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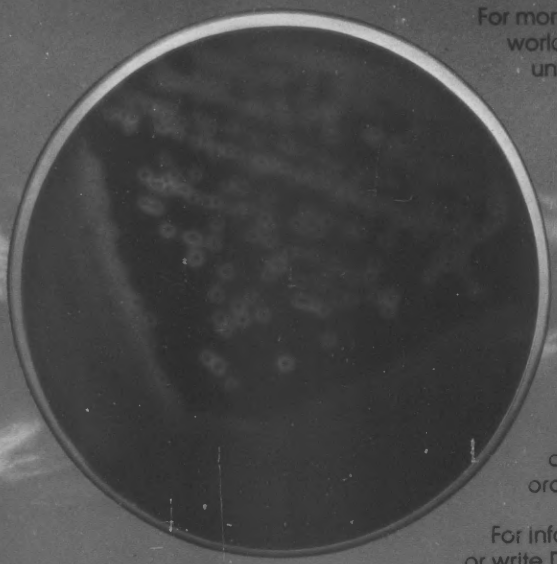

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Food Phosphates for Use in the Meat, Poultry and Seafood Industry

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All phosphates perform three basic chemical functions: pH by buffering, sequester metal ions, and act as polyanions to increase the ionic strength of solutions. This article discusses the benefits and functions of phosphates in food systems as well as the methods of application and legal aspects.

CHEMISTRY AND NOMENCLATURE OF PHOSPHATES

Phosphate Chemistry

Phosphates are salts of phosphoric acid. The two general classes of phosphates are ortho (simple) phosphates, and poly (condensed) phosphates. The orthophosphates contain a single phosphate anion while the polyphosphates contain two or more phosphate anions.

Orthophosphates are made by partially or fully neutralizing phosphoric acid with an alkali metal. This results in replacing one or more of the three available hydrogen atoms on phosphoric acid with alkaline metal ions. *Monobasic* orthophosphates have one hydrogen atom replaced with alkali; *Dibasic* orthophosphates have two hydrogen atoms replaced, while *Tribasic* orthophates have all three hydrogen atoms replaced.

Polyphosphates are made by heating mixtures or orthophosphates to high temperatures where they condense into phosphate chains. *Pyrophosphate* is the simplest polyphosphate and contains two phosphate anions. Tripolyphosphate contains three phosphate anions. Both pyro- and tripolyphosphate are crystalline solids, while polyphosphates with chain lengths greater than three phosphate anions are not crystalline solids, but amorphous glassy materials, now called *sodium polyphosphates, glassy*. There are actually three types of glassy phosphates which contain averages of 6, 12, and 22 phosphate anions.

The polyphosphates are all fully neutralized (contain no hydrogen atoms) and behave as bases, except for the acidic form of pyrophosphate, known as sodium acid pyrophosphate, which has two hydrogen atoms intact.

Polyphosphates are generally available only in the sodium form; however, two polyphosphates are available with potassium substituted for the sodium. These are the fully neutralized form of pyrophosphate and tripolyphosphate, or TKPP and KTPP, respectively.

BASIC CHEMICAL FUNCTIONS OF PHOSPHATES

All phosphates perform three basic chemical functions: they control pH by buffering; they sequester metal ions; and they act as polyanions to increase the ionic strengths of solutions.

Buffering is the ability to maintain a constant pH even when components of a different pH are added to the system. The orthophosphates are the best buffers. Of the polyphosphates, buffering capacity is greatest for pyrophosphate, and decreases with increasing chain length.

Sequestering is the process of tying up metal ions in solution so that the ions cannot participate in chemical reactions. Long chain polyphosphates (particularly the glassy phosphates), are the best sequestering agents for light metal ions such as calcium and magnesium. Their sequestering efficiency increases as pH increases. Short chain polyphosphates (especially pyrophosphates) are best for sequestering heavy metal ions such as iron and copper. Contrary to the glassy phosphates, the sequestering efficiency of short chain polyphosphates decreases as pH increases.

