*James G. Speight Ph.D., D.Sc., in* [*Natural Gas (Second Edition)*](https://www.sciencedirect.com/book/9780128095706/natural-gas)*, 2019*

8.4.2 Sulfinol process

The Sulfinol process, developed in the early 1960s, is a combination process that uses a mixture of amines and a physical solvent. The solvent consists of an aqueous amine and sulfolane. The process is used for the removal of hydrogen sulfide, carbonyl sulfide, mercaptan derivatives, other organic sulfur compounds and all or part of the carbon dioxide from natural, synthetic, and refinery gases. The total sulfur compounds in the treated gas can be reduced to ultra-low ppm levels, as required for refinery fuel and pipeline quality gases. An improved application is to selectively remove hydrogen sulfide, carbonyl sulfide, mercaptan derivatives, and other organic sulfur compounds for pipeline specification, while coabsorbing only part of the carbon dioxide. Deep removal of carbon dioxide removal for liquefied natural gas plants is another application, as well as bulk carbon dioxide removal with flash regeneration of the solvent. The process sequence-Sulfinol/Claus/SCOT can be used advantageously with an integrated Sulfinol system that handles selective hydrogen sulfide removal upstream and the SCOT process that treats the Claus offgas.

The Sulfinol mixed solvent consists of a chemical-reacting alkanolamine, water, and physical solvent sulfolane (tetra-hydrothiophene dioxide). The actual chemical formulation is customized for each application. Unlike aqueous amine processes, the process removes carbonyl sulfide, mercaptan derivatives, and other organic sulfur compounds to stringent total sulfur specifications. A wide range of treating pressures and contaminant concentrations can be accommodated. Refinery fuel gas and gas pipeline specifications, such as 40 ppm v/v total sulfur and 100 ppm v/v hydrogen sulfide are readily attained.

The process is in many respects identical to the familiar amine method and its equipment components similar to those found in amine units. The main difference is that while the conventional amine process employs a fairly diluted concentration of amine in water, removing the acid gas by chemical reaction, the Sulfinol system uses a mixture of highly concentrated amine and a physical solvent removing the acid gases by physical and chemical reactions. The concentrations of the amine and the physical solvent vary with the type of feed gas in each application. Common Sulfinol mixtures are in the range of 40% amine (also called DIPA), 40% sulfolane (an organic solvent), and 20% water.

Sulfinol has a good affinity for most of the acid gases and has the ability to release these gases in the regenerator upon pressure reduction and heat application. When operating under suitable conditions, it is capable of removing twice as much acid gas as a 20% MEA solution.

The Sulfinol-D process uses DIPA, while Sulfinol-M uses MDEA. The mixed solvents allow for better solvent loadings at high acid gas partial pressures and higher solubility of carbonyl sulfide and organic sulfur compounds than straight aqueous amines.

The Sulfinol-D process is primarily used in cases where selective removal of hydrogen sulfide is not of primary concern, but where partial removal of organic sulfur compounds (mercaptans, RSH, and carbon disulfide) is desired, typically in natural gas and refinery applications. The Sulfinol-D configuration is also able to remove some carbonyl sulfide via physical solubility in sulfolane and partial hydrolysis to hydrogen sulfide induced by the DIPA. However, complete removal of carbonyl sulfide by Sulfinol-D cannot be guaranteed. Unlike solvents that use other primary and secondary amines (MEA and DEA) Sulfinol-D is claimed not to be degraded by these sulfur compounds.

Sulfinol-M is used when a higher degree of hydrogen sulfide selectivity is needed. Hydrogen sulfide selectivity in Sulfinol-M is controlled by the relative reaction rate of the reaction of hydrogen sulfide with methyldiethanolamine as well as by the physical solubility of hydrogen sulfide and carbon dioxide in the solvent.