

Hydrogeochemical control and demarcation of High Fluoride belt in the floodplain of the river Ravi, Indus Basin Punjab, Pakistan

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Fluoride (F⁻) in drinking water present a significant challenge to public health worldwide, particularly in the arid and semi arid regions, including India and Pakistan, our previous work [1] based upon large field testing of thousands of wells identified some hotspot areas in the Punjab plains particularly along Ravi river, which needed further exploration, this study aims to determine the extent to which the Ravi river floodplain is affected and attempts the demarcation of F⁻ endemic areas in the floodplain of river Ravi Indus basin Pakistan. Along with the controls regulating the F⁻ concentrations in that particular area and to explore the mechanisms responsible for elevated F⁻ concentrations in the groundwater by comparative analysis of High F⁻ and Low F⁻ groundwater geochemistry, further more an attempt was also made to quantify the health risks associated with the consumption of High F⁻ groundwater in the endemic areas. Forty-Eight groundwater samples from 7 villages along the Ravi flood plain in October 2019. Villages were selected using google earth imagery along the villages that were already reported by previous survey as shown in figure upstream and downstream to the reported areas for the demarcation of High and low F⁻ areas. Our results show that groundwater chemistry in that specific area marked as red in figure which the slope of land as measured with the google earth elevation profile shows that due to almost uniform slope, the groundwater resides longer than usual and is poorly drained as compared to upstream and downstream where the slope is normal decreasing from north to south, based upon groundwater chemistry as well as slope data it is evident that it could be a major reason behind this unusual groundwater characteristic with higher Na, Higher EC and elevated F⁻ concentrations. This finding is helpful in understanding the hydrogeochemical control of elevated F⁻ concentrations in groundwater, and also in the demarcation of High F⁻ area, which have policy implications for prioritizing groundwater quality management in the F-endemic areas.

[1] Khattak et., al. (2022), Science of the Total Environment 806, 151353.

