

THE STUDY OF THE INTERACTION OF TiSiO_4 NANOPARTICLES WITH THE MODEL SYSTEM *Allium cepa* L.

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In the last decades, nanotechnology has developed continuously, having ever wider applications in various fields. The most well-known objects used in nanotechnology are metal nanoparticles and the nanoclusters they form. Nanoparticles (NPs) are currently found in more than 1000 items or product lines on the market. They are widely used in industry, electronics, medicine and agriculture, being used as additives for paper packaging, paints, ceramics, food, drug delivery, biosensors and cancer therapy.

Titanium nanoparticles, increasingly used in industrial, microelectronic, cosmetic and medical applications, are used to improve the characteristics of several products. The progressive increase in the use of titanium NPs leads to the potential release of nanoparticles into the environment, which could produce, over time, adverse effects on living systems, including humans. As there is limited and controversial knowledge regarding the effects of the interaction of nanoparticles with living systems, they need to be studied to enable the safe use of this technology.

The present study aimed to investigate the effects of the interaction of titanium silicate nanoparticles (TiSiO_4) with the meristematic cells of the *Allium cepa* roots, as an indicator system. TiSiO_4 NPs with dimensions ≤ 50 nm, in the form of white powder, with a purity of 99.8% (based on trace metal analysis), purchased from Sigma-Aldrich, were used for the experiments. Onion bulbs were placed for germination in aqueous TiSiO_4 NPs suspensions (dispersed by ultrasonic vibration (130 W, 20 kHz) for 30 min) of different concentrations (12.5 mg/l, 25 mg/l and 50 mg/l). Distilled water served as a control.

To determine the cytotoxic and genotoxic potential of titanium silicate nanoparticles, the following parameters were analyzed: root length, mitotic index, presence of chromosomal anomalies.

Exposure of onion bulbs to TiSiO_4 NPs caused a suppression of root growth and a decrease in the mitotic index in root meristems. Cytological analysis allowed the observation and quantification of chromosomal and nuclear abnormalities in meristematic cells, in all phases of the cell cycle, such as abnormal telophases and anaphases, fragmented or lost chromosomes or C-metaphases. Chromosomal aberrations, observed in root meristems exposed to increased doses of nanoparticles, confirmed the genotoxic effects of TiSiO_4 NPs on *Allium cepa*. This study suggests that exposure to TiSiO_4 NPs is capable of inducing cytotoxicity and genotoxicity in the model plant, which are directly dose-dependent.

Keywords: *nanoparticles, titanium silicate, mitotic index, cytotoxicity, genotoxicity.*