Arid Soil Research and rehabilitation.14:387—401, 2000

0890-3069/00 Sl2.00 +.00

Nature and Composition of Newly Formed Precipitates in Relationship to Characteristics of Groundwater in Arid Environment

A. S..SHETA
M. S. AI-SEW AILEM
A. She SALLAM
A. S. AI-MASHHADY

Soil Science Department
College of Agriculture
King'Saud University
Riyadh, Saudi Arabia

Chemical characteristics of ground,l;ater and the composition of newly formed precipitates are critical in the managemeni of modern irrigated agriculrure in arid regions. Water samples representing the main aquifers in Riyadh region, Saudi Arabia, and solid samples from the newly formed precipitates were studied. Results showed that water temperature varied between 30.3-69°C. being higher in the deep aquifer and low in the relatively shallow aquifers. Initial water pH ranged from 6.39-7.92, *increasing to 7.65-8.20 at atmospheric conditions. Shallow aquifer waters were categorized into sulfate-type and CI- or no-dominant type waters, while the deep aquifers were characterized as Cl-type and no-dominant type. Soluble H4Si04, soluble Fe and Mn ranged from* 3.15 *to 18.82,0.10 to 1730, and 0.01 to 0.32 mg* L^{-1}, *respectively. Calculation of saturation indices from water composition ,at initial, closed and equilibrium conditions indicated that changes in pH and water temperature cause major chemical changes in the water favoring the precipitation of carbonates and Fe-silicates. Data of total chemical analysis indicated that carbonates are present in all samples and constituted up to* 976 *g kg-1 of the precipitates formed from the deep aquifer water in the irrigation tubes. Amorphous and/or crystalline Fe compounds were the dominant fractions in the surface crust precipitates, while crystalline Fe compounds was the dominant form in the precipitates in irrigation tubes and in the cooling reservoir. X RD data confirmed that aragonite was the dominant carbonate mineral in the precipitates formed from the deep aquifer water. Calcite and Mg-calcite were detected in considerably low quantities. Poorly crystalline Fe-oxide minerals were present* i/1 *all the precipitate samples. Results suggested that formation of precipitates -either. in -cooling reservoirs or in irrigation systems can be minimized by controlling the degassing through keeping the system closed, lowering the pH through the injection of inorganic acids in the system or both.*

Keywords carbonates, desert, Fe-<:arbonates, mineralogy, precipitates in PVC, precipitates from wells, saturation indices, Saudi Arabia.