Chemical-physical processes optimization of drinking water treatment

Federica De Marines

federica.demarines@unipa.it

Drinking Water Treatments

Concept

The latest Intergovernmental Panel on Climate Change (IPCC) report reveals that climate change is widespread, rapid, and intensifying. Besides quantitative impacts (e.g., floods and droughts), it is widely recognized that surface water quality is also affected by climate change. A key factor affecting surface water quality is temperature, since it influences physical, chemical and biological processes, as well lake stratification and mixing, leading to increased concentrations of soluble metals, natural organic matter (NOM), turbidity, and algal blooms. In addition, the new regulatory framework (EU 2184/2020) set stricter limits for turbidity and percentile statistics for continuous compliance, demanding a greater robustness of the treatment processes. These changes pose challenges to traditional water treatment plants, needing innovative approaches. The aim of this research is to develop and implement the Water Safety Plan (WSP) approach to the Garcia supply system and Sambuca water treatment plant managed by Siciliaque. In addition, a special focus on an innovative drinking water treatment technology will be assessed aimed at removing some target pollutants.

Scientific approach

The research activity is divided into 3 phases:

1) the analysis of the parameters that describe the quality of the raw water and the treated water, in order to assess the compliance with the limits imposed by the regulations.

2) the application of a turbidity robustness index (TRI) and a manganese robustness index (MRI) to historical operating data in attempt to highlight specific events and periods that adversely affect the treatment process deviating it from safe operating conditions. Through the RIs, it will be possible to identify, starting from the quality of the incoming water, which units could potentially be at risk.

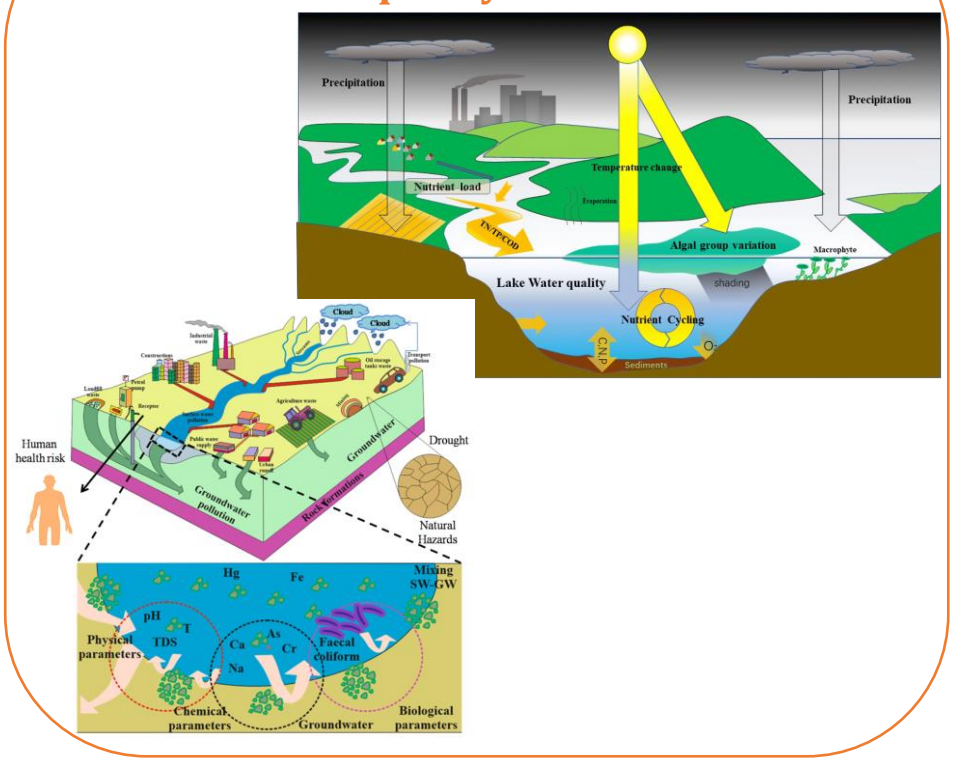
3) the use of ferrate in Sambuca drinking water treatment plant. Several batch tests will be conducted on the raw water entering the plant and ferrate will be tested at different concentrations in order to evaluate the optimal dose. The contaminants that are naturally present in the water and on which the effect of ferrate will be evaluated are manganese, algae, NOM and turbidity. A comprehensive comparison with the conventional coagulants and oxidizing products will be assessed, in order to highlight the strengths of using ferrate.

Research objectives

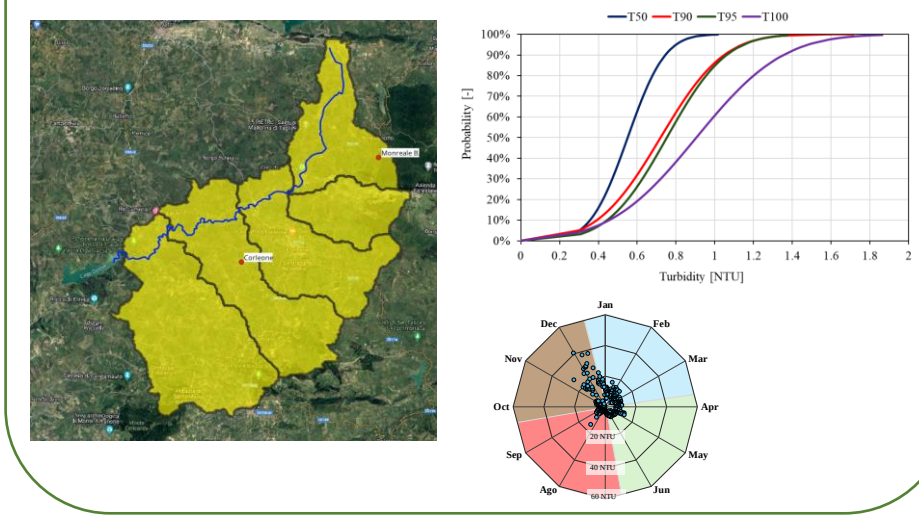
The research activity is focused on:

- studying the causes of contamination at the source (Garcia dam) and during the treatment phases (Sambuca water plant);
- the application of robustness indices (RI) for the analysis of operation of the Sambuca drinking water treatment plant;
- proposing a more innovative, effective and environmentally sustainable intervention strategy in drinking water treatment by means of potassium ferrate.

Effects of climate change on surface water quality and human health



Analysis of the origin of pollution and evaluation of water treatment plant performances



Ferrate(VI) treatment to produce safe water