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Biogenic minerals formation by an Fe^{III}-reducing *Desulfitobacterium* sp. isolate

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Dissimilatory iron reduction is an anaerobic respiratory pathway, wherein ferric (Fe^{III}) reducers couple the oxidation of organic acids, sugars and aromatic hydrocarbons to the reduction of Fe^{III}-species [1]. This may lead to the formation of minerals such as magnetite ($Fe^{II}Fe^{III}{}_2O_4$) and siderite ($Fe^{II}CO_3$) [2], which, in turn, can mediate the reduction of soluble pollutants as pertechnetate ($Tc^{VII}O_4^-$) to insoluble oxides ($Tc^{IV}O_2$) [3].

The genus *Desulfitobacterium* contains obligate anaerobic bacteria that are capable of utilizing a wide range of electron acceptors, including nitrite, sulfite, metals, humic acids and halogenated organic compounds [4].

In this work, the Fe^{III} reduction of a *Desulfitobacterium* species was examined. The microorganism has been isolated from bentonite, which is potentially used as geotechnical barrier in deep geological repositories for radioactive waste [5].

The cultivation conditions included DSMZ 579 medium with Na-acetate as electron donor to reduce Fe^{III} citrate [6]. During cultivation, the formation of white precipitates was observed. The phases were collected both under aerobic and anaerobic conditions and repeatedly investigated by using Raman microscopy and powder X-ray diffraction (pXRD). It was noticed that the phases turned immediately to blue-greenish overnight under oxic conditions. Both Raman spectra and pXRD diffractograms can be attributed to vivianite ($Fe^{II}{}_3(PO_4)_2$). Moreover, Raman spectra revealed the possible presence of pyrite ($Fe^{II}S_2$), siderite, magnetite and hematite ($Fe^{III}{}_2O_3$). These results suggest the ability of the bacterium of forming different Fe^{II}-minerals. Notwithstanding, both methods indicate the change of the chemistry of the precipitates according to environmental factors. The Fe^{II}-minerals formation by this microorganism depending on Fe^{III}-compounds and background electrolytes is currently ongoing. The biogenic ferrous minerals will be studied regarding the reduction of $Tc^{VII}O_4^-$.

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