

Effects of soil, sea salt and anthropogenic activities on precipitation chemistry in western Iran

K. ASAI¹, Y. YOKOO^{1*}, R. ANMA², S. MEHRABANI³

¹ Fac. of Sci. and Eng., Doshisha Univ. (*correspondence: yyokoo@mail.doshisha.ac.jp), Kyoto 610-0321, Japan

² Univ. of Tsukuba, Ibaraki 305-8571, Japan

³ Kurdistan Univ., Iran

We collected monthly precipitation in four cities (Hamedan, Ilam, Shiraz, Ahvaz) of western Iran from January 2014 to July 2015, and determined their pH values, electrical conductivity (EC) and major ionic concentration (Na^+ , Mg^{2+} , K^+ , Ca^{2+} , Cl^- , NO_3^- , SO_4^{2-} and HCO_3^-) in order to elucidate the effects of soil dust, sea salt and anthropogenic activities on precipitation chemistry. In no-rainfall months, we rinsed the sampler with ultrapure water and collected it to understand the influence of aerosols. The climate in western Iran is semiarid, and dry and wet seasons are from June to September and from October to May, respectively.

The precipitation samples showed neutral to slightly alkaline ranged from 6.26 to 9.04 in pH. The ionic compositions of most precipitation samples were enriched in Ca^{2+} and HCO_3^- . These results indicate precipitation in western Iran was neutralized and alkalized by carbonate minerals. Although the pH of natural rain in equilibrium state with atmospheric CO_2 is typically ~ 5.6 , precipitation in western Iran is not acidic because of neutralization by aeolian minerals such as calcite originating from arid areas. Evaporite minerals precipitate around subsurface during the dry-wet seasons in western Asia.

The ionic compositions of several precipitations were abundant in NO_3^- and SO_4^{2-} in Hamedan, Ilam and Shiraz. These precipitation were collected during dry season and wet season immediately after dry season. These results suggest the precipitation wash out and dissolved NO_3^- and SO_4^{2-} derived from anthropogenic activities and/or soil dust such as sulfate minerals concentrated in atmosphere during the dry season.

The ionic compositions of precipitation in winter in Ahvaz were relatively enriched in Na^+ and Cl^- , indicating the precipitation are subject to sea salt from the Persian Gulf and/or the Mediterranean. Ahvaz is closer to the Persian Gulf than other sites, however, air moisture is generally transported by the northwest wind from the Mediterranean.