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MODELLING AND SIMULATION OF A THREE-PHASE FLUIDIZED SYSTEM APPLIED TO ATTACHED-GROWTH NITRIFICATION OF WASTEWATER

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Abstract

The paper approaches the subject of chemical fluidized bed reactors applied in environmental engineering for wastewater treatment. In view of the importance of biological fluid wastes treatment, it is the purpose of this work to study and simulate the attached-growth process on suspended particles applied for wastewater biological aerobic nitrification, based on an analytical model from the literature considering the multicomponent reaction within a biofilm. The bioreactor was modelled as three tanks-in-series with a recycle loop. Under continuous operation, ammonium ion is fed to the reactor, and the product nitrite and nitrate exit in the effluent.
Oxygen is supplied external to the bed in a well-mixed gas-liquid absorber. The nitrification kinetics involve a sequence of two oxidation steps, influenced by dissolved oxygen and the corresponding substrate concentration. Component balances are required for all components in each section of the reactor column and in the absorber, where the feed and effluent are located.
The simulation revealed that high nitrification efficiency is possible by choosing the influent flow rate, as well as the oxygen mass transfer coefficient, depending on pollutant concentration.
The results prove the possibility to perform the synthesis of a nitrification system and to assess its performance as well as to pre-establish the technical and economical working conditions.

Keywords: fluidized bed, modelling, nitrification, simulation, wastewater

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