

Title:

Accuracy and Usability of Free Chlorine Residual Testing Methods

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Abstract:

Chlorine is the most widely used disinfectant worldwide, in part because residual protection is maintained after chlorination. This residual is measured using colorimetric test kits varying in accuracy, precision, training required, and cost. Seven commercially-available colorimeters, color wheel and test tube comparator kits, pool test kits, and test strips were evaluated for use in resource-limited environments by: 1) measuring in quintuplicate 11 samples from 0.0 – 4.0mg/L free chlorine residual (FCR) in laboratory and natural light settings to determine accuracy and precision; 2) conducting volunteer testing where participants used and evaluated each test kit for usability; and 3) comparing costs. Laboratory accuracy ranged from 5.1% – 40.5% measurement error, with colorimeters the most accurate and one test strip method the least. The only variation between laboratory and natural light readings occurred with one test strip method. Volunteer participants found test strip methods easiest and color wheel methods most difficult, and were most confident in the colorimeter and least confident in test strip methods. Costs range from 3.50 – 444 USD for 100 tests. Ranking test kits by five criteria revealed that colorimeters and test tube comparator kits were most appropriate for use in resource-limited environments, although the ideal appropriate kit may well vary by context.