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Cleaning Plastic Equipment used in Handling Maple Sap

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CLEANING PLASTIC EQUIPMENT USED IN HANDLING MAPLE SAP

By C. O. Willits, H. A. Frank, and R. A. Bell
Eastern Regional Research Laboratory
Philadelphia 18, Pennsylvania

INTRODUCTION

Collection of maple sap has been undergoing a rapid and revolutionary change during the past few years. Instead of the traditional, expensive, and laborious method of collecting and carrying sap by hand, the use of plastic tubing to collect sap from the individual tap holes and transport it to the evaporator house is growing at an astonishing rate. This new method of collection has reduced the cost of maple sirup production nearly one-half.

Maple sap, as it issues from the tissue of the tree, is sterile. However, during the tapping, handling, and installation of the spouts and tubing, a considerable number of microbes may be introduced into the sap. Good sanitation practices during the tapping of the trees and the installation of tubing will tend to keep the initial infection low. The cold weather which is usual during the early part of the sap season slows down the growth of these organisms. The germicidal ultraviolet rays of sunlight, transmitted through the plastic tubing, will diminish the number of microbes and may even effect complete sterilization. As the temperature in the bush

increases so does the growth of the microbes. At first, the predominant type is bacterial, followed by yeasts and molds which increase as warmer weather prevails.

The effects of these microbes are many, and all are undesirable. To list a few effects, they cause: Dark, low grades of sirup, sirups of high invert content (unsuitable for sugar making), off-flavors, and the premature stoppage of sap flow from tap holes.

If clean tubing is used, the extent of microbial build-up is usually not excessive during the sap season itself. However, if the tubing after use is not immediately cleaned and sterilized, the microbes will grow during the warm spring and summer storage. When such tubing is put into use the next sap season, it is highly infected and before this next season is over the following circumstances are likely to occur. Heavy deposits of microbial cellular material will form which are difficult to dislodge. Some of the deposits are colored, often black, producing a filthy appearance. These deposits will prevent the transmission of the sterilizing ultraviolet rays of the sun. Microbes in the tubing will sufficiently infect sap to be stored so that excessive fermentation will occur. Highly infected plastic fittings also serve as a source of infection for uninfected tap holes, causing them to "dry up" prematurely. All of these effects result in lower cash returns. These effects can be minimized by installing only clean, sterilized tubing each year. The effective cleaning of tubing becomes more difficult as the microbial growth increases. Therefore, for best results the tubing should be cleaned immediately at the end of each sap season.

WASHING SOLUTIONS

Disinfectant (Solution A)

Make from any commercially available disinfectant of the hypochlorite type, either solid or liquid. Use 4 gallons (1 part) of the commercial hypochlorite (50,000 p.p.m. available chlorine) to 16 gallons (4 parts) of water to yield Solution A, which contains about 10,000 p.p.m. available chlorine. Most commercial hypochlorites

contain about 5% active ingredients as sodium hypochlorite.

Detergent (Solution B)

Make by adding 1 cup of any commercially available household detergent (solid or liquid) to 10 gallons of water. Stir well until dissolved or mixed.

Combined Disinfectant-Detergent (Solution C)

Add 1 cup of detergent to each 10 gallons of water, mix until dissolved, add 2-1/2 gallons of disinfectant and mix. (See Simplified Washing Method, page 10 .)

EQUIPMENT FOR WASHING PLASTIC TUBING

Pump and Method of Calibration

The pump must be of a type and size that will give a minimum output of 5 gallons per minute at 70 pounds' pressure and develop 75 pounds' pressure. The pump must be equipped with (1) a safety, or relief, valve mounted on the discharge side of the pump, (2) a bypass with valve (fig. 1), and (3) a pressure gage mounted on the discharge side of the pump, between the bypass and the manifold

To obtain 1-gallon-per-minute flow of solution through different lengths of tubing, the discharge pressure from the pump must be adjusted. While this can be done empirically each time a set of tubing is assembled on the manifold, it is recommended that a calibration table be made showing pump discharge pressures corresponding to different tube lengths. To make the calibration, attach different lengths of tubing - for example 50,100,150,200, and 300 feet - one to each cock of the manifold (see fig. 1).

(1) Close all cocks except the one with 50 feet of tubing, which is to be open.

(2) Open the bypass valve.

(3) Put suction line in tank of water.

