ORGANIC SPECIES IN PRODUCED WATER: NATURE, DISTRIBUTION AND IMPLICATIONS TO WATER REUSE

Yousif K. Kharaka

U. S. Geological Survey, Menlo Park, California, 94025

Biographical sketch of author

Kharaka has been a research hydrologist with the USGS, Menlo Park, California, since 1975. His fields of research cover the broad area of water-gas-rock interactions over a wide range of temperature and pressure conditions. His current investigations cover naturally occurring organics, organic- inorganic interactions, CO2 sequestration, water produced with petroleum, and the role of fluids on the dynamics of the San Andreas Fault. Kharaka has authored or coauthored more than 100 scientific papers, reports and book chapters. He received his B. Sc. (honors) from Kings College, London, in 1963, and his Ph.D. from the University of California, Berkeley, in 1971.

Abstract

The concentrations of organic compounds in produced water are generally much higher than in other natural waters, reaching a value of ~10,000 mg/L as acetate. The highest concentrations are present in produced water obtained from reservoir rocks of Tertiary age at temperatures of 80-120^{o}C. The concentrations commonly decrease at lower temperatures primarily due to bacterial degradation and decrease at higher temperatures mainly due to thermal decarboxylation.

Monocarboxylic (mainly acetate, propionate and butyrate) and dicarboxylic (mainly oxalate, malonate and succinate) acid anions comprise the bulk of dissolved organic species in produced water. However, phenols, benzoic acids, citric acid, amino acids, and BTEX are also present in significant concentrations. Oil and grease, primarily as entrained globules, are present at variable concentrations (~5 to >100 mg/L). Finally, significant quantities of organic compounds are added to the produced fluids, as scale and corrosion inhibitors and bactericides.

Because of increased demand for existing water supplies, especially in the arid western USA, and to lower the cost of brine disposal, a 10 gpm pilot field study was designed to reclaim produced water from Placerita oil field, California, to meet drinking water standards. Produced water from Placerita has a relatively low salinity of ~8,000 mg/L dissolved solids, but a relatively high concentration of organics (DOC of 40-120 mg/L), including oil and grease (50-60 mg/L), organic acid anions (4-10 mg/L) and BTEX (~100 μg/L as C). Removal of organics from this water proved more difficult than inorganic salts, indicating that such water may be more suitably treated for use in irrigation.