

Klorfasil

Review and Recommendations



Klorfasil is a point-of-use water treatment product distributed in Haiti by Klorfasil Safe Water Program, headquartered in Duluth, Georgia, USA. The product is composed of sodium dichloroisocyanurate (NaDCC) granules dispensed in a dose measured to treat five gallons of drinking water. The product is marketed along with a safe storage container for treating household water to prevent diarrheal disease in Haiti (1).

A sample of Klorfasil was obtained in Haiti in June 2013. Tufts University is assisting the Haitian MSPP by evaluating this sample and reviewing materials about the product.

Summary of Results

Klorfasil should be approved for point-of-use drinking water treatment in Haiti, for these reasons:

- Its active chemical, NaDCC, is recognized by the US EPA, WHO, and NSF for use to treat drinking water at the point-of-use.
- Its active chemical, NaDCC, has been shown to improve the microbiological quality of drinking water at the household level.
- The product can be easily measured, and it delivers a dose that is effective and safe for human consumption.
- The packaging is written in Kreyól and provides instructions for use.



However, it is recommended that the product packaging carry a lot number, manufacture date, and expiration date.

Independent Certifications

The Klorfasil product itself does not have any international certifications; however, the active ingredient of Klorfasil, NaDCC, is listed as complying with NSF / ANSI Standard 60, is registered with the US Environmental Protection Agency (EPA), and is also listed as a possible water treatment method by the World Health Organization (WHO).

- **NSF / ANSI Standard 60: Drinking Water Treatment Chemicals - Health Effects:**
Klorfasil is not listed as complying with NSF / ANSI Standard 60 for use as a drinking water disinfectant. However, other NaDCC products, such as Aquatabs (Medentech, Ltd.) are approved at a dose of 10 mg/L (2). This standard applies to chemicals used for drinking water treatment, and it certifies that the chemical is safe at the maximum dose, and that any impurities are below the maximum acceptable levels (3).
- **US Environmental Protection Agency (EPA) Registration:**
Klorfasil is not registered with the US EPA. Other products that use NaDCC for drinking water treatment are registered, however. For example, the manufacturer Occidental Chemical has had a NaDCC granule product registered for drinking water disinfection since 1996 (4).



- **World Health Organization (WHO):**

The World Health Organization does not currently approve products for use to treat drinking water. However, the Guidelines for Drinking Water Quality lists NaDCC tablets as a point-of-use water treatment method commonly used to prevent diarrhea in developing countries and for travellers (5). Granular NaDCC is not specifically listed, although tabular NaDCC should perform the same as granular NaDCC if applied at the proper dose.

Verification of Composition and Dosage

The Klorfasil bottle delivers 70 mg of NaDCC grains with an accuracy of ± 4 mg. One dose is meant to treat 5 gallons of water (about 20 liters), where the target free chlorine residual (FCR) concentration is 2 mg/L.

A sample of Klorfasil was tested at Tufts University in Medford, MA, USA in September 2013. One dose was dispensed from the bottle and mixed into 20 liters of clean, deionized water, and the FCR concentration was measured after 30 minutes with a LaMotte portable colorimeter. In these test results, the FCR concentration in the treated water differed from the target concentration by 18% (Table 1). While it was lower than the target, the chlorine concentration was within the range recommended by the Centers of Disease Control and Prevention for household water treatment with chlorine products (0.2 mg/L – 2.0 mg/L) (6).

At the recommended dose of 2.0 mg/L, the chlorine concentration in water treated with Klorfasil would be below the World Health Organization (WHO) recommended limits for drinking water for free chlorine, which is 5.0 mg/L (5). The US EPA allowable limit for chlorine in drinking water is 4.0 mg/L (7).

The recommended daily intake limit for the chemical dichloroisocyanuric acid is 0–2.0 mg/kg of body weight. For a normal adult, this means the recommended NaDCC limit is 50 mg/L (5). Water treated with Klorfasil is far below this limit.

Table 1: Klorfasil Free Chlorine Residual Testing

Volume of Treated Water (L)	Target FCR Concentration, Treated Water (mg/L)	Tested FCR Concentration, Treated Water (mg/L)	WHO Drinking Water Guidelines for FCR (5) (mg/L)
20	2.0	1.64	5.0

In summary, the tested concentration of free chlorine is close to the expected concentration, and NaDCC and free chlorine concentrations are within safe recommended limits of human consumption for drinking water.