Polyanions are negatively charged ions that have more than one negative charge. All phosphates act as polyanions. Orthophosphates can have up to three negative charges depending on concentration and pH. Polyphosphates, because they are made up of chains of phosphate anions, exhibit a much more pronounced polyionic character. This leads to several types of useful effects. For example, polyphosphate ions can attach one end of their chain to a positively charged site on a particle surface, and the rest of the chain can attract water

molecules from the surrounding solution. This tends to maintain particles in suspension by keeping them separated and surrounded by water. On the other hand, under different conditions, polyphosphates can bridge two or more positively charged sites and help bind particles together, causing precipitation.

BENFITS/FUNCTIONS IN FOOD SYSTEMS

The three basic chemical functions of phosphates -- buffering, sequestration, and polyanionic bahavior -- provide many beneficial effects in meat systems, such as:

1. Water Binding (yield)
2. Retardation of Oxidative Rancidity
3. Emulsification
4. Color Development and Stabilization

Simply put, meat is a protein and water system. It is 75% water and 18% protein. Therefore, keeping the water in the meat keeps its quality high. This is accomplished through what is known as "water binding."

All proteins contain both acidic and basic groups. At a certain pH, called the isoelectric point, the protein is stable. If, however, the pH of the surrounding medium is raised or lowered from the isoelectric point, the protein charges become unbalanced and the protein structure opens up to attract ions and polar molecules (such as water molecules) to regain stability. This action "binds" water.

Because the isoelectric point of meat proteins is low - about pH 5.4 - the pH of meat is raised rather than lowered to increase water binding. The polyphosphates added to meat to increase its water binding capacity usually have a higher pH than the meat.

As mentioned earlier, polyphosphates do more than simply act as buffers. There is evidence that the other effects of polyphosphates on meat are more important in water binding than simple pH effects.

For instance, although simple phosphates, called orthophosphates, can raise the pH of meat as much as polyphosphates, they exert little or no influence on water binding. Orthophosphates differ from polyphosphates by having less sequestering power and no significant polyanionic character.

As polyanions, polyphosphates have many charged sites along their length. By attaching to one or more protein sites they can attract many more water molecules than the proteins could attract alone. This may only be a temporary advantage, though, because meat protein can rapidly hydrolyze polyphosphates to simple orthophosphates.

The hydrolysis of polyphosphates to orthophosphates by meat protein illustrates the unique advantage of the polyphosphates - they interact directly with meat proteins.

TSPP can interact with the actomyosin complex in such a way that the complex dissociates into actin and myosin. STPP has similar effects, although it may be hydrolyzed to TSPP before becoming active. While the actin and myosin are being disassociated by polyphosphate, salt - in synergy - solubilizes the actin and myosin, thereby enhancing water binding.

Although polyphosphates are added to meat to improve moisture retention, their antioxidant properties should not be overlooked. Both the color-stability and the flavor of meat are affected by oxidation. Oxidation of fat is an especially serious problem.

Oxidation in meat is catalyzed by certain metal ions found in the meat, especially iron. STPP and TSPP can sequester these metal ions more efficiently than other phosphates and thus prevent the metals from participating in the oxidation reaction. STPP or, better yet, a combination of STPP and antioxidants (such as sodium erythorbate) can provide greatly increased resistance to oxidation in meat products.

Many phosphates--especially SAPP and STPP--show antioxidant effects in foods, yet phosphates are chemically unreactive toward oxygen. The antioxidant effects are brought about by the sequestering action of phosphates on iron and copper. Iron and copper ions act as oxidation catalysts and when they are sequestered by phosphates, their catalytic abilities are lost.

Many food products contain oil, protein, and water, the three of which must be kept in intimate suspension. Phosphates have the ability to maintain oil-protein-water suspensions or emulsions. This ability is used to advantage in manufacturing meat products, since phosphates prevent protein from denaturing and, instead, stabilize the protein in hydrated form. The hydrated protein forms a web around individual oil droplets, keeping them from coalescing into large drops which would separate.

In meats, emulsification is the tying up of fat droplets so that they remain dispersed throughout the meat. This is particularly important in comminuted meats where large accumulations of fat in pockets are unappetizing. In poultry and cured meat, fat retention results in more tenderness, flavor, and nutrition.

APPLICATIONS

When a phosphate is used to treat meat it will perform many of the functions described above such as moisture binding, fat emulsification, color stabilization, tenderness and flavor enhancement. It is practically impossible to separate these effects. That is, one effect cannot be achieved without the other, since one treatment can cause them all. Therefore, phosphate use brings a number of benefits to each specific application.

