SANITATION ABOARD FISHING TRAWLERS IMPROVED BY USING CHLORINATED SEA WATER

By Arvey H. Linda* and Joseph W. Slavin*

ABSTRACT

Chlorine, having proved effective as a sanitizing agent in fish-processing plants, was used for improving sanitation aboard fishing vessels. Sodium hypochlorite equipment was installed on a commercial fishing trawler for chlorinating the sea water used aboard this vessel. The equipment operated satisfactorily, and the chlorinated sea water was effective both in washing off slime and blood from eviscerated fish at sea and in washing and cleaning the hold of the vessel in port.

INTRODUCTION

Much has been done in recent years to improve sanitation in fish-processing plants. Today, the use of antibacterial compounds, disinfectants, detergents, and equipment made of stainless steel, plastic, or other impervious materials has resulted for the most part in a high degree of sanitation in fishery plants. Little has been done, however, to duplicate this aboard the fishing vessel. In most cases the closest approach to cleanliness consists of washing the hold and pen boards of the vessel with plain sea water, or in some cases with harbor water, without any antibacterial or other suitable cleaning compounds. The use of sea water for this purpose is far from satisfactory: slime and other organic material are not adequately removed, and by building up in the hold, they stimulate the growth of spoilage organisms. Under such conditions, the landing of high-quality fish is difficult, especially if the vessel is at sea for a long period of time.

In 1958 a project was started at the U. S. Bureau of Commercial Fisheries technological laboratory at East Boston, Mass., to develop a simple, inexpensive, and effective means for improving washing methods on fishing trawlers. Since chlorine has proved effective as a sanitizing agent in fish-processing plants (Fisheries Research Board of Canada 1947, Food Industries 1950, Hess 1950, Hurley 1949, and Kaylor 1949), it was used in this project to improve the sanitation on a commercial fishing trawler. Chlorinated sea water was used on the vessel instead of plain sea water for washing eviscerated groundfish at sea and the hold of the vessel in port after the fish were unloaded. The effectiveness of the chlorinating equipment was evaluated by industry and by members of the laboratory staff. The following is a report of this study. It contains information on the chlorinating equipment used and the experimental tests conducted. Conclusions and recommendations are also given concerning the use of chlorinating equipment on the vessel.

CHLORINATING EQUIPMENT

The equipment used consisted of a motor-driven sodium hypochlorite metering pump, a storage drum, and chlorine-test equipment.

DESCRIPTION OF EQUIPMENT: Metering Pump and Motor: The sodium hypochlorite metering pump and motor were mounted on a common base. This pump is of the diaphragm type and is belt driven by one-eighth horsepower, direct-current, electric motor. The length of the pump stroke may easily be adjusted in order to meter the desired amount of sodium hypochlorite into the line through which the saline wash-water passes. The flow of sea water through the line may vary from 20 to 60 gallons per minute.

Storage drum: A 55-gallon container was used for storing the sodium hypochlorite solution. This particular type of drum was selected because of its rugged construction, which is necessary to withstand the rough handling aboard the vessel.

*Mechanical Engineer, Fishery Technological Laboratory, Division of Industrial Research and Services, U. S. Bureau of Commercial Fisheries, East Boston 28, Mass.

Chlorine-Test Equipment: A chlorine colorimeter was used to determine the concentration of free chlorine discharged from the salt-water line. This colorimeter consists essentially of a set of calibrated color standards representative of the different concentrations of free chlorine in the chlorinated sea water. To determine the concentration of free chlorine, one adds a prescribed amount of stabilizer and reagent to a sample of the treated sea water. The resulting color is then matched with the color standards in order to determine the chlorine content of the sample in parts per million. A simpler and less expensive kit consisting of chemically-treated paper strips may also be used to determine the chlorine content.