Verification of Effectiveness

When dissolved in water, NaDCC disinfects with free available chlorine in the form of hypochlorous acid (HOCl). Chlorination is known to be effective at disinfecting drinking water, and it has been used in municipal systems all over the world since the early 1900s (8). There have been several studies showing that NaDCC is effective against *E. coli*, salmonella, total coliform, *Vibrio cholerae*, and viruses (9). There have also been studies of NaDCC tablets used in developing countries to disinfect stored household drinking water. These studies show that NaDCC is effective at improving the microbiological quality of drinking water at the household level (10, 11), although these studies were done with NaDCC tablets, and not granular NaDCC dispensed in the manner of the Klorfasil packaging. Also, there is a growing body of evidence showing that chlorination at the household level is protective against endemic diarrhea. No studies using NaDCC have shown a significant disease reduction, but in these studies the water was clean to begin with, or not enough people used the tablets to show a reduction in disease. Further studies are needed.

In summary, the active ingredient of Klorfasil is effective at improving the microbiological quality of drinking water when used at the household level.

Product Packaging and Labeling

The Klorfasil packaging is labeled in Haitian Kreyól. The bottle lists the product composition, volume of water to treat, and instructions for use. Manufacturing lot number, manufacture date and expiration date are not listed.

Recommendations

The use and promotion of Klorfasil for household water treatment should be approved in Haiti. However, it is recommended that the manufacturer provide dates of manufacture and expiration on the packaging, as well as a manufacturing lot number.

References

- (1) "Klorfasil Safe Water Program"
<http://www.klorfasil.org/>
- (2) NSF Product and Service Listings, Medentech Limited.
<http://info.nsf.org/Certified/PwsChemicals/Listings.asp?Company=4H810&Standard=060>
- (3) NSF / ANSI Standard 60.
http://www.nsf.org/business/water_distribution/standards.asp?program=WaterDistributionSys
- (4) United States Environmental Protection Agency Pesticide Product Label System, ACL 60 EUP Chlorinating Granules.
http://iaspub.epa.gov/apex/pesticides/f?p=PPLS:8:17558770702065::NO::P8_PUID,P8_RINUM:20242,935-41
- (5) WHO Guidelines for drinking water quality. 4th ed. Geneva: World Health Organization, 2011.
- (6) Centers for Disease Control and Prevention. 2008. "Chlorine Residual Testing Fact Sheet."
http://www.cdc.gov/safewater/publications_pages/chlorineresidual.pdf.
- (7) United States Environmental Protection Agency Primary Drinking Water Regulations, 2006.
<http://water.epa.gov/drink/contaminants/index.cfm>
- (8) Black & Veatch Corporation, 2010. *White's Handbook of Chlorination and Alternative Disinfectants, 5th ed.* John Wiley & Sons, Inc., Hoboken, NJ, USA.
- (9) Clasen, Thomas, and Paul Edmondson. 2006. "Sodium dichloroisocyanurate (NaDCC) tablets as an alternative to sodium hypochlorite for the routine treatment of drinking water at the household level." *International journal of hygiene and environmental health* 209(2): 173–81.
<http://www.ncbi.nlm.nih.gov/pubmed/16387550>.
- (10) Jain, Seema, Osman K Sahanoon, Elizabeth Blanton, Ann Schmitz, Kathleen A Wannemuehler, Robert M Hoekstra, and Robert E Quick. 2010. "Sodium dichloroisocyanurate tablets for routine treatment of household drinking water in periurban Ghana: a randomized controlled trial." *The American journal of tropical medicine and hygiene* 82(1): 16–22.
<http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2803503&tool=pmcentrez&rendertype=abstract>.
- (11) Clasen, Thomas, Tanveer F Saeed, Sophie Boisson, Paul Edmondson, and Oleg Shipin. 2007. "Household water treatment using sodium dichloroisocyanurate (NaDCC) tablets: a randomized, controlled trial to assess microbiological effectiveness in Bangladesh." *The American journal of tropical medicine and hygiene* 76(1): 187–92. <http://www.ncbi.nlm.nih.gov/pubmed/17255252>.