Come-up Time Method Of Milk Pasteurization

By Denzel J. Hankinson, Ph.D., R. B. Read, M.S., Warren Litsky, Ph.D., and Robert R. Brown, M.S.

CONVENTIONAL milk pasteurization treatment recognized by State and Federal statutes includes the vat method (143° F. for 30 minutes) and the high-temperature, short-time method (161° F. for 15 seconds). The high-temperature, short-time method has gained in popularity in the larger milk plants because of reduced space requirements and ease of application of regeneration (heat exchange from hot to cold milk). One disadvantage of the high-temperature, short-time method is the difficulty in accurately measuring and establishing the holding time at the short interval of a few seconds.

One solution to this difficulty is the elimination of the holding time, and hence the holding tube, by increasing the temperature to the point where only the "come-up" time will insure adequate pasteurization. This is the time required to heat milk to a given temperature. Studies at Cornell University in 1941 (*1*) indicated that this approach offers some possibilities.

In order that an adequate margin of safety may be established, standards should be based on a shorter come-up time than is possible with commercial milk heating equipment. Furthermore, since it is believed that any new definition of pasteurization should be based upon studies with pathogenic bacteria, equipment that would permit such studies was designed. Basically, the equipment consists of a stainless steel pressure tank and small-bore stainless steel tubing. The tube is heated by high amperage, low voltage alternating current connected to the tubing at three or more points. This arrangement is illustrated schematically in the chart. Dimensions and operational data are as follows:

Capacity of pressure tank	5.0 gal.
Flow rate	5.75 to 11.5 gal. per hr.
Flow velocity	10 to 20 ft. per sec.
Reynolds number	3,500 to 7,000.
Air pressure required	30 to 120 lb. per sq. in.
Length of heating tube	2 to 10 ft.
Diameter of heating tube	0.065" i.d.×0.125" o. d.
"Come-up" time, total	0.1 sec. to 1.0 sec.
Estimated time from final heating to collecting vessel (at 20 ft. per sec.)	0.025 sec.
Temperature rise, max	170° F.
Rate of heating	170° to 1,700° F. per sec.
Operating voltage (a. c.)	0 to 15.
Operating amperage	0 to 1,200.

Results of preliminary studies have indicated that phosphatase is destroyed and that there is a 100-percent kill of a 24-hour culture of *Escherichia coli* within the range of 176° to 185° F. at heating rates varying from 170° to 1,700° F. per second. Flavor observations on milk heated to 200° F. indicated quality at least comparable to high-temperature, short-time pasteurization. Studies on pathogenic bacteria will be initiated after satisfactory operating ranges are established with the phosphatase test and with heat-resistant test organisms.

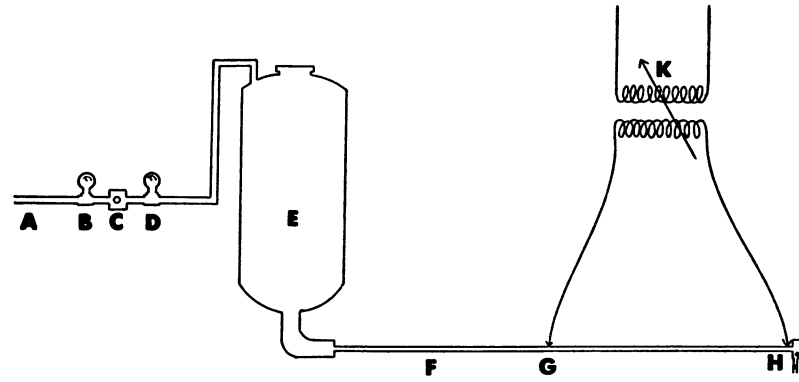
This method of heating in continuous flow, by which rates of flow and temperatures can be readily controlled, should permit the accumulation of reliable data on thermal destruction of enzymes, heat-resistant test organisms and, more important, on pathogenic bacteria, all of which are necessary before acceptance can be obtained for any process of importance to public health. Other applications could be found for the equipment in studying heating effects on fruit juices, wines, and other fluids in which controlled heating is required.

If these studies indicate that come-up time pasteurization is effective at temperatures less

Dr. Hankinson is with the department of dairy industry, Mr. Read and Dr. Litsky, the department of bacteriology and public health, and Mr. Brown, the department of electrical engineering, of the University of Massachusetts, Amherst, Mass. *This investigation was supported by a research grant from the National Institutes of Health of the Public Health Service and is a contribution of the Massachusetts Agricultural Experiment Station.*

Schematic diagram of laboratory apparatus for come-up time pasteurization

A. Air line
B. and D. Pressure gauges
C. Pressure regulator
E. Stainless steel milk container
F. Stainless steel tubing
G. and H. Adjustable connectors
J. Dispensing apparatus
K. Variable voltage transformer



than 200° F., it should be possible to apply the process with existing high-temperature, short-time equipment. The necessary alterations would be (*a*) elimination of the holding tube and (*b*) raising of the "cut-out" temperature for the flow diversion valve. The health inspector would no longer need to check both temperature and holding time, only the pasteurizing temperature.

REFERENCE

(*1*) Dahlberg, A. C., Holland, R. F., and Miner, R. K.: Quick-time pasteurization of milk. New York State Agricultural Experiment Station. Technical Bulletin No. 261. Geneva, N. Y., 1941.

Applications for Cancer Research Grants

Applications for new grants-in-aid for cancer research will be accepted before October 1, 1953, by the Committee on Growth, National Research Council. The grants will be effective July 1, 1954.

The Committee on Growth is acting for the American Cancer Society, which upon recommendation of the committee awarded approximately 250 grants totaling more than $1.7 million during the past year. In addition to clinical investigations on cancer, the scope of the research program includes fundamental studies in the fields of cellular physiology, morphogenesis, genetics, virology, biochemistry, metabolism, nutrition, cytochemistry, physics, radiobiology, chemotherapy, endocrinology, and environmental cancer.

Investigators now receiving grants will be individually notified regarding renewal applications. Application forms and additional information may be obtained from the Executive Secretary, Committee on Growth, National Research Council, 2101 Constitution Avenue, Washington 25, D. C.