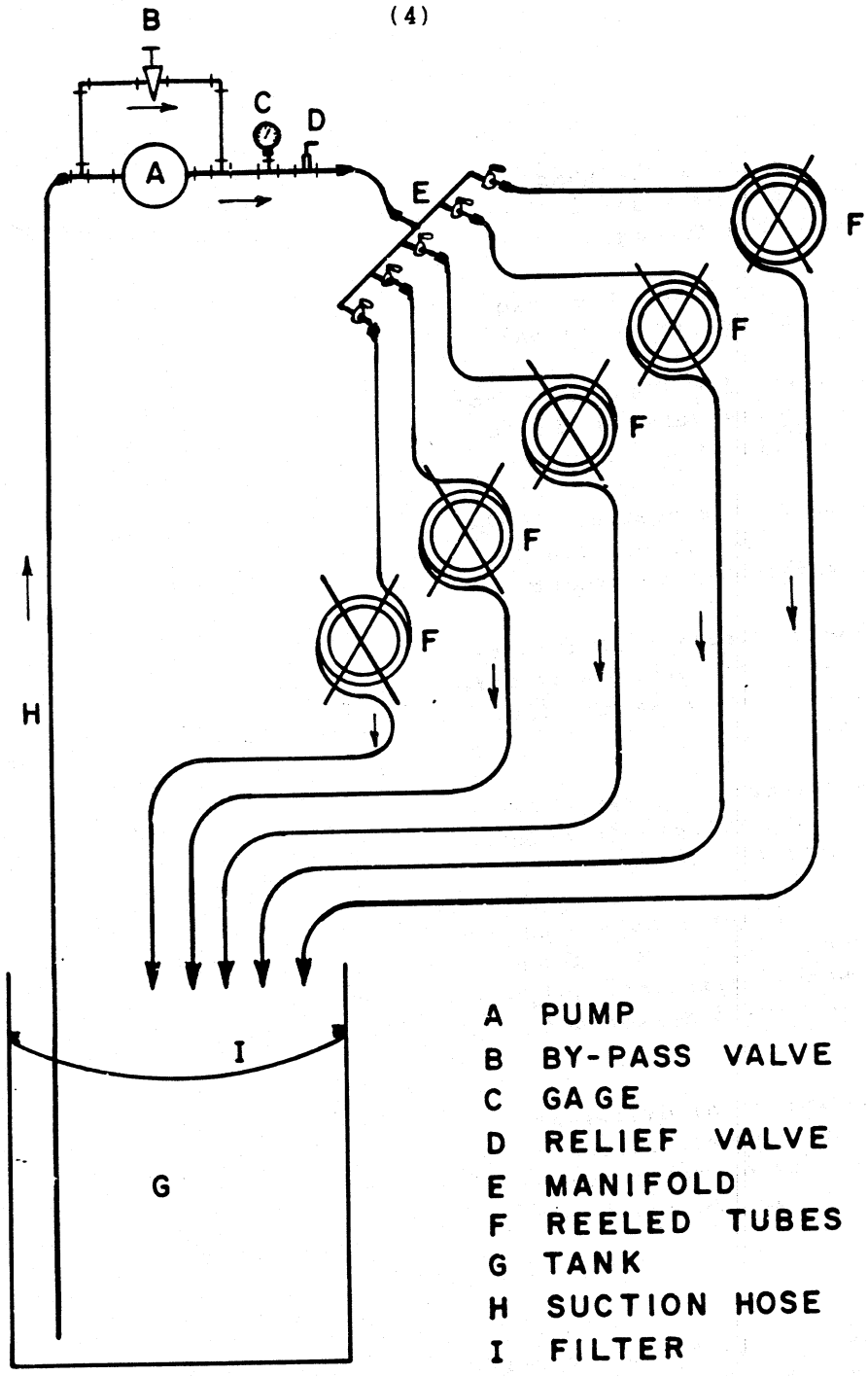

Figure 1.
Suggested assembly for washing plastic tubing.

(4) Start pump.

(5) Close bypass valve slowly until the pump is primed and then open it slowly until the liquid is flowing from the tubing.

(6) Measure the time required to collect an exact volume (1 quart, 1/2 gallon, or 1 gallon).

(7) If time required to collect 1 gallon is longer than 1 minute, close bypass valve a little and again measure the rate of discharge.

(8) Continue this process until the opening of the bypass allows 1 gallon of water per minute to be discharged from the 50-foot tubing.

(9) Note and record the gage pressure. If the bypass-valve setting allows a discharge of more than 1 gallon per minute, decrease the flow rate by opening the valve.

(10) Measure and record the discharge pressure required to give 1-gallon-per-minute flow from each of the other lengths of tubing.

These pump gage pressures will deliver 1 gallon of liquid per minute regardless of whether 1 or more tubes are attached to the manifold and washed simultaneously providing all are approximately the same diameter and length.