RED MEAT APPLICATIONS

Cured meats include ham, bacon, other pork products, and corned beef. Phosphates are added to the pickling solution which is used to treat the meat by injection, soaking or tumbling. The phosphates are added principally for moisture retention, but, as mentioned above, also conveys several other benefits at the same time: color and flavor retention, tenderness, and prevention of rancidity and spoilage.

Comminuted Meats

The principal use of phosphates in comminuted (chopped or diced) meat

is the binding of the pieces into a cohesive whole. This is used in making meatloaf, sausage, and turkey and chicken rolls. In such applications the secondary effects of phosphate use are moisture retention, prevention of fat separation, and retention of color and flavor.

Sausages

Phosphates are added to sausage products for fat emulsification and moisture retention. Phosphates also stabilize color, bind the ground meat into a firm whole piece, and increase the product's tenderness and juiciness.

One special phosphate use is for cure acceleration in frankfurters and similar products. Sodium acid pyrophosphate (SAPP) is used to speed up color development by making the meat acid enough for rapid curing, while at the same time stabilizing the emulsion so that it does not break into unsightly pockets of fat.

Polyphosphates also provide beneficial effects when applied to frozen meats, where they act to dramatically retard thaw-drip loss and "freezer burn" through their ability to bind and hold water.

In the new generation of "formed" or "flaked" meat products, the phosphates can play a major roll by increasing the binding ability of the meat. They also function in this application to increase yield and retard oxidative rancidity.

Poultry Application

Even the finest quality poultry can be improved by the addition of phosphates. Tenderness and juiciness can be improved by injecting self-basting birds with a phosphate in combination with added fat.

The production of pre-cooked, further-processed poultry products has increased dramatically in recent years. Consequently, there is a greater demand for products that can increase the cooked yield and lengthen the storage life of these value-added products. Phosphates have been found to provide these benefits.

In further processed poultry products such as poultry ham, loaves, rolls and franks, polyphosphates play an important role in increasing yield, acting as a binder to coalesce meat pieces, and providing faster color development and stability. Polyphosphates are also important in these products as sequestering agents to slow oxidative rancidity.

SEAFOOD APPLICATIONS

At the present time, the seafood industry represents a large potential growth area for food phosphates. As the industry and its technology develop, phosphates can be used to provide the same benefits for seafood products as for red meat and poultry products. These advantages include increased cooked yield, lower thaw-drip losses, better texture, and greater resistance to oxidative degradation.

The seafood industry has two major problems which can be solved through phosphate treatment.

(1) Almost all seafood products are frozen at some point in the processing cycle. This results in thaw-drip losses as well as toughening of the product.

(2) The composition of seafood flesh is different from other meats. This leads to a greater problem with oxidative rancidity. Phosphates can significantly reduce the magnitude of both these problems.

Phosphates can help reduce thaw-drip losses by increasing the pH of the flesh and by binding directly to the proteins. Both actions help to open up the protein structures, allowing better water penetration. Some proteins are actually dissolved into the flesh juices by the action of the phosphates. During cooking, these proteins coagulate and help to trap juices that otherwise would be lost. This is a major reason why phosphate addition results in increased cook yield for seafood.

Polyphosphates can help reduce oxidative rancidity because they are capable of sequestering heavy metals that can catalyze the formation of peroxides in fats and oils. It is these peroxides that cause rancidity. By slowing down peroxide formation the phosphates can significantly increase the shelf life of many seafood products.

Another use of phosphates which shows great potential is in the processing of chilled or frozen fish filets. They are usually chilled or pre-cooled in a salt solution. Adding a phosphate to the salt solution is an ideal way to treat the filets and can significantly reduce thaw-drip losses if the phosphate concentration is high enough.

In the production of fish blocks, fish are often treated with a phosphate such as STPP. The phosphate dissolves the surface protein which helps to lubricate the fish and make fabrication of the fish blocks easier. Once the blocks are formed, the STPP helps to preserve the quality of the fish.

Shrimp and shellfish processors use phosphates to improve the yield and quality of their final product. The phosphate is applied mainly by soaking. Phosphates have also been found effective in softening the underskin of shrimp to make peeling easier. This reduces peeling costs and increases the yield of valuable whole shrimp.

