

### **battery-operated portable device for water decontamination**

Groundwater contamination by fluorides affects an estimated 260 million people in many countries around the world. The FLOWERED initiative followed a methodological approach for the identification of contaminated water and implemented mitigation and defluoridation measures for its treatment.



Groundwater is the only realistic water supply option in many rural areas of the world, as it offers good quality water and is little affected by droughts. However, there is very little hydrogeological information with scientific evidence on groundwater quality, which poses a risk to its use. The East African Rift Valley region is characterized by the presence of a large amount of fluoride in groundwater and surface water. It is one of the regions with the highest concentration of fluoride in the world (Ethiopia: 1.3-300 mg/L; Kenya: up to 180 mg/L; Tanzania: up to 70 mg/L).

### **Geological Overview of Fluoride Contamination**

The EU-funded [FLOWERED](#) project aimed to develop a sustainable water management system in areas affected by fluoride contamination of water, soil and food in specific test areas in the East African Rift Valley countries (Ethiopia, Kenya, Tanzania). "Our goal was to generate sustainable and adapted strategies for water use," explains project

coordinator Giorgio Ghiglieri. Considering that geological and hydrogeological conditions influence water contamination, project partners investigated the groundwater chemistry of these countries. They found that the level of fluoride in the groundwater of the East African Rift Valley varied greatly from place to place. This was due to different factors that influenced fluoride mobility and concentration, including the time it took for groundwater to interact with fluoride-rich minerals and other geogenic factors.

"Obtaining hydrogeological information about an area can help local or government agencies build wells that capture good quality water," says Ghiglieri. FLOWERED's scientific approach is based on a detailed knowledge of the geological and hydrogeological context that affects water contamination. Geological, hydrogeological, hydrochemical, geophysical and hydrological studies have contributed to the location of safe groundwater in the areas studied. This was a prerequisite for the implementation of sustainable water management, water purification and agricultural purposes. In addition, the project found that prolonged irrigation of crops with fluoride-contaminated water significantly affects soil quality and leads to the uptake of fluoride by crops, increasing its concentration in the edible parts of maize, tomatoes and beans. This poses additional dangers to human and animal health.

### **A defluorination device**

FLOWERED has designed and developed a defluorination device that consists of a 20 L tank and a recirculation pump that mixes water and octacalcium phosphate. The device is powered by a car battery and uses a fixed amount of octacalcium phosphate for each defluorination cycle. Tests of the prototype in rural areas of Tanzania demonstrated a decrease in fluoride to levels below the limit set by the World Health Organization in just two hours. It is important to note that it has no negative side effects on water quality and costs only about 220 USD (about 200 EUR).

To implement the FLOWERED approach to clean water, the partners conducted a survey to determine the psychological and demographic factors that influence fluoride-free water consumption. The results were encouraging and underscored the importance of raising awareness through educational programs about the danger of drinking untreated water. Therefore, international or regional actions should aim to mitigate the cost of defluorination and ensure access to clean water in line with the UN Millennium Development Goals. Overall, FLOWERED has provided important results on water contamination and its impact on human health, agriculture and livestock. "We have confirmed that fluoride contamination of water requires mitigation measures that depend on scientific knowledge and evidence, political commitment and public support," concludes Giorgio Ghiglieri. Encouraging these efforts will be paramount for groundwater management in countries affected by water contamination.

### **Keywords**

FLOWERED, fluoride, groundwater, defluoridation, water contamination, octacalcium phosphate, East African rift valley

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