Beyond Lafite and Rémy Martin, France also has "Dakin 's" which saved countless lives

A Bottle of 1820 "Eau de Labarraque"

The Discovery and Application of Sodium Hypochlorite

Speaking of hypochlorous acid, we must start with its interchangeable twin - sodium hypochlorite. In 1787 France, Claude Louis Berthollet, a chemist and inspector responsible for overseeing textile processing, first bubbled chlorine gas through a solution of potash (potassium carbonate). After filtration, he obtained a liquid with extremely strong bleaching properties – "Eau de Javel" (Javel Water), which significantly improved the efficiency of local printing and dyeing mills. Its main component was actually potassium hypochlorite, marking the earliest application of hypochlorite.

The First Application of Sodium Hypochlorite Before the 19th century in France, violin strings were primarily made from "catgut", which produced a putrid odor during manufacturing due to a lack of mature preservation techniques. To change this situation, in 1820, the French Society for the Encouragement of National Industry posted a bounty: "A reward of 1500 francs for anyone who develops a method to prevent the rotting of animal intestines and separate the peritoneum." The famous French chemist Antoine Germain Labarraque took great interest. He discovered that while calcium hypochlorite was more antiseptic than Eau de Javel, it slowed the separation of the intestinal mucosa. He then substituted the more economical sodium hydroxide (NaOH) for potassium carbonate, resulting in the widely acclaimed "Eau de Labarraque" (Labarraque's solution) – what we now know as sodium hypochlorite solution (NaClO). Thus, NaClO entered the stage of chemical history, primarily used as an antiseptic and deodorant.

The First Fight of Sodium Hypochlorite against Epidemic During the major Paris cholera outbreak of 1832, medical knowledge was limited, and germ theory was not fully developed. To combat the pervasive stench in the air, the French government decided to use Labarraque's solution to deodorize hospitals, streets, and sewers in Paris. Although the intent was deodorization, it inadvertently and successfully helped stop the spread of the cholera epidemic. It wasn't until later, when the father of microbiology, Louis Pasteur, demonstrated the germ-killing effect of NaClO, that people realized its disinfecting function.

“Dakin’s Solution”, Shining in WWI When World War I broke out in 1914, a lack of antibacterial drugs led to numerous soldiers dying or requiring amputations due to wound infections. The French military tasked the renowned Nobel Prize-winning surgeon Alexis Carrel with researching wound infections. Collaborating with British chemist Henry Dakin, they tested countless chemicals including Mercurochrome (merbromin), Gentian Violet, and hydrogen peroxide. Finally, in 1915, they discovered that NaClO possessed both bactericidal and wound-cleansing properties. Dakin then simulated the buffering system of human blood and added boric acid to reduce the irritancy caused by high alkalinity on tissues, ultimately developing “Dakin’s Solution”. It contained 0.5% NaClO (5000 ppm), had a pH of 9.0 - 10.5 (weakly alkaline), and was primarily used for irrigating wounds and disinfecting skin and mucous membranes.

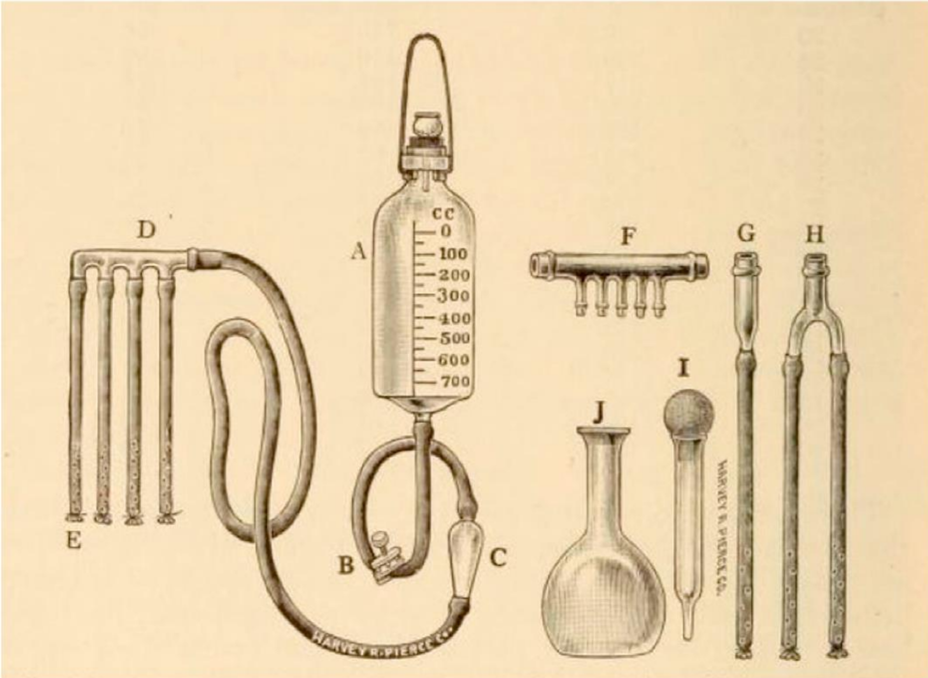


Fig. 4 – A Carrel apparatus for applying Dakin's solution. The perforated distributing tubes are tied at the end (from Hare, 1922) [42].

