Assessment of in-home reverse osmosis systems

Removing atrazine+cyanazine pesticide compounds and nitrate-nitrogen from private well water

Background

In an effort to provide homeowners with additional information about the use of in-home reverse osmosis (RO) water treatment systems for the removal of specific pesticides and nitrate-nitrogen (nitrate), the Minnesota Department of Agriculture (MDA) conducted a study to evaluate RO treatment system effectiveness. From 2019 through 2021, the MDA collected samples before and after RO system treatment from 55 private wells that had a detectable concentration of atrazine+cyanazine compounds and nitrate in the pre-treatment sample. The average age reported by homeowners since installation, for 34 of the RO systems, was approximately 10 years and most of the homeowners (38) indicated their RO system had been maintained (filters changed) within the last two years. The result summaries below include all the RO systems evaluated, regardless of age or if the homeowner was able to provide age and/or maintenance records.

Cyanazine plus its degradates was also evaluated and is referred to as total cyanazine. Total cyanazine is calculated by summing the concentrations of cyanazine with the degradates noted below:

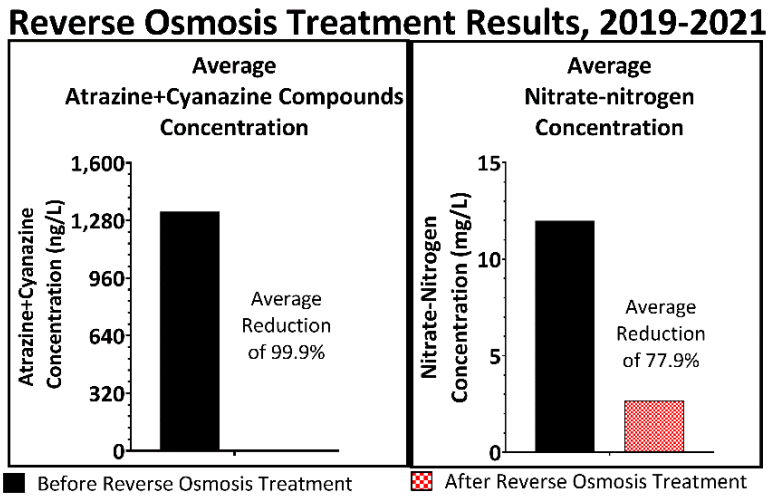
- *Cyanazine acid*
- *Cyanazine amide*
- *Deethylcyanazine*
- *Deethylcyanazine acid*
- *Deethylcyanazine amide*

Two additional cyanazine degradates included in the total cyanazine calculation are also degradates of atrazine:

- *Deisopropylatrazine*
- *Didealkylatrazine*

Based upon a Minnesota Department of Health recommendation, deisopropylatrazine and didealkylatrazine were only included in total cyanazine concentrations when cyanazine or a cyanazine specific degradate was detected in the same sample.

Results



Based on the available data RO treatment systems performed well for removing atrazine+cyanazine compounds and nitrate. The average atrazine+cyanazine concentration (summed total of these pesticide compounds detected) was reduced by 99.9%. and the average nitrate concentration was reduced by 77.9%. Most (54) of the RO systems evaluated indicated a complete removal of atrazine+cyanazine compounds. Only one of the systems had a very small amount of atrazine+cyanazine compounds in the treated water. Of the wells that were evaluated with RO treatment, 18 had a total cyanazine concentration and 38 had a nitrate concentration over the human health risk limits (HRLs) of 1,000 ng/L and 10 mg/L, respectively, in the water before RO treatment. After RO treatment, all wells were below the total cyanazine and/or nitrate HRL. The figure indicates the reduction in total pesticide and nitrate concentration in the 55 RO systems that were evaluated.

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