

Water treatment for Nitrate

Mahshid Keshavarzi, Elnaz Zehtab Lotfi

Abstract

Nitrate concentrations in surface water and especially in ground water have increased in Canada, the United States, Europe, and other areas of the world. This trend has raised concern because nitrates cause methemoglobinemia in infants. Several treatment processes including ion exchange, biological denitrification, chemical denitrification, reverse osmosis, electrodialysis, and catalytic denitrification can remove nitrates from water with varying degrees of efficiency, cost, and ease of operation. Available technical data, experience, and economics indicate that ion exchange and biological denitrification are more acceptable for nitrate removal than reverse osmosis. Ion exchange is more viable for ground water while biological denitrification is the preferred alternative for surface water. This paper reviews the developments in the field of nitrate removal processes.

Keywords: Nitrate Removal, Denitrification, Ion Exchange,

Introduction

Nitrogen is a natural part of the environment. The atmosphere is 78% nitrogen (N₂) by volume. During the process of soil formation, nitrogen accumulates in the soil. Nitrogen stored in organic matter in the soil is converted into nitrate by bacteria.

Nitrate is found in plants, animal manure, human waste (septic systems and sewage sludge), manufactured fertilizers made of nitrogen and ammonium, and airborne nitrogen compounds given off by industry and automobiles deposited on the land in precipitation and dry particles. Small amounts of nitrate are naturally found in groundwater. In nature, water usually contains less than 1 milligram (mg) of nitrate-nitrogen per liter and is not considered a major source of nitrate exposure. Researchers agree that naturally-occurring nitrate-nitrogen concentrations in groundwater seldom exceed 3-4 milligrams per liter[1].

Infants under six months of age are at risk of nitrate poisoning, called methemoglobinemia. Toxic effects occur when bacteria in the infant stomach convert nitrate to more toxic nitrite. When nitrite enters the bloodstream, it interferes with the body's ability to carry oxygen to the body tissues. Symptoms include shortness of breath and blueness of the skin around the eyes and mouth (blue-baby syndrome).

Some scientific studies suggest a linkage between high nitrate levels in drinking water with birth defects and certain types of cancer.