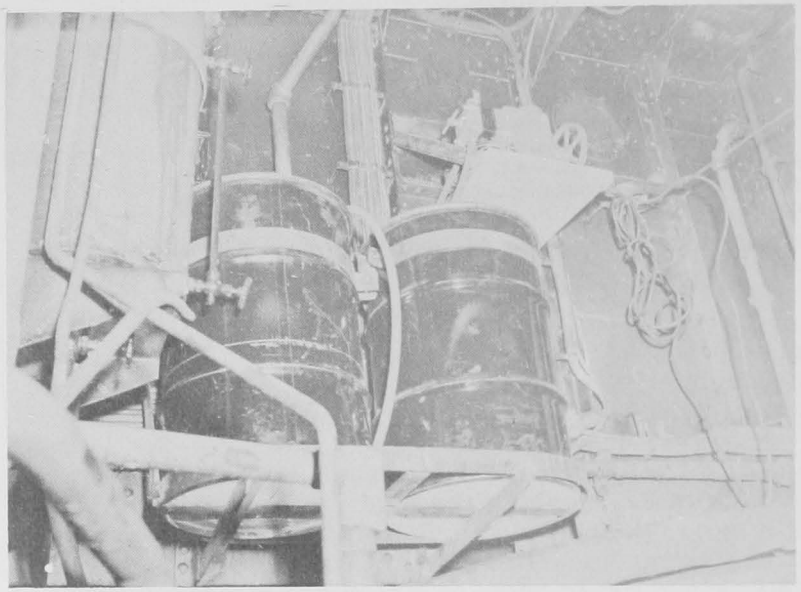

Fig. 1 - Sea water chlorinating equipment aboard a fishing vessel.

Installation of Equipment: On most New England trawlers, the compartment situated below the wheelhouse offers an ideal place for locating the chlorinating equipment. To conserve space, the metering pump and motor were mounted on one wall bracket and the two storage tanks on separate wall brackets below this pump (fig. 1). The plastic hypochlorite discharge line from the metering pump was connected into the side of the salt-water line, on the discharge side of the deck wash-water stop valve. In future permanent installations, a check valve should be installed between the wash-water stop valve and the hypochlorite connection on the wash-water line to prevent any of the caustic hypochlorite from attacking the sea-water pump or related piping. The desired equipment arrangement is shown in figure 2.

EXPERIMENTAL TESTS

PROCEDURE: The chlorinating equipment described previously was assembled at the laboratory and installed on a commercial fishing trawler (fig. 1). The hypochlorite metering pump was set to inject a 14-percent sodium hypochlorite solution into the wash-water line at a rate that resulted in a concentration of 50 to 60 parts per million (p.p.m.) of free chlorine in the salt water. This water was used for washing both the eviscerated fish at sea and the hold of the vessel at the end of each trip. Chlorinated sea water was used aboard this vessel for six regularly-scheduled trips. During that period information was obtained on the operation of the chlorinating equipment. Observations were also made concerning the sanitary condition of the fish hold and the quality of the fish landed.

RESULTS: Operation of Chlorinating Equipment: During the entire period of the test, the chlorinating equipment operated satisfactorily and required little attention. It was found that during continuous operation of the unit, 30 to 60 gallons of a 14-percent sodium hypochlorite solution was consumed during a 10-day trip The consumption of sodium hypochlorite was reduced to about one-half this amount, however, by operating the metering pump intermittently instead of continuously. This intermittent operation was accomplished by installing a switch in the wheelhouse, which made it possible to use the unit only during the period that the fish were being washed at sea or that the hold of the vessel was being washed in port.

