Preparation of coated polystyrene surfaces with hematite nanoparticles to study cell-mineral adhesion under well-characterized environment

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Regarding the importance of understanding reactions that occur at iron oxides and bacterial cell interface a series of experiments was set up to;

1-Synthesize iron oxides nanoparticles and characterize them by XRD, FTIR, AFM, potentiometric titration and drop shape analysis techniques.

2- Develop a thin film coating method to coat polystyrene well plate exposable surfaces for bacterial adhesion with synthetic hematite nanoparticles.

3- Evaluate and characterize the altered polystyrene well plate surface properties as a result of hematite nanoparticles deposition using; optical microscopy, sonication and optical density measurements, contact angle measurements, XPS and ATR-IR.

Results showed that synthesized material is ellipsoid shaped hematite nanoparticles with PZC equal to 7.5. The thin film coating process consisted of deposition of nanoparticles from aqueous suspensions. Different concentrations of hematite were prepared and nanoparticles were deposited on polystyrene well plate surface by evaporation of aqueous suspension. The characteristics of exposed surfaces to coating were evaluated by optical microscopy imaging, ATR-IR spectra, water drop contact angle measurement and XPS. The obtained results at this stage were compared with the characteristics of two different reference surfaces; pure polystyrene and pure hematite. Repeating the experiments with a range of suspensions from 0.65- 4.00 g/l showed that after repeating the coating procedure for at least 4 times, suspension concentrations as low as 0.65g/l are able to provide a complete and stable thin film of synthetic nanoparticles on polystyrene well plate surface. The coating shows surface characteristics which are completely consistent with a pure hematite surface. The evaluation of coated polystyrene proved that the developed iron oxide nanoparticle deposition method is a facile technique that enables us to study different bacterial adhesion steps, cell–mineral interface reactions and attached microbial growth under controlled and well-characterized condition.

Variability of atmospheric depositions on moutainous area

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Several field studies were carried out in mountainous area of France in order to better understand the main parameters which increase atmospheric deposition of airborn pollutents in those areas. Main studied tracers are ^{137}Cs and plutonium released by nuclear atmospheric tests but also natural atmospheric tracers such as ^{210}Pb and ^{7}Be. In some studied areas the variability of accidentally released Chernobyl ^{137}Cs has also been studied.

Thus soils were extensively sampled to quantify the inventory of main radioactive pollutents and excess ^{210}Pb. Correlations occuring between soils inventories and several environmental parameters (such as altitude, rain amount, snow accumulation, vegetation, etc…) were tested.

Our data show that at least four main parameters account for the sensitivity of mountainous area with respect to atmospheric depostion : (1) the high rainfall rates induce high deposition on highland with respect to lowland (2) further orographic effects (i.e. excess aerosols migrating from lowland to highland) enhanced atmospheric depositions (3) an increase of deposition with vegetation is also observed and lastly (4) local accumulations of snowfall induced strong enrichment of airborn pollutents in soils, especially the ^{137}Cs released by Chernobyl explosion.