World Academy of Science, Engineering and Technology
International Journal of Bioengineering and Life Sciences
Vol:8, No:10, 2014

Proinflammatory Response of Agglomerated TiO2 Nanoparticles in Human-Immune Cells

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Abstract : The widespread use of Titanium oxide nanoparticles (TiO2-NPs), now are found with different physic-chemical properties (size, shape, chemical properties, agglomeration, etc.) in many processed foods, agricultural chemicals, biomedical products, food packaging and food contact materials, personal care products, and other consumer products used in daily life. Growing evidences have been highlighted that there are risks of physico-chemical properties dependent toxicity with special attention to “TiO2-NPs and human immune system”. Unfortunately, agglomeration and aggregation have frequently been ignored in immuno-toxicological studies, even though agglomeration and aggregation would be expected to affect nanotoxicity since it changes the size, shape, surface area, and other properties of the TiO2-NPs. In this present investigation, we assessed the immune toxic effect of TiO2-NPs on human immune cells Total WBC including Lymphocytes (T cells (CD3+), T helper cells (CD3+, CD4+), Suppressor/cytotoxic T cells (CD3+/CD8+) and NK cells (CD3-/CD16+ and CD56+), Monocytes (CD14+, CD3-) and B lymphocytes (CD19+, CD3-) in order to find the immunological response (IL1A, IL1B, IL2 IL-4, IL5 IL-6, IL-10, IL-12, IL-13, IFN-γ, TGF-β, and TNF-a) and redox gene regulation (TNF, p53, BCl-2, CAT, GSTA4, TNF, CYP1A, POR, SOD1, GSTM3, GPX1, and GSR1)-linking physicochemical properties with special reference to agglomeration of TiO2-NPs. Our findings suggest that TiO2-NPs altered cytokine production, enhanced phagocytic indexing, metabolic stress through specific immune regulatory- genes expression in different WBC subsets and may contribute to pro-inflammatory response. Although TiO2-NPs have great advantages in the personal care products, biomedical, food and agricultural products, its chronic and acute immune-toxicity still need to be assessed carefully with special reference to food and environmental safety.

Keywords : TiO2 nanoparticles, oxidative stress, cytokine, human immune cells
Conference Title : ICGMB 2014 : International Conference on Genetics and Molecular Biology
Conference Location : Osaka, Japan
Conference Dates : October 12-13, 2014