Microbial competition control in high rate anaerobic reactors fed with industrial wastewaters

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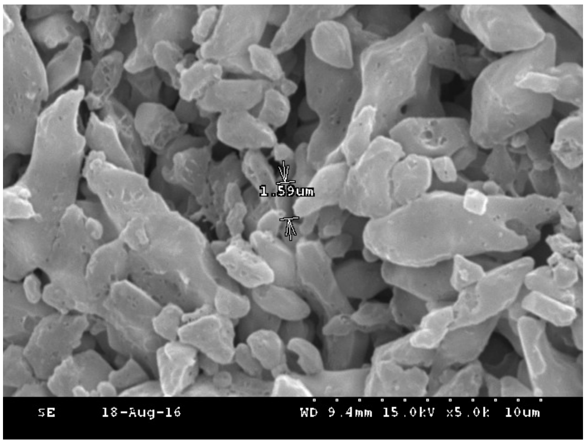
Social Impact

Limited water resources and increasing urbanization require more advanced technologies in order to preserve water quality. The efficiency and successfulness of wastewater treatment systems implies a high removal of the pollutants affecting public health. Nitrate is a typical contaminant in urban and industrial wastewaters and high nitrate concentrations are often associated with various negative environmental and human health impacts. Biological nitrate removal can be performed with both organic and inorganic electron donors (i.e. reduced sulfur compounds or hydrogen). However, there is still scanty information about the application of denitrification for the simultaneous removal of C, N and S compounds from complex mixtures such as industrial wastewaters (González-Blanco et al., 2012). Therefore, the primary goal of the current research is to develop a 'process control' methodology which enhances the yields of a particular bioprocess over another by controlling both environmental and operating conditions.

Technological Challenges

During sulfur-driven autotrophic denitrification, is removed while reduced sulfur compounds are oxidized to by sulfur denitrifying bacteria (SDB). Once is produced, reduction takes place and sulfate reducing bacteria (SRB) can compete with methane-producing bacteria (MPB) and heterotrophic denitrifying bacteria (HDB) in presence of organics. Moreover, the symbiotic relationship between SDB and SRB in wastewaters with a low content of organics was previously reported (Kim and Son, 2000).

To the best of our knowledge, only a few researchers reported a combined heterotrophic-autotrophic approach to remove . Reduced sulfur compounds (Kim and Son, 2000; Sahinkaya and Dursun, 2012; Sierra-Alvarez et al., 2005) were used as inorganic electron donors in autotrophic-heterotrophic denitrification applications. The main shortcoming associated with this approach was the slow biooxidation due to its low solubility. However, the oxidation and dissolution rates of can be enhanced by using 'biosulfur' which is generally produced in desulfurization plants aimed at removing H_2S from gas streams (Kleinjan, 2005). In conclusion, the concomitant presence of C, S and N compounds in biological treatment systems result in several multi-step sub-processes which are not of easy control. Further investigation is required in order to understand the biochemical, microbiological and physiological mechanisms occurring during the simultaneous removal of pollutants in "multipurpose" bioreactors. The development of a microbial competition strategy is of major importance in order to achieve a pre-determined goal in the treatment of such complex wastewaters.



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