



Slovak Society of Chemical Engineering
Institute of Chemical and Environmental Engineering
Slovak University of Technology in Bratislava

PROCEEDINGS

52nd International Conference of the Slovak Society of Chemical Engineering SSCHE 2026

Hotel SOREA TRIGAN
Štrbské Pleso, Slovakia
May 26 - 29, 2026

Editors: Assoc. prof. Mário Mihaľ

ISBN: 978-80-8208-177-3, EAN: 9788082081773

Published by the Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava in Slovak Chemistry Library for the Institute of Chemical and Environmental Engineering; Radlinského 9, 812 37 Bratislava, 2026

Petrovová, E., Demčišáková, Z., Hurníková, J., Luptáková, L., Shao, K.: The in vivo evaluation of RNase-A@PbS QDs based on avian embryo as an animal model , Editors: Mihaľ, M., In *52nd International Conference of the Slovak Society of Chemical Engineering SSCHE 2026*, Štrbské Pleso, Slovakia, 2026.

The in vivo evaluation of RNase-A@PbS QDs based on avian embryo as an animal model

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Key words: animal model, embryotoxicity, irritation potential, PbS QDs

Over recent years the field of nanomaterials, particularly quantum dots has accepted the chicken model as a rather useful one, a quick and cheap alternative to evaluating embryotoxicity of new nanoparticles with respect to traditional animal models. Lead sulfide quantum dots (PbS QDs) have been widely investigated for biomedical imaging applications due to their favorable optical properties. The chicken embryotoxicity screening test (CHEST) and the chicken chorioallantoic membrane (CAM) are widely used models in medical research and fulfil the requirements laid out in the 3 R's principles, also with regard to similar development with mammals. This study combines evaluating the embryotoxic effect using the chicken embryotoxicity screening test (CHEST) and irritation potential evaluated with the Luepke grading system of the different administered concentrations of PbS QDs (10%, 25%, 50%, 100%). The results demonstrated that the administration of QDs different concentrations at early stage of development (embryonic day 4) did not affect the body weight of chicken embryos or the weight of selected organs (liver, heart). A mild decrease in body and organ weights was observed at 25% PbS QDs. The mortality of chicken embryos was increased with rising PbS QDs concentrations, and the LD₅₀ was determined to 117 µl /egg. In 100% PbS QDs group as an extreme-dose condition was observed the 56% of mortality 5 days after the administration. Furthermore, the irritation potential suggests a slight effect at all tested concentrations, with a vasodilation like the main effect on the 9th embryonic day. The evaluation of the results thus indicates/confirms the biosafety of the tested PbS QDs regarding to the developing organism, particularly at doses relevant to biomedical imaging applications.

This work was supported by the Slovak Research and Development Agency under the Contract no. SK-CN-23-0017.