Cross-linked polyethylene (PEX) pipes are widely installed in the USA, and the usage is increasing due to the advantages of PEX pipes. The maximum contaminant levels (MCLs) of disinfection by-products (DBPs) were regulated for water treatment plants and distribution system, however, it is an open question for premise plumbing system in house. This study identified that the PEX pipes can alter the water quality through a combination of (i) formation of DBPs from the reaction of TOC with disinfectants and (ii) removal of these DBPs by PEX pipes sorption. By exposing the synthetic water with varying conditions to PEX pipes for 3d, the effect of pipe types, temperature and bromide were detected using kinetic experiments, and the effect of pH and disinfectant dosage were detected by fixed-reaction-time experiments. For all tested PEX pipes, nitrosamines were not formed after 5d chloramination (< 10ng/L), while trihalomethanes (THMs) were formed after chlorination. For nearly all influence conditions that was detected, the THM formation of experiment samples was about twice as that in controls. Temperature was the most important influence condition for which the THM concentration at 55 °C was 5-fold higher than room temperature (22 °C), followed by bromide concentration, disinfectant dosage, pH and pipe types. In the meanwhile, the PEX pipes were not only a “source” of DBPs, but also verified to sorb these DBPs as a “sink”. At 22 and 55 °C, the sorption percentage of total THM (TTHM) was 42% and 80% for PEX-a pipes, 50% and 78% for PEX-b pipes, and 48% and 76% for PEX-c pipes after 5d. When exposing to PEX pipes, THMs can be formed and also removed at the same time in the water. We suggested that, the regulation of THMs in house plumbing systems should be established as well.