CE.ENG.1

DEVELOPMENT OF ELECTRODES FOR ELECTROCHEMICAL DENITRIFICATION OF CONTAMINATED GROUND WATER

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Groundwater is one of the main sources of potable water and thus the quality of groundwater is vital in protecting health. Nitrate is a well known groundwater pollutant and is known to cause methaemoglobinaemia and certain cancers. Elevated levels of nitrate in ground water have been reported due to extensive use of fertilizers. According to the World Health Organization (WHO), the maximum allowable exposure level of nitrate nitrogen (NO_3^- - N) in drinking water is 10 mg l^{-1}. Among denitrification technologies, electrochemical denitrification is an attractive technology since it is easy to operate and maintain. In addition, by careful development of materials, electrochemical denitrificaion can offer higher efficiencies at lower energy cost and within short treatment durations. Most of the reported work on electrochemical denitrification is based on available electrode materials. Little attention is paid to the development of novel electrode materials. Moreover, according to the literature, electrochemically generated chlorine has been reported to oxidize the nitrate reduction byproducts and thus limited to electrolytes with chloride ions.

In this research, attention is paid to the development of novel electrode material, considering the electrode properties pertaining to a higher degree of nitrate removal in chloride free electrolytes. Cathode material is developed using copper as the main coating element. Using an uncoated inert material as anode, the maximum efficiency of denitrification is found to be around 35%. Time dependent studies show that possible cyclic reactions (i.e. reduction and re-oxidation to nitrate) hinder further removal of nitrate. Change of anode from inert uncoated electrode to dimensionally stable anode based on oxides of rare earth matter increases the nitrate removal efficiency from about 35% to about 70% showing the importance of oxidation efficiency of the anode material.

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