

## Surface properties and complexation on titanium dioxide nanoparticles

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There is an increasing amount of synthetic nanoparticles in the environment. Due to their small size, they have properties that result in higher reactivity compared with larger particles and bulk materials. Interactions that occur at the surface of nanoparticles are important for understanding and predicting nanoparticle fate and behavior, as well as characterizing the potential risks for the environment and human health.

Surfactant-free TiO<sub>2</sub> nanoparticles were synthesized and characterized according to [1]. Temperature during synthesis reaction, dialysis and storage was found to strongly influence the particle size and crystal structure. Potentiometric titrations were used to determine the surface charge of the particles at varying pH and ionic strength.

In order to mimic the interactions of nanoparticles with natural organic matter (NOM), surface complexation on TiO<sub>2</sub> was studied using model organic substances possessing carboxyl and hydroxyl groups. Results show that the adsorption of 2, 3-dihydroxybenzoic acid (2, 3-DHBA) was influenced by pH, and the amount adsorbed varied greatly with initial TiO<sub>2</sub> particle size. The size dependent surface complexation is investigated further in order to obtain a mechanistic understanding of the processes that occur at the molecular level when TiO<sub>2</sub> nanoparticles interact with NOM.

Further, the stability of TiO<sub>2</sub> nanoparticle dispersions in presence and absence of well-characterized macromolecules (sodium alginate, humic acid, and fulvic acid) was studied in different electrolyte environments and at varying pH. The aggregation behavior was investigated by monitoring the changes in particle size using dynamic light scattering.

[1] Abbas *et al.* (2011) *Colloids Surf. A, Physicochem. Eng. Aspects*, doi, 10.1016/j.colsurfa.2011.03.064

## Stable carbon isotope chemostratigraphy and implications for global carbon cycling, Cretaceous Western interior basin

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The Late Cretaceous provides a critical analog for the anthropogenic greenhouse world. Strata of 100 Ma±20 myr record one of the warmest times in Earth history and are characterized by high-resolution time control, global correlation of deposits from deep ocean to epicontinental seas, and a series of global scale perturbations of the land-ocean-climate system. These perturbations include major changes in carbon cycling, surface temperatures, glacial ice volumes, sea level, and marine redox conditions over geologically short intervals (10's – 100's of kyr, similar to durations predicted for an anthropogenic greenhouse forced by combustion of all fossil fuel reserves). Recent findings from the Cenomanian-Turonian Ocean Anoxic Event 2 (OAE2), one of the largest Cretaceous events, have implicated active volcanism from emplacement of the Caribbean large igneous province as a trigger. One approach to testing this hypothesis involves carbon isotopes, since a volcanically triggered OAE should leave a characteristic signal. This study reports a new Cenomanian to Campanian carbon isotope record for the central Western Interior basin linked to a carbon isotope mass balance model. Major perturbations in the isotope record, such as Mid-Cenomanian Event and OAE2, are correlated to other carbon isotope records and analyzed with a series of model experiments. The new δ<sup>13</sup>C record contributes to Late Cretaceous chemostratigraphy and allows testing of the volcanic initiation hypothesis, as well as the role of regional variations in organic matter burial.