Gage pressures must also be measured for different engths of lines containing different numbers of connect- rs. From the recorded data a calibration table can be onstructed. An example of typical calibration information is given in Table 1.

anifold

This is a metal 1-inch pipe, preferably brass, approx- ıately 24 inches long with a number of cocks, for attach- ent of the plastic tubing, and an inlet connected to the scharge side of the pump. The 1/8-inch bore cocks should

TABLE I

Typical liquid pressures required
to yield flow rates of 1 gallon per minute
in various lengths of tubing with and without connectors.

LENGTH OF TUBING (FEET)	CONNECTORS IN LINE (NUMBER)	LIQUID GAGE PRESSURE (P.S.I.)
50	0	24
50	1-5	33
50	6-10	48
100	0	37
100	1-5	46
100	6-10	61
150	0	54
150	1-5	63
150	6-10	78
200	0	63
etc.	etc.	etc.

be of the long-handle, service type, with male inlet and tapered serrated outlets.

Tanks

Three tanks are required, one each for the disinfectant, the detergent, and the rinse water. These can be of the galvanized ashcan type. Suggested sizes required for the washing of different amounts of plastic tubing are 32-gallon size for 5,000 or more feet, 24-gallon for 2,000 to 5,000 feet, and 16-gallon for less than 2,000 feet.

Miscellaneous

Hose: The hose used for pump suction lines and for connecting pump to manifold must withstand 1,000 p.s.i.

Clamps: For hose and tubing connections.

Measures: For calibrating the rates of flow of wash liquid through the tubing. These can be of quart, 1/2-gallon, or 1-gallon size.

Reels: For coiling the plastic tubing during washing and storing. Reels should hold up to 500 feet of tubing.

WASHING TUBING AND FITTINGS

Plastic Tubing

(1) Wash the tubing by pumping successively the disinfectant, detergent, and the rinse water through the tubing at a rate of 1 gallon per minute. Cold wash solutions can be used, but better results are obtained if solutions are warm. Hot solutions, above 160° F. must not be used since they will soften and enlarge the tubing.

(2) All branch lines must be disassembled and all fittings, spouts, "T"s, "Y"s, etc., removed. Reassemble the tubing, using connectors, into continuous unbranched lines of 150 to 300 feet. Very long lines require excessive pump pressures to maintain the 1-gallon-per-minute flow rate (see method of pump calibration under Equipment) causing separation at the connections.

(3) Attach an assembled length of tubing to one or several of the cocks of the manifold, cocks open. Coil each of the lengths of tubing very loosely on a reel and place the discharge end in the tank containing Solution A so that the disinfectant can be recirculated through the system.

(4) Place the suction line of the pump in the disinfectant (Solution A), open the bypass valve of the pump and open all the cocks on the manifold to which tubing is attached. Start the pump.,

(5) Adjust to the desired pump pressure by adjustment of the bypass valve. Pump the disinfectant through the lines for 15 minutes.

(6) After pumping the disinfectant for 15 minutes, move the intake hose and the discharge lines into the detergent (Solution B).

(7) Pump the detergent through the tubes 15 minutes.

(8) After pumping the detergent through for 15 minutes, rinse the tubing with clear water by transferring the intake hose of the pump to a tank of clear water. Don't recirculate the rinse water; discharge it into a waste pipe. Pump the rinse water through the lines for at least 5 minutes.

(9) Disconnect the washed, rinsed tubing from the manifold. Drain and store the tubing. Draining is best accomplished either by suspending the tubing or by laying it on a slope. (The tubing will seldom drain completely dry). For storage, wind the tubing on reels and store out of the sun in a clean dry place.

Fittings (Spouts, "T"s, "Y"s, Connectors, Etc.)

Plastic:

(1) Soak in the disinfectant (Solution A) for 15 minutes. Remove from the disinfectant and allow to drain. Cold disinfecting solution can be used, but better results are obtained if solutions are warm. Hot solutions above 160° F., must not be used since they will soften and deform the plastic.

(2) Wash in the detergent (Solution B) for 15 minutes. The detergent must be agitated during this period so that it will be carried through all openings of the fittings. This can be done easily in a domestic clothes washing machine

(3) Following the 15-minute detergent wash, remove the fittings, drain, and rinse in clear flowing water or in three successive lots of clean water.

(4) Dry, preferably in the sun, on a tray lined with clean cloth or paper.

(5) Store in a covered, clean, dry container, such as a fiberboard box.

Metal:

(1) Soak in the disinfectant (Solution A) for 15 minutes.

(2) Remove and drain, place in the detergent (Solution B) in a metal container, and heat to a full rolling boil. Continue the boiling for 15 minutes. The boiling detergent will agitate the fittings sufficiently to insure thorough washing.

