NEW WASTE WATER PRACTICES IN DAIRY PLANTS

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(Received for publication June 18, 1973)

ABSTRACT

Water pollution legislation is now having a national impact on pollution control activities in the Dairy Industry. The legislative programs that are being enforced are establishing uniform standards throughout the 50 states to abate pollution. It is apparent that individual plants will be forced to evaluate their present operation in terms of reducing waste water. The waste water from dairy plants presents certain characteristics which make treatment difficult. The wastes are produced over a short period during the day and this presents peak loads to a treatment facility. The strength of waste water will also vary. Rather than the dairy plant constructing its own treatment facility, the predominant means of disposal is to discharge to a municipal sewer system. For this method of treatment, certain charges are made against the dairy plant to pay for operation of the facility. These charges are becoming substantial, dollarwise, because of the high strengths and volumes of waste water being treated daily. By collecting product/water rinsings from the HTST and CIP system waste water loads can be reduced. Further equipment augmentation to existing CIP systems results in additional reduction in daily water usage.

We must now acknowledge that the recent emphasis on ecology has made its impact on the Dairy Industry. New regulations and controls for fluid and solids wastes, noise pollution, and air pollution are the principal areas of concern to the processor. This article discusses the fluid waste water segment of the problem.

Water has always played an important part in operation of a milk plant. Before the days of automation and central cleaning systems, daily take-down of gasketed pipelines and fittings, hand washing of storage tank and processing vats, and manually cleaning of 10-gal milk cans were the accepted practices of good housekeeping sanitation. From this cleaning procedure, dairy plants would send large volumes of water that contained milk fat, solids, washing compounds, and sanitizers to the drain as waste water. Continued reassembly of pipelines and fittings often resulted in leaks in the system. Not only was this a source of contamination, but product leaking from manual valves, gaskets, or pumps, eventually ended up being flushed to the drain.

CLEANING-IN-PLACE

Some 15 years ago cleaning-in-place (CIP) was introduced to the dairy industry. Along with this new technique for cleaning were related items that would help make this new procedure a success. Air-operated valves replaced out-dated manual valves, all welded pipeline systems replaced the gasketed take-down lines, and permanent spray devices were installed in tanks, thus eliminating the need for manual cleaning.

With a CIP system, a tank or line circuit could be pre-rinsed, washed, post-rinsed, and sanitized as part of a daily cleaning procedure. The important time, temperature, and pH relationships were maintained by installing a CIP "Programmer." The plant was cleaned on a daily basis by a CIP unit that consisted of a 50-gal tank. The small size of this unit allowed it to be installed at a low capital investment and minimal floor space. With this system, a loop was developed between the equipment being cleaned and the CIP unit. The end result was that all rinses and chemicals were sent to the drain and ended up as part of the total plant waste water. This system was then termed a "Throw-a-way" type (Fig. 1).

As CIP operation became more prevalent throughout the industry, so did the degree of automation in new plant design. During the 1960's new developments on the West Coast for milk processing plants emerged which found plants installing minimal equipment which was of large volume capacity in design. These plants were limited product, efficient dairy processing centers, and were termed "high-efficiency" plants. Along with their production and efficiency came a concern for the CIP operation and water usage. For these plants a two-tank CIP system was installed that included one tank for rinse and one for wash. Like the early CIP units, the tanks were supplied with proper valves, steam controls, level controls, and chemical pumps. The only items sent to the drain in this system were the pre-rinse and post-rinse waters. Because the wash solution was returned to a tank and its strength monitored, this procedure was termed a "re--use" system (Fig. 2). Both systems were used throughout the nation as the accepted methods for cleaning-in-place circulation systems.

ENVIRONMENTAL CONCERNS

During the early 1970's the subject of national environmental control became an intense target for

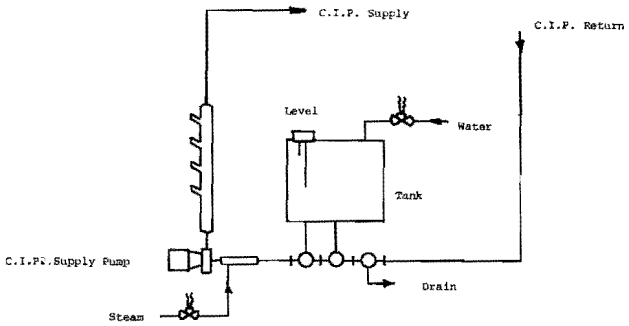

Figure 1. "Throw-away" type of CIP system.

