Background research (TDS and drinking-water safety)

Total Dissolved Solids (TDS) means the total amount of dissolved salts like calcium magnesium sodium chlorides sulfates and some small organic matter that is present in water. In drinking water testing TDS is used a lot as a general indicator of mineral content and also water taste smell and acceptability. According to the World Health Organization (WHO) water with TDS levels below around 1000 mg/L is usually acceptable for people to drink, but this can change depending on location and personal taste. WHO also mentions that there is not strong or clear evidence that TDS alone directly causes health problems because TDS is a mixture of many substances not just one chemical.

In real practice many organisations treat TDS mainly as a non health based or aesthetic measure. for example the U.S. Environmental Protection Agency (EPA) includes TDS in the secondary drinking water standards and suggests a guideline value of about 500 mg/L to control taste issues and problems like scaling or staining. these limits are useful when we try to understand whether the TDS values in a dataset are normal or very high compared to common standards.

Even though TDS is not always seen as a direct health risk, very high TDS levels can reduce how good the water tastes and can make people drink less water. sometimes high TDS also comes together with high levels of specific ions like nitrates or sulphates which may cause negative effects. animal studies and agriculture based research often show performance or health issues when TDS is very high, which shows that TDS can still matter in real life situations.

Since real water potability depends on many chemical and biological factors, TDS usually works better when analysed along with other parameters like conductivity pH sulphates chlorides and turbidity. because of this many data science studies treat TDS as just one feature among many instead of a single deciding factor. in this report we focus on checking whether TDS alone shows any meaningful statistical difference between drinkable and non drinkable samples, while keeping in mind that water safety is likely multi factor based.