

TECHNICAL BRIEF BOIL WATER

https://iris.who.int/bitstream/handle/10665/155821/WHO_FWC_WSH_15.02_eng.pdf?sequence=1&isAllowed=y

Introduction

There are a number of circumstances in which it may be necessary to treat water at the point of use to remove or inactivate microbial pathogens. These include:

- failure of control measures, including lack of or improper disinfection and unsafe handling and storage;
- emergencies and disasters leading to inadequate sanitation, hygiene and protection of water sources; and
- uncertain quality of water sources when travelling.

A number of proven water treatment methods exist for the removal or inactivation of microbial pathogens, including chemical disinfection, filtration, flocculation/disinfection and heat. Boiling is one heat method. It is highly efficacious, killing human pathogens even in turbid water and at high altitude. However, boiling involves the high-cost use of carbon-based fuel sources and does not provide any residual protection.

Scientific basis for the efficacy of boiling

Enteric bacteria, protozoa and viruses in liquids are sensitive to inactivation at temperatures below 100 °C. Thermal inactivation has been examined in water, sewage, milk and other liquids at temperatures close to those used for pasteurization (e.g. 63 °C for 30 minutes, 72 °C for 15 seconds) and in hot water (about 60 °C). Only a few studies have examined thermal inactivation in liquids at temperatures approaching 100 °C.

The results of these investigations, which are summarized in Table 1, show that bacteria are particularly sensitive to heat, and rapid kills – less than 1 minute per log (90%) reduction – are achieved at temperatures above 65 °C. Viruses are inactivated at temperatures between 60 °C and 65 °C, but more slowly than bacteria. However, as shown for poliovirus and hepatitis A, as temperatures increase above 70 °C, a greater than 5 log inactivation (99.999% reduction) is achieved in less than 1 minute. *Cryptosporidium parvum* oocysts are inactivated in less than 1 minute once temperatures exceed 70 °C. The data for *Giardia* cysts are more limited, but inactivation at temperatures ranging from 50 °C to 70 °C has been reported.

Conclusions

Based on these results, it is considered that the process of heating water to a rolling boil, as recommended in the WHO Guidelines for Drinking-water Quality (WHO, 2011), is sufficient to inactivate pathogenic bacteria, viruses and protozoa. After the water has reached a rolling boil, it should be removed from the heat, allowed to cool naturally, without the addition of ice, and protected from post-treatment recontamination during storage. If turbid water needs to be clarified for aesthetic reasons, this should be done before boiling