

Inactivation and sub-lethal injury of Escherichia coli in a copper water storage vessel: effect of inorganic and organic constituents.

Antoine van Leeuwenhoek

This study provides information on the effects of inorganic and organic constituents on inactivation and sub-lethal injury of Escherichia coli in water stored in a copper vessel. E. coli suspensions were stored for up to 24 h in copper vessels containing one of the following dissolved constituents at 1 g/l: salts of inorganic ions, carbohydrates, proteins and complex natural organic mixtures. Samples were surface plated onto (i) nutrient agar, incubated under standard aerobic conditions to provide conventional counts for uninjured bacteria count and onto (ii) nutrient agar plates with 0.5 g/l sodium pyruvate incubated under anaerobic conditions to enumerate sub-lethally injured (oxygen-sensitive) bacteria alongside their healthy counterparts. The concentration of dissolved copper in the stored water was determined using atomic absorption spectrophotometry. The addition of chloride salts resulted in a faster inactivation of E. coli compared to pure water with no dissolved additives, irrespective of the counterion. In contrast, a slower inactivation was observed in the presence of Na₂SO₄, NaNO₃ and NaNO₂ when compared to NaCl. Addition of the carbohydrates glucose, lactose and starch gave broadly similar results to those obtained using unsupplemented water. However, the addition of amino acids, proteins, humic acid or complex organic mixtures caused a dramatic decrease in inactivation of E. coli, with evidence of a greater number of sub-lethally injured bacteria than was seen with other added constituents. The amount of copper was highest in stored water containing amino acids and complex organic constituents, with the slow inactivation most likely to be due to complex formation between leached copper and these organic constituents. The present study clearly demonstrates that water composition, particularly natural organic constituents, has a substantial impact on the antibacterial effectiveness and dissolved copper concentration of water stored in copper vessels and that both aspects will need to be considered in terms of their impact on the practical use of copper-based systems for small-scale water treatment.

Source URL (retrieved on 03/30/2015 - 10:43pm):

<http://www.chem.info/articles/2010/10/inactivation-and-sub-lethal-injury-escherichia-coli-copper-water-storage-vessel-effect-inorganic-and-organic-constituents>