Application of Biological Denitrification to Drinking Water Treatment

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ABSTRACT

Nitrate contamination in drinking water has been a matter of increasing concern since the 1970's. Across the globe water supplies have become contaminated due to the increased use of nitrate fertilizers and other human activities. Nitrate levels above 10 mg NO_3^--N/L can be fatal to infants and cause possibly serious health ramifications for older children and adults. In the U.S. physical/chemical treatment methods have traditionally been used to remove nitrate from potable water, with the most common method being ion exchange. The disadvantages of ion exchange are the high associated cost and the production of highly concentrated waste. Over the past ten years an area of research has focused on the application of biological denitrification to drinking water. Biological denitrification can provide economical treatment plus the complete reduction of nitrate to nitrogen gas. Biological treatment has been used in Europe since the mid 1980's, but has been slow to gain acceptance in the U.S. due to the associated risk of chemical or bacterial contamination. Biological denitrification can occur through heterotrophic or autotrophic microbial degradation. Traditional bioreactor treatment processes, along with membrane and hybrid technologies have been studied.

KEYWORDS

Biological denitrification, drinking water, potable water, nitrate removal, membrane, hybrid process

INTRODUCTION

The presence of nitrate in potable water supplies has become a matter of global concern over the past 30 years. Increasing nitrate levels have been reported in the United States, Canada, Europe, Africa, the Middle East, Australia and New Zealand. In many areas wells and aquifers have become unsuitable for drinking without additional treatment (Kapoor and Vararaghavan, 1997). According to the U.S. Geological Survey (1998) most of the upper central United States is at high or moderate risk of existing or future ground water contamination (Figure 1).

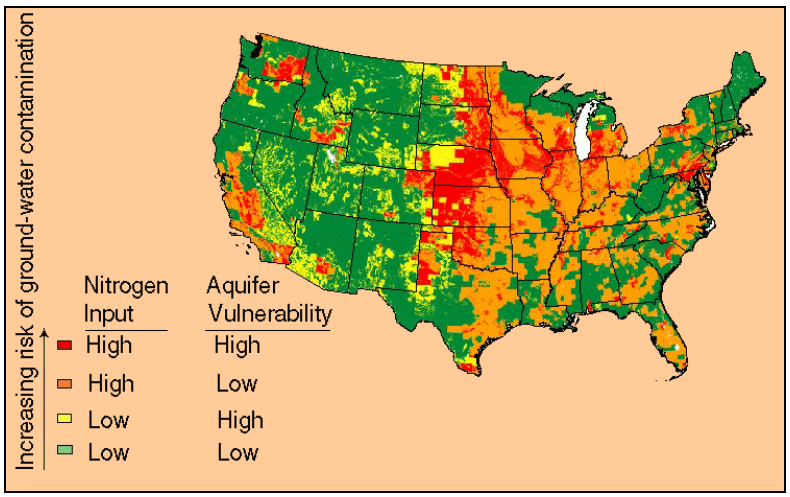

Figure 1: Risk of U.S. Groundwater Contamination by Nitrate (USGS, 1998)