxicity testing of MNs as well as the overarching issues that challenge the reliability and relevance of such testing. We conclude that within the field there is an increased focus on characterization of the exposure rather than controlling exposure as it is traditionally done in guideline testing of chemicals. However, the lack of characterization options under actual testing conditions makes it difficult to make meaningful comparisons between studies, which question the regulatory reliability of the data currently available. Accordingly, lack of data suited for regulatory decision-making is still a pressing issue in nanotoxicology even though the data availability has increased. Nevertheless, we emphasize that by deliberately directing test method developments towards increased regulatory reliability and acknowledging the implicit limitations in the dual purpose of guideline testing for chemical risk assessment (i.e. for hazard identification and for hazard assessment) it is possible to generate data sufficient for regulatory needs.

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