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Extended Abstracts

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title: A study on recharge of groundwater by hydrogen and oxygen stable isotopes in Lin-Bian river basin

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Pingtung County is an agricultural developed region, the surface water of Kaoping, Tungkang and Linpeing Rivers become the main water resource in Pingtung Plain. In terms of measurement data (WRA 2008),Typhoons and thunderstorms during the wet season from May to October bring about 80% of annual precipitation(2,503mm), primarily in the mountains region, while only 10% of the rainfall occurs during the dry season (November to April), a great quantity of annual rainfall in this area. This uneven distribution in the monthly rainfall poses a major problem to the planners is difficult to utilize. Hence, groundwater became the main water resources in Pingtung Plain, Taiwan. Owing to the property of groundwater was stable on the quality, temperature, quantity, receptivity, and lacking of management and sustainable utilization viewpoint groundwater has long been overdrawn improperly that caused serious land subsidence, seawater intrusion, and soil salinity.

In order to solve these problems, local government initiatives have been launched to utilize and manage the water resources and developing artificial recharge of groundwater schemes. If the assessment and management of groundwater resources could effective employed in Pingtung Plain, the groundwater pumping rate, recharge and sources need in accurately control of the situation under stable for long-term. In view of this, the purpose of this study are (1) employ the hydrogen and oxygen isotopes as natural tracer to analyze groundwater flow direction, and (2) employ the groundwater hydrograph to estimated the groundwater recharge amount by at Linpeing River in Pingtung Plain.

In this study, stable isotopic compositions of groundwater, stream water and precipitation from different seasons are analyzed to discuss the infiltration process in detail. Oxygen and hydrogen isotopic compositions of water have served for decades as a natural tracer all over the world to characterize the provenance of water mass, including groundwater and surface water. Learning how the water resources recharge into aquifer at Pingtung Plain wills important issue, Hence, Using natural tracers to identify the groundwater sources and find relation of each out, Oxygen and hydrogen isotopic compositions of water have served for decades as a natural tracer all over the world to characterize the provenance of water mass, including groundwater and surface water.

Stable hydrogen isotopic compositions is extracted from reduction of water to H2 using zinc shots made after VG MM602D isotope ratio mass spectrometer by Biogeochemical Laboratory of Indiana University (Coleman et al., 1982). Stable oxygen isotopic compositions were analyzed by well-known CO_2–H_2O equilibration method (Epstein and Mayeda, 1953).The equilibrated CO_2 gas was measured by a VG SIRA 10 isotope ratio mass spectrometer. Both analyses were conducted with isotope ratio mass spectrometers at the Isotope Hydrology Laboratory of Academic Sinica, Taiwan.

Basically, the isotopic ratio base on V-SMOW (Vienna Standard Mean Ocean Water) and SLAP (Standard Light Antarctic Precipitation) standard are $\delta D = 0‰$, $\delta^{18}O = 0‰$ and $\delta D = -428‰$, $\delta^{18}O = -55‰$, respectively. The oxygen and hydrogen isotopic ratio results are reported using δ-notation as per mil (‰). In this study, the analytical precision (1σ) is 0.1‰ for$\delta^{18}O$ and 1.5 ‰ (1σ) for δD.

Finally, according to the hydrogen and oxygen isotopic mass balance analyses of the groundwater recharge sources in Lin Bian River basin, the aquifer F1 has the highest ($\delta^{18}O = 16\%$, $\delta D = 19\%$) and F3 has the lowest ($\delta^{18}O = 9\%$, $\delta D = 7\%$) proportions of rainfall recharge, respectively.

On the other hand, F3 has the highest ($\delta^{18}O$ = 91.3%, δD = 93%) and F1 carries the lowest ($\delta^{18}O$ = 84%, δD = 81%) proportions of lateral recharge from the mountain area, respectively. These results show that the groundwater for the deeper aquifer of Lin Bian River area has relatively higher recharge from the mountain river, while in the shallower aquifer the rainfall recharge is the dominant factor.

The annual groundwater recharge amount in Lin Bian River basin is estimated as about 460 million cubic meters in 2006. The total annual water extraction amount plus the water loss is estimated as about 410 million cubic meters; thus, these two parameters are within the extraction allowance, except for some coastal areas. The groundwater flow direction in Lin Bian River basin is generally from northeast to southwest, by combining the evidence of findings in water quality project, with the groundwater level and isotopic studies, the phenomenon of sea water invasion along the coastal area has been identified and still continues to move towards inland.

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