Processed fish products, such as fish paste and fish sticks made from chopped or minced fish, can take advantage of the unique ability of the polyphosphates to dissolve proteins. In whole fish products, these dissolved proteins coagulate upon cooking and act to retain moisture. The same thing happens in chopped or minced fish products except that, in addition, the coagulated proteins act as binders to provide a finished product with a more uniform texture.

Another important application of one of the phosphates is in the prevention of struvite crystals in canned fish (particularly tuna). Struvite crystals, although completely harmless, look like glass and lead to rejection of the product by consumers. Since magnesium is one of the components of struvite, a polyphosphate (particularly sodium acid pyrophosphate) can sequester the magnesium so that the struvite crystals cannot form.

METHODS OF APPLICATION

There are five basic methods of adding phosphates to meat, poultry &

seafood products: (1) dry, (2) spraying, (3) soaking, (4) injection, and (5) tumbling.

(1) An example of dry phosphate use is direct addition of the phosphate to the raw materials being used to form an emulsion, such as frankfurter emulsion.
(2) Spraying is a simple and easy way of incorporating the polyphosphates into the product, particularly where surface application or size market is feasible.
(3) Soaking the product, such as shrimp, for a period of time in a phosphate solution is an effective and inexpensive means of incorporating the phosphate into the finished product.
(4) Injection of the phosphate solution by suitable equipment, where applicable, provides a highly automated and effective means of incorporating the phosphate solution throughout the meat.
(5) Tumbling the product with a phosphate solution has also been used successfully when it is desirable to have meat peices coated with water soluble proteins to act as binders, and when production time is not a factor.

Legal Aspects

The use of phosphates in meat falls under the jurisdiction of the Meat Inspection Division of the USDA. They issue regulations on the types of phosphates and amounts permitted in any given meat product.

New regulatory changes by the USDA have expanded the use of specific sodium and potassium food grade phosphates to include most types of processed red meat and poultry products.

Phosphates are now allowed in beef products (hamburger and chopped beef *excluded*) as well as pork, veal, mutton, and poultry products.

All cured meats, such as corned beef and pastrami, and all cooked and pre-cooked sausages, included franks, vienna, bologna, knockwurst, and similar products, may now contain certain phosphates up to 0.5% by weight of the final product.

The potassium analogs of the food grade phosphates are permitted as a partial or whole replacement for their sodium counterparts in any of the red meat, poultry and seafood products where sodium phosphates are now permitted. The potassium phosphates may not exceed 0.5% by weight of the final product. The total combined amount of sodium plus potassium phosphates cannot exceed 0.5%.

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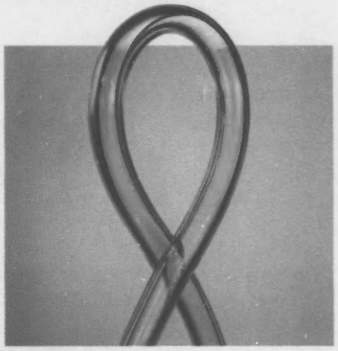

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Dairy and Food Sanitation, Vol. 3, No. 7, Pages 250-251 (July 1983)

MISLEADING INHIBITORY SUBSTANCES TEST RESULTS

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Bacteria in milk samples may produce easily verifiable inhibitory substances or beta-lactamase in amounts that influence inhibitory substances test results. These bacteria should be suspected when test results conflict or disagree with available information.

INTRODUCTORY STATEMENT

Results of tests for inhibitory substances in milk using the *B. stearothermophilus* or Delvo test may sometimes be misleading due to substances produced by bacteria in the milk. The dairy fieldman and the laboratory should consider this possibility when laboratory results conflict, when milk producers dispute a positive test result, and in other similarly incongrous situations as a load sample testing positive and all contributing producer samples testing negative. A related situation can occur when laboratories screen samples for inhibitory substances then later try to confirm a positive and get a negative result. A fieldman confronted with such situations should request that his laboratory perform confirming tests described below.

DETECTION METHODS

When inhibitory substances are present in a milk sample but test results are negative, one explanation may be due to the presence of certain types of bacteria that produce beta-lactomase. This enzyme destroys beta-lactams. Penicillin is the most common beta-lactame. This mechanism is well known in clinical microbiology and this situation can be confirmed by the following method.