Fig. 5 – Nurse using Carrell apparatus to administer Dakin's solution on patients wound, U.S. American National Red Cross Hospital No. 109, Évreaux, France (from U.S National Library of Medicine digital collection).

- In 1998, documentation from the French Red Cross on managing wound infections and disinfecting first aid facilities stated that Dakin's solution could be used for disinfecting skin and mucosal wounds, with no contraindications and no irritation.

- In 1999, a report from the French Ministry of Health on clinical infection management clearly identified Dakin's solution as the optimal disinfecting and antiseptic solution for treating infections.

The Disinfection King "84"

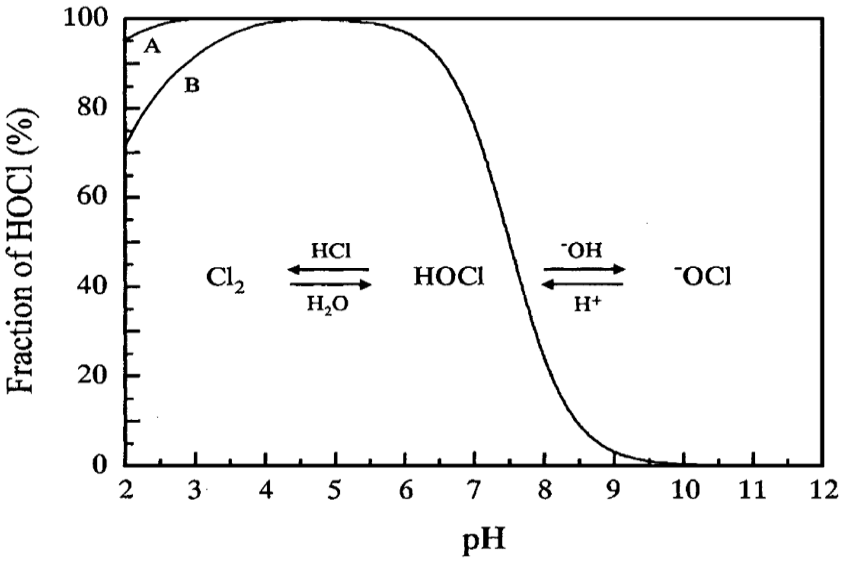
In 1982, during a widespread Hepatitis B outbreak in China, the Beijing Municipal Science and Technology Commission and the Beijing First Infectious Disease Hospital established a research team, inviting Jin Yaoguang to lead the research. Jin Yaoguang was convinced that chlorine-based disinfectants were the best choice, but there were many varieties with differing efficacy and stability. After thousands of experiments and screening dozens of formulations, they finally confirmed that a high concentration of NaClO combined with highly alkaline NaOH could achieve both environmental disinfection and stable storage. As this occurred in 1984, it was named "84 Disinfectant". During subsequent outbreaks — the 1988 Shanghai Hepatitis A epidemic, the 2003 SARS outbreak, and the 2020 COVID-19 pandemic — 84 Disinfectant repeatedly demonstrated its powerful effects, becoming the preferred disinfectant and cleaning product for millions of households.

Although the main component of both Dakin's Solution and 84 Disinfectant is NaClO, they differ significantly.

	Dakin's Solution	**"84"**
Target Use	Human body; Irrigation of wounds and disinfection of skin/mucous membranes	Objects; Surface and environmental disinfection
NaClO Concentration of the Original Solution	0.5% (5000ppm)	3-5% (30000-50000 ppm)
PH	9-10.5	12-13.5
Alkalinity	Moderate	Strongly Alkaline
Common Dilution	0.025% (250ppm)	0.01-0.5% (100-5000ppm)

