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EVALUATION OF OCCUPATIONAL EXPOSURE TO TiO₂ NANOPARTICLES: MICROWAVE-ASSISTED ACID DIGESTION METHOD ON AIR MEMBRANE FILTERS

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Abstract

Titanium dioxide (TiO₂) nanoparticles have been extensively used in various industrial sectors and applications, including cosmetics, catalysts, food additives, inks, paints, and coatings. However, the International Agency for Research on Cancer (IARC) has classified TiO₂ nanoparticles as a potential carcinogen for humans, meaning they may cause cancer and pose serious health complications, particularly for manufacturing workers. This highlights the need for better evaluation to determine worker exposure. In this study, suspended TiO₂ nanoparticles were sampled using a nanoparticle respiratory deposition (NRD) sampler fitted with specially designed membrane filters and analyzed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The digestion method used for titanium element recovery after nanoparticle sampling is crucial for optimal ICP-MS analysis. Therefore, this study aimed to investigate the most suitable digestion method. A microwave-acid digestion method using concentrated nitric acid and concentrated hydrochloric acid at a 7:4 ratio, with a run time of 30 minutes and the temperature set to 200°C showed remarkable titanium recovery compared to other methods. These findings may pave the way for optimal analysis of suspended TiO₂ nanoparticles in assessing occupational exposure while promoting sustainability and eco-friendliness in resource utilization. © 2023, Faculty of Medicine, University of Malaya. All rights reserved.

Author Keywords

ICP-MS; Nanoparticles; Occupational Health; Titanium Dioxide; Workplace

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