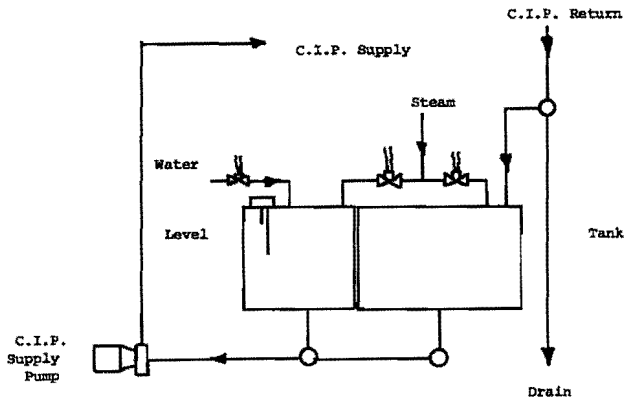

Figure 2. "Re-use" type of CIP system.

public criticism. One outgrowth of this criticism was a renewal in enforcement of old existing laws such as the *Rivers and Harbors Act of 1899* that required a plant to apply for permission to discharge water into navigable streams and tributaries. Thus, plants had to either acquire a permit or find new areas for dumping their waste water. For many plants, the municipal sewage system seemed to be the logical answer. Since most plants have locations in urban areas, about 87% are now dumping waster into municipal sewage systems. Unfortunately, municipal sewage systems have been an expensive answer to this problem. Depending on plant locality and local conditions, the dairy plant is, in many instances, the largest contributor of waste water to the community sewage system. Revision of monthly surcharges to cope with the increased BOD content and waste water volume emitted by these plants, required them to tighten their belts and review all areas that contributed to the waste water problem.

Plant Operations That Yield Waste Water

High-temperature-short-time operation

The first area of concern for reducing waste water loads is operation of the HTST system. This system in today's modern plant could include a plate heat exchanger, homogenizer, timing pump, automatic desludging separator/clarifier, vacuum treatment unit, and constant level tank. The capacity of these components can range from 100 to 150 gal/min. It is generally recognized that the system is started up and shut down using water in lieu of product. Water can also be used when changing products as