To a portion of the milk sample to be tested, add penicillin in the amount of 0.26μ/ml. Incubate this mixture at room temperature for 1 to 2 hours. If psychrotrophs are suspected in the milk sample of producing beta-lactamase, refrigerate the milk-penicillin mixture for 8 hours. Then retest the incubated mixture for inhibitory substances.

If the inhibitory test result is negative on the milk-penicillin sample, the presence of bacteria in the sample that produces beta-lactamase has been confirmed. Our laboratory experience indicates to us that bacteria producing beta-lactamase are the most common cause for conflicting inhibitory results.

BBL has developed a rapid test method for detecting bacteria that produces the beta-lactamase enzyme in samples. This paper disc method has, as yet, not been adequately tested so as to assure complete reliability.

If you suspect that bacteria in the milk sample may be responsible for a positive inhibitory test result, a simple test will determine if this is true or not. Obtain a loop full of each kind of bacteria colony from the total count plate. Transfer each loop to a *B. stearothermophilus*[1] plate. Also on this plate add a loop of bacteria culture known not to produce an inhibitory reaction as well as a penicillin standard. Pure cultures should be made from bacteria on the standard plate count to produce colonies suitable for transfer if those on the plate are not suitable. After suspect colonies have been transferred to the *B. stearothermophilus* plate, it should be inverted and incubated at 32°C for 1 hour, followed by 56-60°C for 2 1/2 to 3 hours. A clear zone around the transferred colony indicates it is producing inhibitory substances. Use of pH indicator paper verifies that is not due to acid production. Due to mutation, a subculture of a bacteria colony may have more or less inhibitory activity on the *B. stearothermophilus* plate.

OBSERVATIONS

Some practices common in the handling of samples, more common in the handling of manufacturing grade

[1] *Kaufmann, O. W. 1980. B. Stearothermophilus Assay for Detection and Confirmation of Beta-lactams in Milk. State Training Branch, Division of Federal-State Relations, EDRO, Food and Drug Administration.*

milk, can contribute to misleading inhibitory substances testing results, such as sanitizer in the sample. Samples taken for antibiotics only testing are often not refrigerated properly enroute to the laboratory, may be taken in a variety of containers that may contribute to a problem bacterial load or may be old since they are not tested until a load or silo is reported positive and an effort is made to find the source.

Our experience, which is primarily with manufacturing grade milk, in three states, leads us to estimate that bacteria producing inhibitory substances or beta-lactamase may occur in as many as 1 in 250 samples.

The occurrence of bacteria producing antibiotics in amounts sufficient to give a positive inhibitory substance test is rare. In one month, when accurate statistics were kept, abnormalities investigated and results verified, 1 in 1000 samples tested for antibiotics were found to contain bacteria producing antibiotics in amounts sufficient to give a positive inhibitory substances test.

5 samples initially testing positive for beta-lactams, out of 1000 tested also contained bacteria producing beta-lactamase in amounts sufficient to give a negative test by the time the milk reached its destination and was retested.

The occurence of such bacteria is often not recognized or suspected, perhaps due to their infrequent occurance and, therefore, infrequent reason to suspect them. Often fieldmen are in the best position to collect statistics by insisting on resolution of anomolies involving inhibitory substances tests.

Dairy and Food Sanitation, Vol. 3, No. 7, Pages 254-255 (July 1983)

TEAT DIPS — Selection and Use

BY
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ABSTRACT

Teat dipping with a microbial inhibitor is the single most effective practice dairymen have to prevent the spread of mastitis. Thus, the dipping of every teat of every cow as soon as possible after every milking continues to be a strongly recommended practice. The application of an effective teat dip to at least the lower one half of teats after milking greatly reduces the population of organisms to near zero. Consequently, the likelihood of new infections occurring is greatly reduced. Research shows that teat dipping with an effective product may reduce the incidence of new infections by as much as 75%, when used in conjunction with other good dairy management practices, such as dry cow treatment and good sanitation.

Teat dipping with an approved antimicrobial agent is a practical, low cost way to prevent mastitis. Answers to some frequently asked questions about teat dips are:

WHAT TEAT DIP WORKS BEST?

Recognizing that teat dips are very important for preventing mastitis, herd managers must decide what product to use. How do they decide? This is difficult because so many different products are available. A current list of all commercially available teat dips, known to be effective, is available upon request from Cooperative Extension Service personnel.

