# H2S Production in Petroleum Reservoirs During Steam Injection Process: TSR Experimental Simulation

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The thermo-reduction of sulphates (TSR) naturally occurs in deep petroleum reservoirs. TSR can also artificially be induced by the injection of hot water during Enhanced Oil Recovery (EOR) operations in shallow reservoirs containing heavy oils. Due to the high temperatures (150°C<T<300°C) reached in the reservoirs during hot water flooding, chemical reactions involving oil, water and mineral matrix enriched in sulphates can lead to a significant increase of $H_2S$ production.

In order to better understand TSR mechanisms and to tentatively estimate the risk of $H_2S$ occurrence during hot water stimulated enhanced recovery operations, experimental pyrolyses were undertaken under conditions as close as possible to those prevailing in reservoirs during hot water injection. The purpose of this set of experiments was to measure $H_2S$ production rates at various temperatures, then to tentatively derive a numerical model of $H_2S$ formation due to artificial TSR. The three primary processes involved in induced TSR, i.e. (1) oxidation of organic matter (vulcanisation), (2) sulphate reduction and (3) thermal cracking, were independently simulated in laboratory conditions and the results compared to those obtained from experiments simulating the complete TSR phenomena.

Artificial simulation using a n-alkanes mixture, elemental sulphur, water and mineral were conducted using an inert closed system pyrolysis at variable temperature for different residence times.

TSR induced by hot water injection during EOR can thus be reproduced under laboratory conditions generating high amounts of $H_2S$. The reduction of sulphates under the used conditions was confirmed, notably, by the presence of secondary $MgCO_3$. TSR and vulcanisation seem to be kinetically controlled in our experimental conditions. However the rate of vulcanisation is very high compared to that of TSR. Therefore the alteration of hydrocarbons and formation of $H_2S$ are kinetically controlled by the rate of sulphates reduction.