TREATMENT OF WASTEWATER THROUGH BIOFILTERS: NITRIFICATION AND DENITRIFICATION PROCESSES

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The biological processes of nitrification and denitrification, used to remove nitrogen in the wastewater treatments, lead to an effluent of better quality so that nitrification and subsequent oxygen depletion are reduced in the receiving medium; further nitrogen deliveries to the coastal zone may be lowered to a level that would prevent coastal eutrophication [1]. Nitrification is an autotrophic aerobic process, to convert ammonium into nitrate, by two successive reactions: $NH_4^+ \rightarrow NO_2^- \rightarrow NO_3^-$. Ammonium is converted into nitrite during the first step of ammonium oxidation by ammonium-oxidizing bacteria, and nitrite into nitrate during the second step by nitriteoxidizing bacteria. The fraction of nitrifying organisms is known to decrease with the increase of the wastewater C/N ratio. Denitrification is a heterotrophic anoxic process that converts nitrate into gaseous nitrogen by denitrifying organisms through the following sequence of reactions: $NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \rightarrow N_2$ [2]. In the wastewater treatments, nitrification and denitrification are generally carried out in two separate steps, as the environmental conditions of these processes are different. The biological treatment of wastewater requires cultures of specialized bacterial populations which can be intensified and accelerated by engineering, e.g. immobilization. Indeed, the principal advantages of biofilters over activated sludge are their compactness and their efficiency in the biological treatment of wastewater [3]. Generally, biofilms have been characterized as matrix-enclosed microorganisms that adhere to a surface and/or to each other, producing a dynamic environment in which the component microbial cells appear to reach homeostasis, optimally organized to make use of all available nutrients. Although there are a respectable number of comprehensive reviews that cover biofilm characteristics and biofilm formation [3] they generally place less emphasis on the role that biophysical principles play in biofilms [4]. In the present study we revisit the membrane catalysis biophysical model in the light of recent technological and theoretical advances and how they can be exploited to highlight the details of membrane mediated nitrification and denitrification. We examine the possible effects that nitrogen concentration causes in the membrane catalysis and focus our attention in techniques used to determine the partition constant.

Literature:

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