TECHNOLOGY SHEET

MEMBRANE DEGASSING SYSTEM

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Sulfide occurs in many well water systems as a result of bacterial action on organic matter under anaerobic conditions in the ground, wherein the sulfate reducing bacteria (SRBs) convert the naturally occurring sulfate to sulfide:

$$\underset{\text{Sulfate}}{SO_4^{2-}} + \underset{\text{Organic}}{CH_2O} \text{ -------}\rightarrow \underset{\text{Sulfide}}{HS^-} + \underset{\text{Bicarbonate}}{HCO_3^-}$$

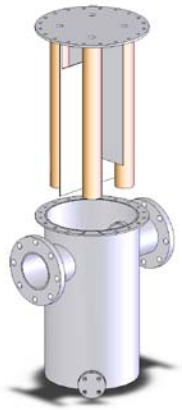
In the above equation, CH_2O represents organic matter. The above biological reaction also occurs in pipes, and any drinking water systems, wherein sulfate and some dissolved organic carbon are often present in the water.

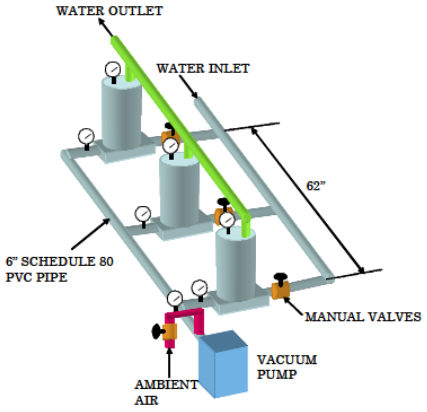
Presence of sulfide in drinking water even at a few mg/L concentration imparts smell of rotten eggs and a bad taste in the water. At low concentrations, less than 0.5 mg/L, this odor is described as "musty" and at concentrations above 1 mg/L, as "rotten eggs". Removal of hydrogen sulfide from drinking water can be accomplished by several methods, such as aeration, degasification, chlorination, etc.

In drinking water, sulfide can exist in two main forms: (1) unionized dissolved hydrogen sulfide gas; and (2) ionized form, either as HS^- or S^{2-}. The distribution of total sulfide between the dissolved hydrogen sulfide gas and the ionized form depends on temperature and pH. At low pH, most of the total dissolved sulfide exists as unionized hydrogen sulfide, while at alkaline pH, most of the total dissolved sulfide exists as ionized sulfide, mainly HS^-. The reason why this distinction is important is because degasification can only remove the unionized dissolved hydrogen sulfide and cannot remove any of the ionized sulfide. Further, this limitation is not due to the method of degasification, but is valid for all degasification methods. Ionized dissolved sulfide can only be removed chemically or electrolytically, while unionized hydrogen sulfide can be removed by aeration or degasification.

It is also important to recognize that pH is also impacted by the amount of dissolved carbon dioxide, since it forms carbonic acid. Dissolved carbon dioxide is also present in well water naturally along with hydrogen sulfide. During degasification, hydrogen sulfide and carbon dioxide are both removed from the water, thereby resulting in an increase of pH, which results in converting more of the dissolved sulfide into ionized sulfide and less of dissolved unionized hydrogen sulfide.

Membrane degassing involves the rapid removal of dissolved gases from the liquid phase using a high surface area membrane system. PRD Tech's degassifier uses a proprietary membrane cartridge that has vacuum condition on one side of the membrane and water on the other side. Dissolved gases transfer cross the high surface area membrane, while water is unable to get across. This allows the water to be degassed in a small footprint, compact system, and achieve very high gas removal efficiencies. Since the water does not cross the membrane, the liquid pressure drop is less than 10 psi. The picture on the left shows a membrane degassifier using four membrane cartridges. The picture on the right shows three membrane gassifiers that are connected in parallel and using a single vacuum pump.





The picture below shows PRD Tech's membrane gassifier that is currently operating in Florida for removing hydrogen sulfide from water.

This membrane degassifier can remove 99.5% of the inlet dissolved hydrogen sulfide for a water flowrate of 500 gpm. The unit is usually enclosed in a box, that has been removed for the picture.

For more information and to get a water sample tested, contact
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