(3) After 15 minutes, remove the metal fittings, rinse well with clear water, drain, and dry on a tray in the sun. Place in a dry, covered container and store in a dry place.

DISCUSSION

The inner surfaces of plastic equipment which has been used to carry sap are not only dirty but may be covered wholly or in part with heavy deposits of microbes. Since many of these organisms are still living, the problem of cleaning the inner surfaces of the plastic involves killing these organisms as well as removal of firmly-held deposits. As in the case of washing clothing, best results are obtained when the wash solutions are agitated vigorously. The wash solutions in the tubing can be agitated only by pumping solutions through the tubes. Since higher flow rates provide greater agitation the minimum recommended rate for cleaning of plastic tubing is 1 gallon per minute.

The use of the unusually strong disinfectant solution is recommended to insure complete sterilization for the relatively short contact time (15 minutes) recommended. A longer contact time with a weaker disinfectant would also be satisfactory but, since this would be too time consuming, it is not practical. Most of the commercial disinfectants of the hypochlorite type also have some detergent action. A detergent following the disinfectant is recommended to insure the loosening and removal of dirt from the inner walls of the plastic.

The length of time, the order, and the manner of washing with the two solutions were established by experimental studies using highly contaminated plastic tubing that had been in use one season in an operating sugar bush.

To attempt to wash plastic tubing with all of the multiple branches and fittings intact is not recommended. Disassembling the tubing and fittings and then reconnecting the pieces of tubing into a single, continuous length of unbranched tubing assures that the volume of wash solution pumped per minute will be the same throughout the length of the tubing. Were the branches to be left intact, the flow of wash solutions would follow the path of least resistance, leaving some portions of the tubing poorly cleaned. For the same reason the fittings are best washed separately rather than while attached to the tubing.

The length of the tubing, either as one continuous piece or composed of short connected pieces, that can be washed at one time is dependent upon the pressure of the wash solution exerted in the lines and upon the strength of the connections between the pieces. Extremely long tubing and large number of connectors require higher pump pressure to maintain a flow rate of 1 gallon per minute. Excessively high pressures will cause separation of the lines at the connections, unless they are secured with clamps or wire. The use of clamps or wire is not recommended, because their installation and subsequent removal is tedious and time consuming.

Since a considerable amount of material is removed from the tubing, the wash solutions may become quite dirty. Consequently, the solutions should be filtered. This can be done by mounting several layers of cheesecloth or flannel between the discharge end of the tubing and the top of the tank, or by filtration of the solutions before each new set of tubes is attached to the manifold.

SIMPLIFIED WASHING METHOD

The strengths of the two wash solutions, disinfectant and detergent, and length of washing time were established

by experimentation using excessively dirty tubing. If the tubing to be washed is relatively clean and free of dirt, the above directions can be modified by shortening the time of washing or by combining the disinfectant and the detergent into a single solution (Solution C) so that only one wash is necessary. Both the disinfectant and the detergent, when combined as directed to make Solution C, have the same concentration as the individual solutions. Use of this simplified method does not eliminate the final rinse with clean water.

The shortened time should never be less than 5 minutes for each of the two solutions and never less than 10 minutes if the combined solution is used.

For moderately dirty tubing, using Solution C with a washing time of 15 minutes and a flow rate of 1 gallon per minute is recommended.

When Solution C is used, considerable time can be saved if the pieces of tubing are attached to the outlets of the manifold in rotation. For a 5-outlet manifold, attach a new piece of tubing every 3 minutes. Thus, as each of the successively added tube has had its 15-minute washing, it is replaced without delay by a new one.

PRECAUTIONS

DO:

- Take down and wash tubing immediately at the end of the sap season. Tubing left in the woods or in storage becomes progressively dirtier and therefore harder to wash because of increased microbial activity with increasing season temperatures. After draining, inspect all tubing for evidence of unremoved material clinging to the inner surfaces. Rewash if necessary.

- Use new wash solutions for each 5,000 feet of tubing.

DON'T:

- Economize on strength of wash solutions by using less detergent or disinfectant than recommended.
- Economize on time of washing.
- Wash plastic tubing or fittings in water hotter than 160° F. Water above this temperature will soften and weaken the plastic. Tubing washed with very hot solutions will stretch, making attachments to the fittings difficult. Fittings may be deformed and thus become unsatisfactory.
- Wind tubing tightly on reels prior to washing because it will cause pinching of the tubes and thereby reduce rate of flow of wash solutions.
- Put metal fittings in a domestic clothes washing machine for they will damage the enamel surface of the machine.
- Overload the washing machine with plastic fittings.