Supporting our understanding of nanoparticle exposure: a focus on titanium dioxide

LGC have been a key contributor to around robin analytical study led by the MRC Biomineral Research Group in Cambridge, UK, to help ensure the necessary rigour in studies on the impact of titanium-dioxide nanoparticles consumed through food.

Department for Business, Energy & Industrial Strategy

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Background

Nanomaterials are increasingly being used in everyday life, present in over 1300 commercial products, from medicines to food. As the impact of nanotechnologies on human life becomes more prevalent, it is becoming increasingly important to be able to monitor and understand the effects dietary exposure to nanomaterials may have on human health.

Food-grade titanium dioxide (E171) is a nanoparticle-containing additive that is widely used in food products such as sauces, coffee creamer, sweets and chewing gum, as a whitening agent. For foods that are sensitive to UV light, titanium dioxide is also used for food safety purposes to prevent spoilage and increase shelf life.

The MRC Biomineral Research Group (BMR) in Cambridge, UK, is leading research in this area. The group is focused on understanding how nanoparticles commonly present in food behave once they enter the body and what potential side effects, if any, might result. During the group's research in to behaviour and effects of titanium dioxide nanoparticles, it became apparent that reported values for the basal levels of titanium in whole blood differ enormously. This measurement variability could be related to the analytical techniques used, rather than natural variation, and could dramatically affect the interpretation of how titanium dioxide particles are absorbed or accumulated.

As a result, BMR initiated an inter-comparison study ('round robin') involving research, regulatory and hospital laboratories to understand the real measurement variability and impact of the analytical approaches chosen for titanium measurements of human blood.

Impact

LGC scientists provided significant input to this titanium inter-comparison work, providing expert discussion and contributing to the analytical results as one of seven key participants.

The outcome of this comparison, which will be submitted for publication shortly, aims to ensure much greater analytical rigour in subsequent metabolism, absorption and toxicology studies. This will, for example, enable the BMR group to develop greater insight into the pathways that titanium dioxide particles follow in the body and hence better understand what impact they might have on health.

Although food-grade titanium dioxide has recently been re-evaluated by the European Food Standards Agency and found to pose no health concerns to consumers, the EFSA could not set an Acceptable Daily Intake (ADI) level due to insufficient data. Accurate and reproducible monitoring of particulate titanium dioxide in whole blood could help inform these limits as well as furthering our understanding of its impact on human health.

In addition to food additive applications, developing an improved measurement capability to monitor small variations of ionic titanium levels in whole blood could support the clinical monitoring of wear from titanium-based implants.

"LGCs invaluable support helped to investigate the analytical pitfalls intrinsic to the analysis of trace titanium levels in biological matrices such as whole blood. This will help to elucidate the biological pathway of titanium nano- and micro-particles."

Dagmar Koller
Senior Analyst, Biomineral Research Group
MRC-Elsie Widdowson Laboratory, Cambridge

For further information, contact:
LGC, Queens Road, Teddington, Middlesex TW11 0LY, UK

Tel: **+44 (0)20 8943 7393** Email: **nmshelp@lgcgroup.com** Web: **www.lgcgroup.com/nmi**

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