

Effect of Clay Particles on the Activity of Autotrophic Nitrifying Bacteria

A.P. Pacheco, I.A. Pinho*, M.J. Vieira*, L.F. Melo

Centro de Engenharia Biológica – IBQF, Universidade do Minho, 4700 Braga, Portugal

Keywords: nitrification, kinetics, kaolin particles

Searching for new technologies to improve ammonia removal in water and wastewater is an up-to-date subject. The improvement of the process may be attained by the design of new reactors or new operating methodologies, including the addition of inorganic particles that may play a significant role on the oxidation process of ammonia and nitrite.

The aim of this work was to evaluate whether the presence of different concentrations of kaolin particles interferes with the kinetic process of nitrification. The nitrification experiments were performed with a mixed culture of nitrifying bacteria, consisting of *Nitrosomonas* sp. and *Nitrobacter* sp. The following experiments were carried out:

- a) Study of some physico-chemical properties of kaolin, namely the effect of the particles on the pH of solutions with different initial pHs, adsorption and desorption of ammonia, nitrite and nitrate by kaolin particles at different pH values.
- b) Study of the effect of the concentration of kaolin particles on the specific oxidation of ammonia and nitrite to nitrate in batch reactors with and without aeration, with and without pH control. In all the experiments the initial ammonia concentration was high (in the range of 480 mg/L to 650 mg N-NH₄/L).
- c) Respiriometric assays to evaluate the effect of the concentration of the particles and the time of contact on the endogenous respiration rate and the substrate (ammonia and nitrite) oxidation rate.

The physico-chemical studies of the kaolin particles showed that, for clay concentrations below 0.5 g/L, the final pH values were near neutrality. However, for higher concentrations (1 and 2.5 g/L) the final pH values of the solutions were more basic, whatever the initial pH values. In addition, for solutions with initial values lower or equal to 7, the final values increased, conversely to the case of initial values higher than 7. With respect to the adsorption of ammonia, nitrite and nitrate, negligible adsorption of those substances was observed.

The nitrification studies carried out showed that in the presence of 1 g/L and 2.5 g/L of particles, the nitrification was more efficient in the reactors without pH control (with and without aeration). For lower kaolin concentrations the nitrification kinetics seemed to be more efficient in reactors with pH control and reactors with aeration.

The respirometric experiments showed that the presence of 0.5 and 1 g/L of kaolin particles produced a stimulation in the specific endogenous respiration rate of the bacteria, and a higher exogenous substrate specific consumption rate. These results were obtained in two different situations: in one case the tests were carried out immediately after the addition of kaolin particles and in the other case there was a 7 days pre-contact of kaolin with the bacteria consortium before the test.