

## Removal of pesticides and nitrate-nitrogen from private well water using in-home reverse osmosis

### Background

In an effort to provide homeowners with information about the use of in-home reverse osmosis (RO) water treatment systems for the removal of pesticides and nitrate-nitrogen (nitrate), the Minnesota Department of Agriculture (MDA) conducted a study to evaluate RO treatment system effectiveness. From 2017 through 2019 the MDA collected samples before and after RO system treatment from 44 private wells that were known or suspected to contain pesticides and nitrate. The average age reported by homeowners since installation for 28 of the RO systems was approximately 10 years. Most of the homeowners indicated their RO systems had been maintained (filters changed) within the last 2 years.

### Results

Overall, RO treatment systems performed very well for removing pesticides. The average total pesticide concentration (summed total of all pesticides detected) was reduced by 99.7%. Most of the RO systems evaluated indicated a complete removal of pesticide chemicals. A few systems had very small amounts of pesticides in the treated water. Of the wells that were evaluated with RO treatment, 13 had a pesticide concentration and 24 had nitrate-nitrogen over a human health guideline in the water before RO treatment. After RO treatment, zero wells had a pesticide or nitrate-nitrogen concentration over a human health guideline. The average nitrate-nitrogen concentration after RO treatment was reduced by 78.9%. The figure below indicates the reduction in total pesticide and nitrate concentration in the 44 systems tested.

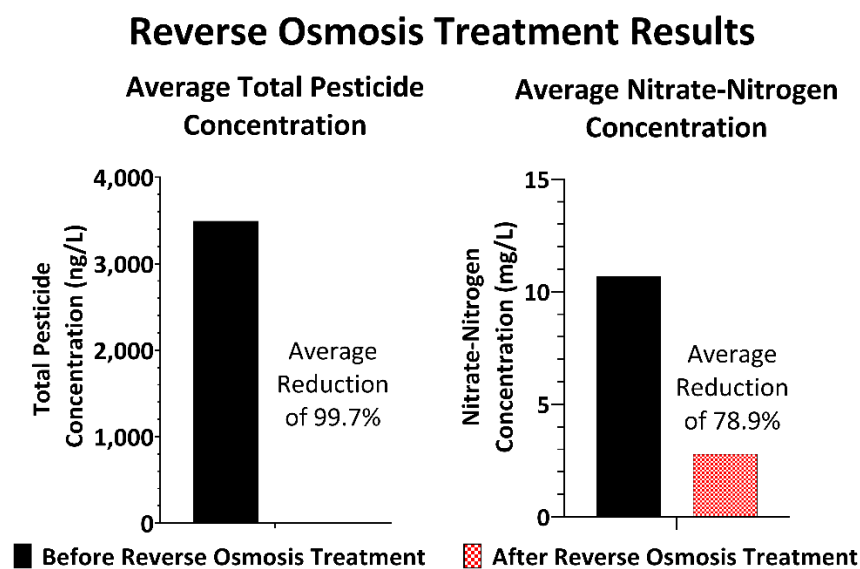


Table 1 shows the percent removal for all detected pesticides and nitrate-nitrogen detected before RO treatment. This table will allow homeowners to better assess RO treatment if concerned about a specific chemical.

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**Table 1. Chemicals removed from 44 private well water samples with in-home reverse osmosis treatment, 2017 through 2019. Pesticides are reported in ng/L or parts per trillion. Nitrate-nitrogen reported in mg/L or parts per million.**

		Before Reverse Osmosis (RO) Treatment		After Reverse Osmosis (RO) Treatment		
Chemical	Number of Samples	Detections	Detection Range (ng/L)	Detections	Detection Range (ng/L)*	Concentration Removal Percentage
2,4-D	44	1	24.6	0	ND	100%
Acetochlor ESA	44	25	39 - 424	0	ND	100%
Acetochlor OXA	44	3	42 - 108	0	ND	100%
Alachlor	44	4	32 - 56	0	ND	100%
Alachlor ESA	44	41	44 - 7,400	1	41	99.9%
Alachlor OXA	44	8	53 - 660	0	ND	100%
Aminopyralid	41	1	112	0	ND	100%
Atrazine	44	30	31 - 460	0	ND	100%
Bentazon	44	15	5.4 - 251	0	ND	100%
Clothianidin	44	2	28 - 87	0	ND	100%
Cyanazine acid	41	20	10 - 1,200	0	ND	100%
Cyanazine-amide	41	17	11 - 1,100	0	ND	100%
Deethylcyanazine acid	41	37	34 -3,800	0	ND	100%
Deethylcyanazine Amide	41	1	100	0	ND	100%
Deisopropylatrazine	44	23	26 - 390	0	ND	100%
Desethylatrazine	44	28	53 - 1,200	0	ND	100%
Didealkylatrazine	44	35	69 – 1,400	1	69	99.2%
Dimethenamid ESA	44	9	6.8 - 63	0	ND	100%
Dimethenamid OXA	44	4	10 - 34	0	ND	100%
Flumetsulam	44	1	98	0	ND	100%
Fomesafen	41	2	300 - 4,100	0	ND	100%
Hydroxyatrazine	44	10	6.8 - 23	0	ND	100%
Imazapyr	44	1	20	0	ND	100%
Imazethapyr	44	1	10	0	ND	100%
Imidacloprid	44	2	6.1 - 57	0	ND	100%
Metalaxyl	44	1	20	0	ND	100%
Metolachlor	44	6	27 - 610	0	ND	100%
Metolachlor ESA	44	37	39 - 4,900	4	12 - 110	99.8%
Metolachlor OXA	44	34	14 - 1,200	0	ND	100%
Metribuzin DA	44	1	68	0	ND	100%
Metribuzin DADK	44	1	2,600	0	ND	100%
Picloram	44	1	72	0	ND	100%
Safluenacil	44	1	96	0	ND	100%
Sulfentrazone	41	1	55	0	ND	100%
Thiamethoxam	44	1	170	0	ND	100%
Nitrate-nitrogen	44	42	0.1 – 26 mg/L	36	ND – 9.1 mg/L	78.9%

\*ND = not detected