There are a wide variety of teat dips available containing a number of different efficacious active ingredients. Active ingredients include alcohols, bronopol, chlorhexidine, iodine, quaternary ammonium compounds and surface active agents as well as latex compounds which seal teats and physically entrap bacteria. Most commercially available teat dips are effective. However, oil-based teat dips are not effective because they do not kill the bacteria that cause mastitis and therefore they do not reduce the incidence of mastitis infections.

HOW SHOULD TEAT DIP BE STORED?

1) Follow the instructions of the manufacturer which generally recommend storage in a cool, dark and dry place. Intense light and temperatures above 90°F are particularly destructive to sodium hypochlorite and iodophor sanitizers.

2) Store teat dips where freezing cannot occur.

3) Rotate the teat dip you have on hand: "first in, first used." Write date received on the containers of teat dip. Do not use after expiration date. Buy dips in reasonable quantity to allow use before expiration date.

4) Keep containers closed to prevent evaporation, contamination and spillage.

5) Never put used teat dip solution back into the original container.

SHOULD I SPRAY OR DIP?

Generally speaking, "dip" application is better because it results in a more thorough covering of the teat than does "spray" application. For example, if a cow's teats are sprayed from one side, the opposite side may not be coated with the dip. Also, hand held sprayers are somewhat cumbersome.

At least one company manufactures a stationary pump/reservoir type sprayer specifically designed for "spray" application of teat dip. Research on this device shows that, if properly used, it can be as effective as immersion of the teat. Some of the advantages claimed for it are:

1) Less teat dip is spilled.

2) Dip is not contaminated in the sprayer whereas teat dip cups may be easily contaminated.

3) Device requires fewer refills.

The sprayer head in this unit should

be rinsed and cleaned between milkings. Also, the mixing unit in the storage tank should be checked routinely to assure that it is functioning. Teat dip reservoirs on spraying units should, on occasion, be rinsed and allowed to air dry.

*SAFETY NOTE — The use of iodine teat dips by spray application may cause considerable irritation to operators in totally enclosed milking sheds.

CAN MASTITIS BE SPREAD IN TEAT DIP?

Case studies have shown that in rare instances mastitis-causing organisms were spread in teat dip. In these instances, this problem would not have occurred if good sanitation practices had been used. To avoid the spread of mastitis through teat dip, the following precautions are suggested:

1) Use only recommended teat dips that have been shown to be effective.

2) Discard dip contaminated with urine and manure during milking and rinse the dip cup thoroughly.

3) Dip clinically and known subclinically infected cows with a separate dip container or teat dip applied by spraying thoroughly.

NOTE: If infected or antibiotic treated cows are milked last as they should be, this will be easy to do.

4) Use teat dip applicators that can be emptied after each milking. Rinse out applicators and allow to dry between milkings. Having extra applicators helps assure that a clean one will be available for each milking.

5) Discard cup sponges found in many horizontal teat dip applicators. These can become contaminated and serve as a source of pathogenic bacteria.

SHOULD I STOP USING TEAT DIP DURING COLD WEATHER?

A recent survey of Nebraska dairymen showed that those who continue to dip during extremely cold weather produce milk with relatively low somatic cell counts when compared to herds that stop using teat dip. Teat dips can be used longer in cold weather if teats are lightly wiped dry with a paper towel after the teat dip has been applied.

Several strategies can be employed which may reduce frost injuries to teats:

1) Provide adequate shelter/windbreaks for housing, feeding and holding areas. Also, provide sheltered/covered return routes to these areas:

2) Blot teats dry after dip so that teats and udders are dry before the cows are released from milking area.

3) Massage teats after removal of milker to restore blood flow.

4) Provide an ample amount of clean, dry bedding.

5) Take special care of fresh cows because their engorged teats are extremely susceptible to freeze injury.

Because teat dipping is such an important way to prevent mastitis even during cold weather, we recommend continuing the use of teat dip, along with the above suggestions.

DO TEAT DIPS CAUSE TEAT IRRITATION OR LESIONS?