The Relationship between HOCI and NaClO

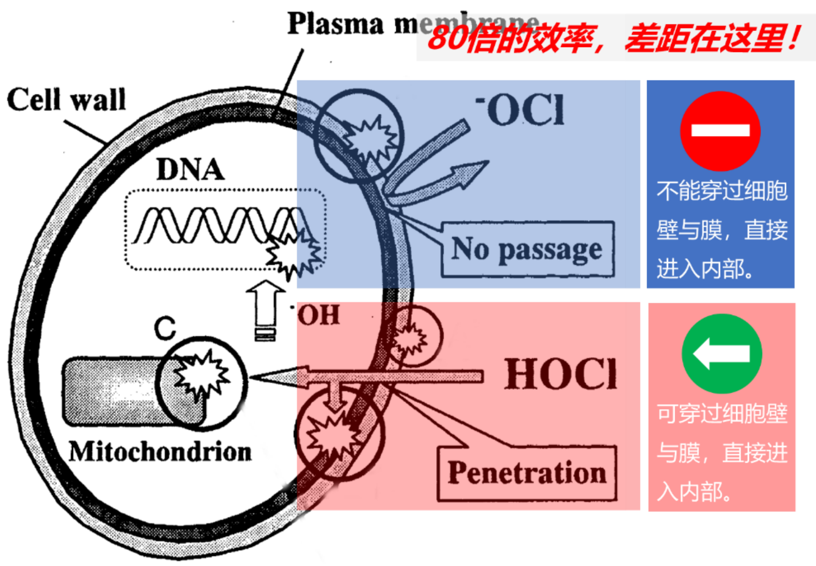
Core Principle In an aqueous solution, HOCI and CIO⁻ exist in a dynamic equilibrium, strictly controlled by pH value: HOCI ⇌ H^+ + CIO⁻ (pKa ≈ 7.5). This means: In acidic or neutral environments (pH < 7.5), the equilibrium shifts left, favoring the HOCI molecule. In alkaline environments (pH > 7.5), the equilibrium shifts right, favoring the CIO⁻ ion (see diagram below).



Characteristics & Strengths

① Bactericidal Efficiency: HOCI is 80-100 times more effective than NaClO.

Reason: The lipid bilayer of cell walls and plasma membranes forms a hydrophobic barrier, making it difficult for the ionic CLO- to pass through. The molecular HOCI, however, can easily penetrate into the cell. Therefore, the first step for OCl- (from NaClO) is to break down the bacterial cell wall and membrane before it can enter and damage organelles, proteins, and nucleic acids. HOCL, in contrast, is like an army with a "Trojan Horse", able to attack pathogens from within and outside simultaneously, hence its far greater bactericidal efficiency than NaClO's.



② Stability & Storage: HOCL is unstable, easily decomposes, and is susceptible to various factors. NaClO, stored in an alkaline solution, is relatively stable, making it more suitable for storage and transport. Furthermore, NaClO acts as a “reserve force”. Any unreacted NaClO on a surface or skin, when encountering a slightly acidic environment (like CO_2 from air dissolving in moisture), can convert into HOCL via the dynamic equilibrium, becoming a “special forces” agent.

③ Corrosion & Cleaning Ability: The strong corrosive nature of NaClO solutions is not primarily due to NaClO itself, but rather the strong alkaline solution (e.g., NaOH) required for its stability. The -OH from NaOH can destroy the molecular structures of various organic matter like proteins, polysaccharides, and lipids, stripping them from surfaces. This destructive and cleaning action is significantly correlated with pH, especially above pH 10 (see diagram below). This is similar to the slight “burning sensation” felt on hands after using strong “old soap” or laundry detergent, as effective cleaning soaps/detergents are often alkaline.

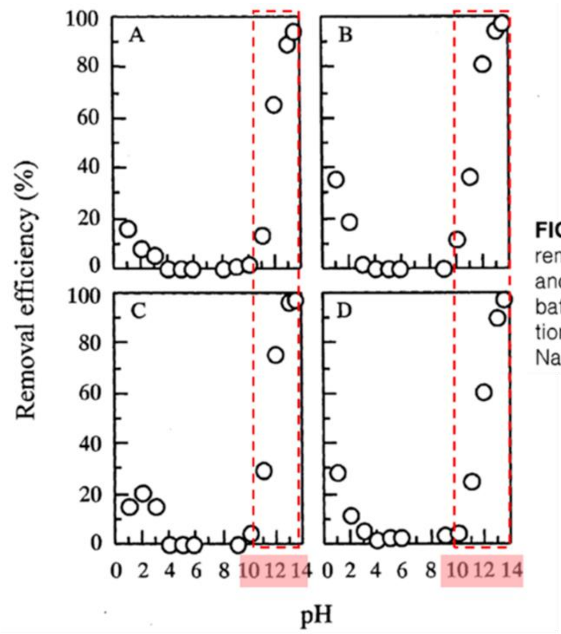


FIG. 3. Effect of the pH of the cleaning solution on the removal of BSA (A), β-lactoglobulin (B), casein (C), and gelatin (D) from stainless steel surfaces during batch cleaning at 40℃. The pH values of cleaning solutions were adjusted to pH 1.0 to 13.5 with HNO_3 or NaOH solution.