

Toxicological Validation during the Development of New Catalytic Systems Using Air/Liquid Interface Cell Exposure

Authors : M. Al Zallouha, Y. Landkocz, J. Brunet, R. Cousin, J. M. Halket, E. Genty, P. J. Martin, A. Verdin, D. Courcot, S. Siffert, P. Shirali, S. Billet

Abstract : Toluene is one of the most used Volatile Organic Compounds (VOCs) in the industry. Amongst VOCs, Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) emitted into the atmosphere have a major and direct impact on human health. It is, therefore, necessary to minimize emissions directly at source. Catalytic oxidation is an industrial technique which provides remediation efficiency in the treatment of these organic compounds. However, during operation, the catalysts can release some compounds, called byproducts, more toxic than the original VOCs. The catalytic oxidation of a gas stream containing 1000ppm of toluene on Pd/ α -Al₂O₃ can release a few ppm of benzene, according to the operating temperature of the catalyst. The development of new catalysts must, therefore, include chemical and toxicological validation phases. In this project, A549 human lung cells were exposed in air/liquid interface (Vitrocell®) to gas mixtures derived from the oxidation of toluene with a catalyst of Pd/ α -Al₂O₃. Both exposure concentrations (i.e. 10 and 100% of catalytic emission) resulted in increased gene expression of Xenobiotics Metabolising Enzymes (XME) (CYP2E1, CYP2S1, CYP1A1, CYP1B1, EPHX1, and NQO1). Some of these XMEs are known to be induced by polycyclic organic compounds conventionally not searched during the development of catalysts for VOCs degradation. The increase in gene expression suggests the presence of undetected compounds whose toxicity must be assessed before the adoption of new catalyst. This enhances the relevance of toxicological validation of such systems before scaling-up and marketing.

Keywords : BTEX toxicity, air/liquid interface cell exposure, Vitrocell®, catalytic oxidation

Conference Title : ICT 2015 : International Conference on Toxicology

Conference Location : London, United Kingdom

Conference Dates : February 16-17, 2015