

## Assessment of Physicochemical Parameters of Water in Cooling Towers and Boilers: Testing and Comparisons

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Scaling and corrosion effects of cooling towers and boilers can be identified by analyzing their water quality parameters. Cooling tower mainly has a refrigeration system, providing cooling in a wide range of applications such as chemical processing, power plants, steel mills and some manufacturing processes. Boiler is a vessel which has an enclosed system. In boiler, water is circulated and heated, either as steam or hot water to generate power or heat. This study investigated six cooling towers and six boilers selected from various industries such as food, beverages, dairy, manufacturing industry and hotels. Each water sample was analyzed for pH, electrical conductivity (EC), total dissolved solids (TDS), alkalinity, total hardness and chloride. According to the experimental results, in cooling towers pH value fluctuated from 7.6 to 8.7. The EC value ranged from 98.8 to 1215.5  $\mu\text{S cm}^{-1}$ . The TDS varied in the range of 50.5 to 793.5  $\text{mg L}^{-1}$ . Alkalinity was detected from 18.3 to 343.6  $\text{mg L}^{-1}$  as  $\text{CaCO}_3$ . The value of total hardness and amount of chloride varied from 12.3 to 429.5 and 14.7 to 22.8  $\text{mg L}^{-1}$  respectively. In boiler waters, the pH value varied from 8.7 to 11.2. The EC value was from 551.5 to 3997.8  $\mu\text{S cm}^{-1}$ . The TDS value was determined from 283.5 to 2748.5  $\text{mg L}^{-1}$ . The alkalinity varied in the range of 90.8 to 404.5  $\text{mg L}^{-1}$ . The value of total hardness and chloride varied in the range of 23.3 to 214.5  $\text{mg L}^{-1}$  as  $\text{CaCO}_3$  and 9.6 to 23.5  $\text{mg L}^{-1}$  respectively. The observed physicochemical parameters from water samples were statistically analyzed with one-way ANOVA. According to the experimental results, it was found that in most cooling towers and boilers physicochemical parameters of waters are not in the range of recommended standards values and have heavy corrosion and scaling effect. These effects can be minimized by correct chemical adjustment for the water quality parameters.

**Keywords:** cooling towers, boilers, corrosion, scaling effect, water quality

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