

# Zirkon® DIS Sensor and Combined Chlorine

## Total Chlorine = Free Chlorine + Combined Chlorine

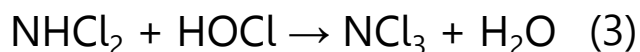
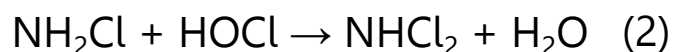
- **Free chlorine:** the sum of molecular chlorine ( $\text{Cl}_2$ ), hypochlorous acid ( $\text{HOCl}$ ), and hypochlorite ion ( $\text{OCl}^-$ ) in a solution
- **Combined chlorine:** formed when an amine-containing molecule (e.g. ammonia) is added to free chlorine (see reactions below)
- **Total chlorine:** the sum of free and combined chlorine in a solution

## Examine the Chemistry: Free Chlorine In Wastewater

- When free chlorine is used to disinfect wastewater, combined chlorine species will form.
- These species include **inorganic** chloramines (mono-, di-, and trichloramine; eq. 1-3) and **organic** chloramines (eq. 4).
- When a free chlorine measurement is required for reporting, the free chlorine measurement must not show signal interferences from combined chlorine species.



### Free chlorine + wastewater reactions



Zirkon® DIS Sensor  
Free chlorine



Zirkon® DIS Total Sensor  
Total chlorine

## Choosing the Correct Sensor

- The Zirkon® DIS sensor (left, top) measures  $\text{HOCl}$ , producing a **free chlorine measurement**.
- The Zirkon® DIS Total sensor (left, bottom) measures  $\text{HOCl}$ ,  $\text{OCl}^-$ , and combined chlorine, producing a **total chlorine measurement**.

## Zirkon® DIS Sensor Is Not Influenced by Combined Chlorine

- The Zirkon® DIS sensor was tested in the presence of inorganic and organic combined chlorine species.

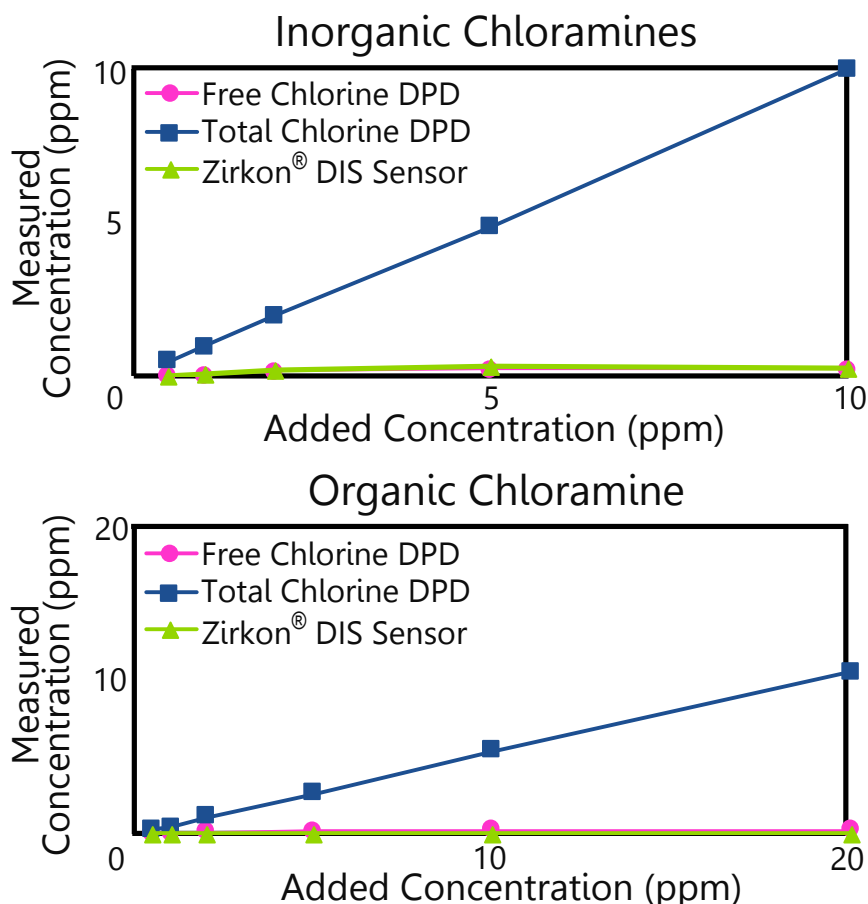
- The free chlorine sensor signal (green triangles) did not linearly increase with added inorganic (right, top) or organic (right, bottom) chloramines.

- The small signal increase of the Zirkon® DIS sensor in the presence of inorganic chloramines is caused by unreacted HOCl, evidenced by an equal increase in the free chlorine DPD test.

- These results show that combined chlorine species **do not interfere** with the Zirkon® DIS sensor.



Zirkon® DIS Sensor – Free chlorine



### Kuntze Academy – CHEM102

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CHEM102:  
Introduction to Total  
Chlorine

### Kuntze Support Center

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