Jamen, S.\textsuperscript{a b}, Mohd Aris, M.S.\textsuperscript{a f}, Shamsul Harumain, Z.A.\textsuperscript{c}, Zahaba, M.\textsuperscript{d}, Danial, W.H.\textsuperscript{d}, Abdul Hadi, H.\textsuperscript{e}

**EVALUATION OF OCCUPATIONAL EXPOSURE TO TiO\textsubscript{2} NANOPARTICLES: MICROWAVE-ASSISTED ACID DIGESTION METHOD ON AIR MEMBRANE FILTERS**

(2023) *Journal of Health and Translational Medicine*, 26 (Special Issue 2), pp. 353-357.

**DOi:** 10.22452/jummec.sp2023no2.39

\textsuperscript{a} Centre of Environmental Health & Safety Studies, Faculty of Health Sciences, Universiti Teknologi MARA, Puncak Alam, Selangor42300, Malaysia

\textsuperscript{b} National Institute of Occupational Safety and Health, Bandar Baru Bangi, elangor43650, Malaysia

\textsuperscript{c} Department of Biotechnology, Kulliyyah of Science, International Islamic University Malaysia, Pahang, Kuantan, 25200, Malaysia

\textsuperscript{d} Department of Chemistry, Kulliyyah of Science, International Islamic University Malaysia, Pahang, Kuantan, 25200, Malaysia

\textsuperscript{e} IIUM Entrepreneurship & Consultancies Sdn. Bhd, Research Management Centre, International Islamic University Malaysia, Kuala Lumpur, 53100, Malaysia

\textsuperscript{f} Occupational Health and Safety Risk Management (OHS/ER) Research Initiative Group, Universiti Teknologi MARA, Puncak Alam, Selangor42300, Malaysia

**Abstract**

Titanium dioxide (TiO\textsubscript{2}) 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 TiO\textsubscript{2} 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 TiO\textsubscript{2} 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 TiO\textsubscript{2} 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

**References**


- Jeevanandam, J, Barhoum, A, Chan, YS, Dufresne, A, Danquah, MK. 
  Review on nanoparticles and nanostructured materials: history, sources, toxicity and regulations  
  Apr 3

- Sarip, NA, Aminudin, NI, Danial, WH. 
  Green synthesis of metal nanoparticles using Garcinia extracts: a review  
  Feb 12

- Gupta, AD, Patil, SZ. 
  Potential Environmental Impacts of Nanoparticles Used in Construction Industry  
  Cham: Springer International Publishing

- Mohajerani, Burnett, Smith, Kurmus, Milas, Arulrajah 
  Nanoparticles in Construction Materials and Other Applications, and Implications of Nanoparticle Use  
  Sep 20

- Halil, N, Rusli, R, Zainal Abidin, M, Jamen, S, Khan, F. 
  An integrated health risk assessment with control banding for nanomaterials exposure  

- Sonwani, S, Madaan, S, Arora, J, Suryanarayan, S, Rangra, D, Mongia, N 
  Inhalation Exposure to Atmospheric Nanoparticles and Its Associated Impacts on Human Health: A Review  
  Aug 18

- Song, Y, Li, X, Du, X. 
  Exposure to nanoparticles is related to pleural effusion, pulmonary fibrosis and granuloma  
  Sep 1

- Kim, J, Yu, IJ. 
  National Survey of Workplaces Handling and Manufacturing Nanomaterials, Exposure to and Health Effects of Nanomaterials, and Evaluation of Nanomaterial Safety Data Sheets  

- Shi, H, Magaye, R, Castranova, V, Zhao, J. 
  Titanium dioxide nanoparticles: a review of current toxicological data  
  Dec 15

- Dankovic, DA, Kuempel, ED. 
  (2011) Occupational exposure to titanium dioxide, 
  Accessed 20 Dec 2022

- Mudunkotuwa, IA, Anthony, TR, Grassian, VH, Peters, TM. 
  Accurate quantification of tio2 nanoparticles collected on air filters using a microwave-assisted acid digestion method  

Turek, A, Wieczorek, K, Wolf, WM. Digestion Procedure and Determination of Heavy Metals in Sewage Sludge-An Analytical Problem
Mar 22

Krzeszowska, E, KoKowska-PawłowsKa, M, KrzeszowsKi, Ś. The role of sample preparation methods in the trace element analysis of westphalian deposits from the Lublin Coal Basin (Poland)

Correspondence Address
Mohd Aris M.S.; Centre of Environmental Health & Safety Studies, UiTM Puncak Alam Campus, Selangor, Malaysia; email: myshukri@uitm.edu.my

Publisher: Faculty of Medicine, University of Malaya

ISSN: 18237339
Language of Original Document: English
Abbreviated Source Title: J. Health Transl. Med.
2-s2.0-85174019033
Document Type: Article
Publication Stage: Final
Source: Scopus