Field reports of teat irritations or lesions due to teat dips have been reported. Improperly formulated iodine dips and frozen iodine dips have been implicated on occasion. Unfavorable interactions between premilking sanitizers and teat dips have also been reported to cause teat irritation. If teat dips or premilking sanitizers are implicated as a cause of teat irritation, dairymen should determine whether the products are being used as recommended or consider alternative products. However, discontinuing use of teat dips and premilking sanitizers is not advised. Furthermore, the Pasteurized Milk Ordinance requires the use of premilking sanitizers.

Teat dips are not the main cause of teat irritation. A number of other factors are more likely to cause teat irritations or lesions. these include:

1) *Faulty milking systems;* i.e., excessive vacuum fluctuation at the teat end, faulty vacuum controllers, excessive vacuum, malfunctioning pulsators, worn out liners and wide bore liners.

2) *Careless milking procedures;* i.e., inadequate stimulation, milk tube pinching, overmilking, excessive machine stripping, and removable of teat cups without turning off the vacuum.

3) *Lack of care when infusing udders.*

4) *Excessive use of teat dilators.*

5) *Injury;* i.e. stepped on cut or bruised teats.

6)*Environmental stress;* i.e. sunburn or freezing.

7) *Infections;* i.e. bacterial, fungal or viral agents (bovine herpes mammillitis or pseudocowpox) of the teat skin.

8) *Combinations* of the above.

The conclusion is that teat dips, at their worst, are probably only a minor cause of teat irritations and lesions.

DOES IT PAY TO "DIP" DRY COWS?

New mastitis infections occur most frequently during the first and last weeks of the dry period. Research has demonstrated that the continued use of teat dip, particularly during the first and last weeks of the dry period should significantly reduce the occurrence of new cases of mastitis. Although a difficult management practice, it appears to be beneficial.

Conclusion: Many management factors contribute to the control and prevention of mastitis. Teat dipping has been proven to be one of the most important strategies that dairymen can employ.

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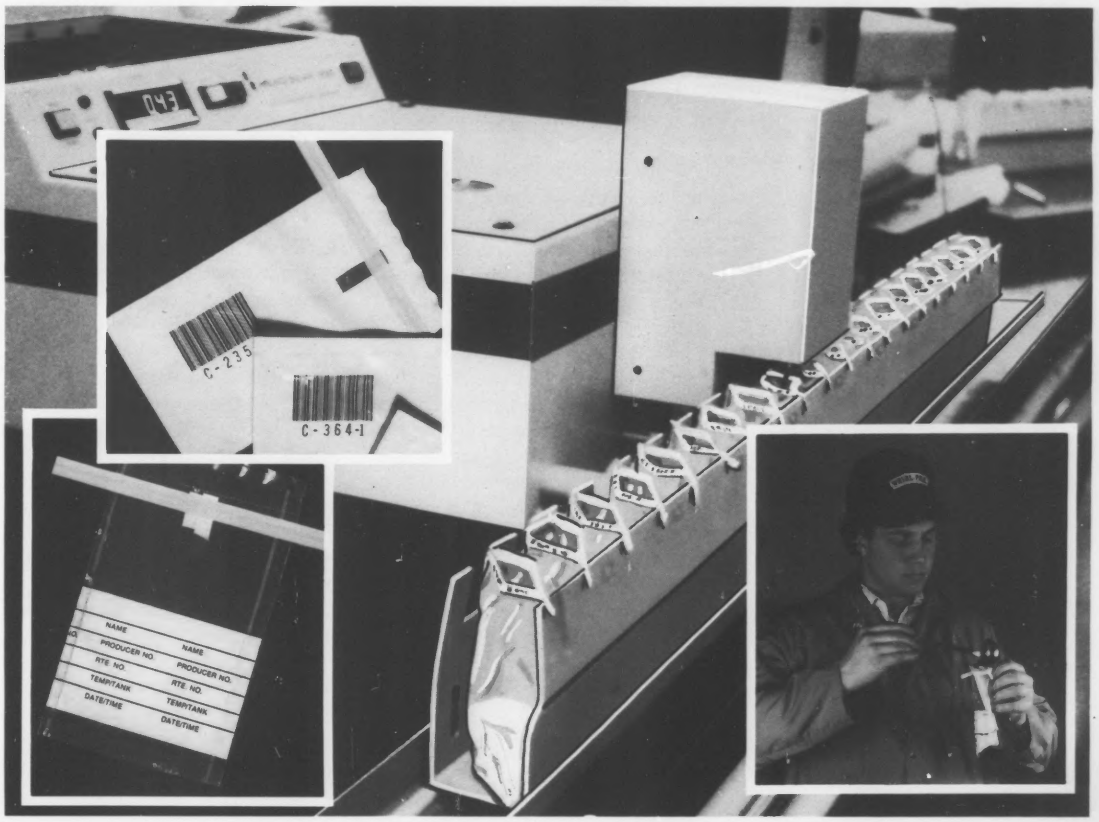


