



**Table 1: Composition of Viking Pure™**

Ingredient		CAS-No	EINICS-No	Wt/Vol %	Symbols
Sodium Chloride		7647-14-5	231-598-3	<0.09%	NaCl
Free Available Chlorine (FAC)	Hypochlorous Acid (chlorine)	7790-92-3	323-323-5	<0.05% Amount HOCl and OCl <sup>-</sup> depending on pH	HOCl
	Hypochlorite ion (sodium hypochlorite)	7681-52-9	231-668-3		OCl <sup>-</sup>
Water		7732-18-5	231-791-2	>99.69	H <sub>2</sub> O

#### 4.1.1 Comparison of Viking Pure™ to Chlorine

Chlorine is currently the most widely used oxidizing biocide. It is a powerful oxidant and is used in bleaching and disinfectants.

The use of chlorine as a micro-biocide and water disinfectant is declining because of safety, environmental and community impact considerations. According to the MSDS for chlorine, this chemical is highly toxic, corrosive, and may be fatal if inhaled. It is considered to be a marine pollutant, and in the upper atmosphere, chlorine atoms have been implicated in destruction of the ozone layer. An environmentally sound alternative to chlorine and other oxidizing biocides is needed.

Various alternatives to chlorine use have been explored, including bleach, bleach with bromide, bromochlorodimethyl hydantoin (BBCDMH), non-oxidizing biocides, ozone, ultraviolet, chlorine dioxide, sodium chlorite, chloramine (chlorine & ammonia), copper-silver ionization, and thermal disinfection. Alternative devices include chlorinators, electrically generated ozonators, and copper/silver cathodes which use electrical activity to cause the release of silver and copper ions into drinking water. Each chemical and device offers some unique advantages, but each has distinct disadvantages.

The HOCl of Viking Pure™ is found to have the advantages of other biocidal alternates without their disadvantages. Categories of objective analysis include: efficacy, safety, taste and odors, impact on equipment and systems, effect on scale, biofilm, residual effects, ease of use, maintenance and cost.

Viking Pure™ is a mixed-oxidant solution. Although it is measured and dosed as free available chlorine, it exhibits behavioral traits associated with a more active chlor-oxygen chemistry than traditional chlorine. In contrast to other chlorine technologies, mixed oxidants such as Viking Purer® offer superior disinfection efficacy, elimination of biofilm, more durable chlorine residual levels, and reduced formation of disinfection by-products. Mixed oxidants readily oxidize ammonia, sulfides, iron and manganese, and can cause a microfloculation effect (reduction in turbidity) in pretreatment. In addition, mixed oxidants offer improved taste and odor. Viking Pure®, even at residual levels over 12 ppm in treated water, leaves minimal to no odor or chlorine taste.

Production of Viking Pure™ is similar to the process of fabricating standard sodium hypochlorite (NaOCl), with one significant difference. Sodium hypochlorite combines Cl<sub>2</sub> with caustic soda (lye) to stabilize chlorine. The manufacture of Viking Pure™ eliminates the use of caustic soda by instead using high rejection membrane technology to produce pure HOCl. With the sodium removed, the benefits of HOCl become immediately evident when used as a biocide. Elimination of lye makes disinfection possible without the high pH elements associated with sodium hypochlorite. Viking Pure™ exists at a more neutral pH (3-4), thereby delivering high efficacy in short contact times without the use of caustics. The human body pH level is approximately 7.3, therefore Viking Pure™ falls within the range where it is safe to the human body..

Activated solutions such as Viking Pure™ have been conclusively shown to exceed chemically-derived equivalents both in low dosage effectiveness as well as physicochemical purity. This heightened biocidal capacity relative to traditional chemical solutions permits the use of Viking Pure™ at lower dose rates, decreasing the risk of adverse environmental impact.

Neutral electrolyzed water is approved under 21 CFR 173.315 for direct contact with processed foods, and is approved for several indirect food contact applications under 21 CFR 172.892, 21 CFR 175.105, 21 CFR 176.170 and 21 CFR 177.2800. It is an approved sanitizer that meets 21 CFR 178.1010. The EPA has also given approval (40 CFR 180.1054) for washing raw foods that are to be consumed without processing.

Viking Pure™ in its most concentrated form cannot be classified as hazardous in accordance with Directive 99/45/EC. Normal COSHH regulations apply.

## **8.2 USDA**

According to FSIS Directive 7120.1 of the United States Department of Agriculture Food Safety and Inspection Service, "Safe and Suitable Ingredients Used in the Production of Meat and Poultry Products", Electrolytically Generated Hypochlorous Acid has been approved in 21 CFR as a food additive for use in meat and poultry products, approved in GRAS notices and pre-market notifications, and approved in letters conveying acceptability determinations.

## **8.3 FDA**

The FDA has expressed no concerns and holds no opposition for the use of electrolyzed water. The use of Electrolytically Generated Hypochlorous Acid is consistent with FDA's labeling definition of a processing aid. Hypochlorous Acid is listed under the GRAS (generally regarded as safe) of the FDA.