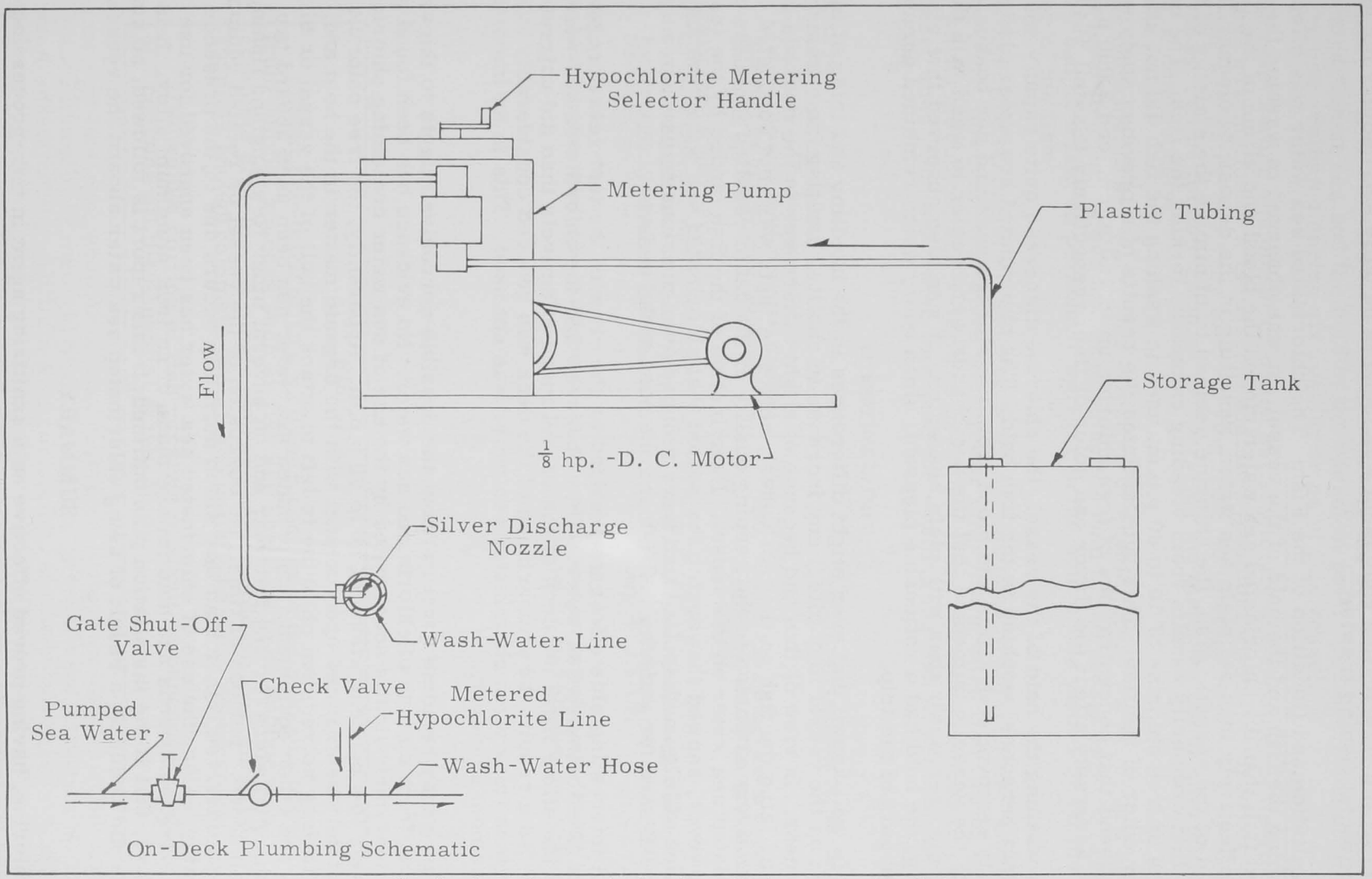

Fig. 2 - General layout of sodium hypochlorite metering installation.

In general, the chlorinating equipment was found to be quite satisfactory for use on a commercial fishing trawler.

