

Effect of treated sewage effluent on stream water chemistry of Yamato River in Nara, western Japan

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We determined the pH values, electrical conductivity (EC) and elemental concentrations of streamwater in the Yamato River and effluent from the sewage treatment plant in order to elucidate the effects of anthropogenic activities on stream water chemistry. We collected 10 sites of the mainstream and 7 sites of the tributaries of Yamato River and the treated sewage samples before and after the addition of NaClO at the treatment plant in Nara prefecture.

The pH values of the mainstream decreased, and their EC and concentrations of Na^+ , K^+ , Ca^{2+} , Mg^{2+} , Cl^- , NO_3^- , SO_4^{2-} , HCO_3^- , Si, B, Mn, Zn, Sr, Ba, Li, Ti, V, Cr, Ni, Cu, As, Rb, Mo, Ag and Sb increased from the upstream to the downstream of the input point of the sewage from the treatment plant. On the other hand, the pH values of sewage samples were lower, and their EC and concentrations of Na^+ , K^+ , Ca^{2+} , Mg^{2+} , Cl^- , NO_3^- , SO_4^{2-} , HCO_3^- , Si, B, Zn, Sr, Ba, Li, Ti, V, Cr, Ni, Cu, As, Rb, Mo and Sb were higher than those of the upstream of Yamato River. These results indicate the input of sewage effluent substantially affected decreasing pH and increasing EC and concentrations of Na^+ , K^+ , Mg^{2+} , Si^{4+} , Cl^- , SO_4^{2-} , B, Zn, Sr, Ti, Ni, Rb, Sb, Li, V and Cr of mainstream water.

The major elemental compositions of Yamato River mainstream changed from Ca^{2+} - HCO_3^- type in the upstream side of the plant to Na^+ - Cl^- type at the site immediately after the input of sewage, and approached to be relatively rich in Ca^{2+} and HCO_3^- . Those of sewage samples and tributaries were enriched in Na^+ and Cl^- and in Ca^{2+} and HCO_3^- , respectively. These results suggest the downstream side of the plant in Yamato River are subjected to dilution by tributaries, however, the elemental compositions of the downstream become different from those of the upstream side of the plant.

The elemental compositions of sewage samples before and after the addition of NaClO had no significant change, indicating the addition of NaClO has small influence on the chemistry of sewage. Therefore, sewage accumulated into the treatment plant is considered originally high concentrations of Na^+ and Cl^- and major changes in river water chemistry of Yamato River after sewage effluent flow is attributed to anthropogenic substances such as domestic effluent.