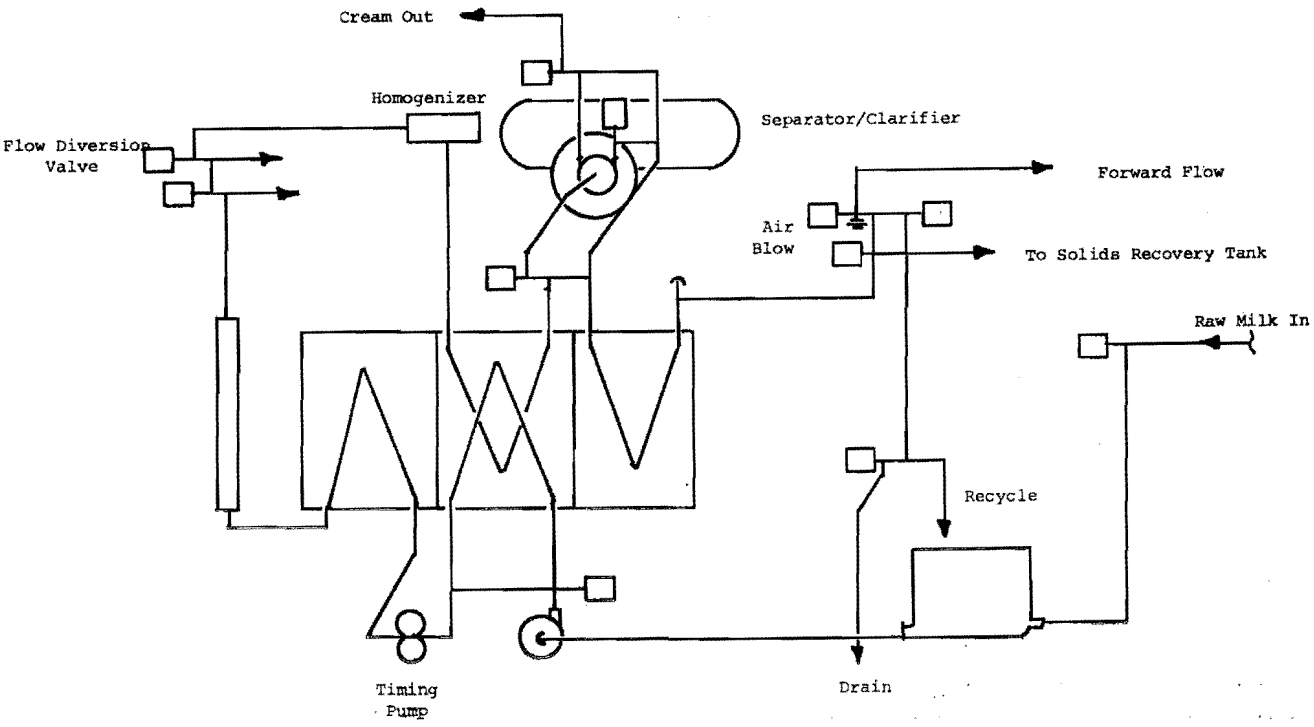

Figure 3. High-temperature-short-time solids recovery system.

often occurs during the day's operation. Any change in mode of operating the HTST will result in an intermixing of product and water. The intermixed product must be disposed of because it is not a legal milk product. To keep the product from reaching the drain and raising the BOD level, many plants are installing a waste collecting tank (Fig. 3). Through the use of air operated valves, level controls, and a timed flow through the system, an accurate reliable method of BOD reduction may be obtained during operation of the HTST. The collected product, depending on the locality, may be used elsewhere in the plant or sold as animal feed. This type of waste collection equipment may also be considered for CIP cleaning of the HTST system to optimize savings of water and cleaning solution used for CIP purposes. The equipment can be controlled by a CIP programmer to insure day-to-day dependability.

Central cleaning system area

In the previous discussion concerning CIP systems, both systems were sending rinse water to the drain. In CIP cleaning, the first rinse is critical as this will remove any milk fat that adheres to the side of a vessel or remains in a pipeline. It is for this reason that plants are installing a recovery tank for this rinsing. As is similar in the HTST system, a tank is provided to store this product that is a combination of water and milk fat. Further efficiency in the system serves to recover the wash water and maintain it at the proper temperature and concentration. The final rinse water is also recovered and stored in the pre-rinse tank where it is used on the next piece of equipment before being discharged to the drain.

Thus, through proper system engineering, the plant CIP system can be a very efficient operation. Whereas the automated circulation cleaning unit has been a large contributor to waste water loads, its water, steam, and chemical consumption can be materially reduced.

Filling area

Another area of the plant that contributes to waste water loads is the high speed filling and packaging area. Drainage in this area contains product from damaged cartons, broken cases, rinsings from machines, and lubricants from casers, stackers, and conveyor chains. A plant recovery program should be established to dispose of damaged or broken cartons and the product in the cartons. A review should be made of the system that supplies the conveyor with lubricants. It is important to use conveyor lubricants at low concentration, particularly since they do contain about 25% hexane solubles.

Separator clarifier area

Many plants have installed either automatic separators or clarifiers in the operation. In either event the machines are set to desludge automatically every 15 to 30 min depending on the operation. The resulting sludge should be collected and not allowed to reach the plant drains.

Hose stations

All plants should have positive shut-offs installed on hoses to prevent excess amounts of water from going to the drain when the hose is not in use.

CONCLUSION

In conclusion, the waste water problem is an individual plant problem as well as an industry problem. Finalized enforcement of legislation will leave plants with no choice but to conserve water. By improving on the foundations that are already established, solutions to waste problems for many plants may already exist. For others, a plant waste treatment facility may be the answer. Such a facility is not inexpensive in design or operation. The Dairy Industry traditionally has been generally good in water conservation practices but increasing costs are forcing the industry to re-evaluate old traditional methods of operating.