Sanitation and Condition of the Fish: The chlorinated sea water was effective in washing the fish and the hold of the vessel. It was observed in washing the eviscerated fish that the chlorinated sea water rinsed the blood and slime of the fish more effectively than did plain sea water, resulting in the deposit of cleaner fish in the hold of the vessel. Also, the chlorine seemed to minimize the staining of the fillets that ordinarily results from bleeding caused by forking the fish. The concentrations of free chlorine of 50 to 60 p.p.m. used in washing the fish did not affect the odor or color of the fish. This substantiates the results of a previous study where it was found that concentrations of free chlorine up to 150 p.p.m. and 2,000 p.p.m. did not adversely affect the flavor and color of fish, respectively (Castell 1947).

In washing the hold of the vessel, the chlorine dispersed quite rapidly and did not affect personnel working in the fish hold. The chlorinated sea water also satisfactorily removed fish slime and blood from the storage pens and pen boards. The crew of the vessel commented that the pen boards were easier to wash with the chlorinated sea water than with plain sea water. It was also observed that after washing, the hold had a noticeable pleasant, clean odor, which remained during the greater part of the trip.

It is well known that even slight differences in the handling and icing of individual fish on the vessel may offset any increase in quality resulting from improved cleanliness. In view of this and because of slight differences in the methods of handling and icing the fish on the test vessel, objective tests were not conducted to determine if any extension in the keeping quality of the catch resulted from the use of chlorinated sea water on the vessel. Examination of the fish landed by the test vessel, however, showed that during the period that chlorinated sea water was used, the instances of bilgy and spoiled fish were reduced over previous trips when only sea water was used for washing the fish and the hold of the vessel.

An interesting side effect was noticed by the crew of the test vessel regarding the use of chlorinated sea water. They observed that the chlorinated sea water removed the slime from the deck of the vessel more effectively than did untreated sea water. As a result, the slipperiness of the deck was reduced considerably over that of previous trips when chlorinated sea water was not used. This is an important improvement in safety.

There may be some concern about the possible corrosive effects to the vessel resulting from the use of chlorinated sea water. No evidence has been found to indicate that corrosion is accelerated by the use of sea water containing chlorine in relatively low concentrations of 50 to 60 p.p.m. Apparently, the free chlorine is immediately neutralized upon contact with the organic matter in the hold and, therefore, little or no residual chlorine is left to attack the hull of the vessel or bilge pumps and other equipment. Chlorinated sea water has been used aboard two Boston fishing trawlers for one full year and on several other New England fishing vessels for shorter periods of time. No corrosion of the vessel or related equipment has been observed, other than that which normally occurs due to the presence of salt water. Also, the use of chlorinated sea water has been approved for use on vessels having pen boards and hold linings made of an iron-aluminum alloy. It is felt therefore, that if the installation plan outlined in this report is followed, no corrosion should occur as a result of using chlorinated sea water aboard the vessel.

SUMMARY

Chlorine, having proved effective as a sanitizing agent in fish-processing plants, was used for improving sanitation aboard the fishing vessel. Equipment was installed

on a commercial fishing trawler for chlorinating the sea water used in washing the eviscerated fish at sea and the hold of the vessel in port. The operation of this equipment was evaluated during six regular trips of this vessel.

The chlorinating equipment operated satisfactorily and required little attention. Also, the consumption of a 14-percent sodium hypochlorite solution used for chlorinating the sea water was very low, varying from 30 to 60 gallons for a 10-day trip. This amount can be further reduced by operating the metering pump intermittently instead of continuously.

The chlorinated sea water was effective in washing away the slime and blood from eviscerated fish at sea and in washing the hold of the vessel in port. The free chlorine had no effect on personnel working in the hold of the vessel or on the odor or color of the fish.

No objective tests were conducted to determine quality differences. Observations indicate, however, that there were fewer bilgy and spoiled fish landed by the vessel when chlorinated sea water was used than there were on previous trips of this vessel when plain sea water was used for washing the fish at sea and the fish hold in port.

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FISH FACT

About one-third of the protein consumed daily should come from animal sources such as fish and shellfish to complement incomplete proteins. A single average serving of fish and shellfish supplies enough complete proteins to satisfy the daily requirement.

The edible portion of fish consists of about 18 percent protein and contains all the essential amino acids.