Dairy and Food Sanitation, Vol. 3, No. 7, Pages 258-259 (July 1983)

Above-Ground Landfills May Decrease Widespread Contamination of Groundwater

ROBERT L. HANEY
TAES Science Writer
The Texas Agricultural Experiment Station, Neville P. Clarke, Director, The Texas A&M University System, College Station, Texas

"The increasing pollution of the nation's fresh water supplies is a problem we must face and solve or it will literally be the death of us," according to Dr. Kirk W. Brown, a nationally recognized authority on soil physics at Texas A&M University.

Brown, who has done a great deal of research on this problem for the Texas Agricultural Experiment Station, has testified before national and state legislative committees concerned with environmental pollution. He has repeatedly warned of inadequacy of standards and disposal sites for municipal, agricultural and industrial wastes.

During the last century, we have seen growing evidence of our fresh water being polluted as, for example, the Great Lakes have been. Many of our rivers and smaller bodies of water have gradually sickened and died from the increasing loads of pollution. Steps have been taken to correct many of these problems, but now the public is becoming aware that our underground supplies of fresh water are gradually being invaded by pollution from thousands of landfill "disposal" sites for municipal and industrial wastes.

Brown says some estimates are that at present only about 2% of our total usable groundwater has been contaminated by toxic chemicals.

"That doesn't sound like much," Brown says, "but if the acquifer, groundwater reservoir, you use for watering your livestock or for drinking water is contaminated, to you it looks more like 100%."

Most of the contamination is a result of leakage from the more than 50,000 waste-disposal sites spread across our country.

Brown says that it would cost an estimated average of 15 million dollars to try to clean up a single contaminated groundwater system and that even then, complete cleanup could not be attained.

As rainfall soaks through a landfill, it picks up a wide variety of chemicals, and this liquid, which soaks ever deeper into the subsoil or runs off the land from a landfill, is called leachate.

The leachate from municipal waste has become increasingly complex, Brown says, as the number of synthetic products sold to the public are ultimately disposed of in these facilities.

Today's wastes include plastics, pesticides, pharmaceuticals, solvents, and other chemicals, which when exposed to the anaerobic acidic environment in the landfill are slowly released or broken down, in some cases, to even more toxic chemicals.

Despite the best efforts to use compacted clay liners or synthetic membranes and to remove leachate from hazardous waste landfills during operation and closure, the potential for

leachate production may continue for a long time following closure. Such leachate will build up in the waste and then migrate through the liners into the adjacent soil and ultimately into the groundwater at many landfill sites. Brown says that increasing concern about the contamination of groundwater by leaking landfills will eventually lead to development and use of alternative technologies for disposal.

"The problem could be avoided by not placing waste in landfills," Brown says, "but this would necessitate intensification of waste reduction, recycling, incineration, and land treatment as options for disposal.

"However, it is unrealistic to believe that in the foreseeable future, all our waste could be disposed of by these or other alternate technologies. Thus, the need to dump bulk wastes will be with us for a long time."

While future land disposal of waste will have many common factors with today's technology, several significant changes are foreseen by Brown.

These include the increasing use of both municipal and industrial disposal facilities built above the ground surface rather than below the surface. Such facilities may be more economical to construct, since the cost of excavation can be avoided.

Future facilities will likely include sloping bases of compacted clay, overlain by drainage systems designed to allow gravitational removal of any leachate which accumulates.

Above the drainage system, layers of absorbing materials will likely be used to remove metals or other undesirable constitutents which leach from the waste. Industrial waste will likely be solidified using fly ash to retard the movement of liquids.

Such facilities are likely to be built in adjacent cells, have adjacent sloping drainage surfaces, and ultimately be covered with a common sloping cap.

"With such an arrangement," Brown says, "the leachates may be collected and reapplied to the waste through a temporary soil cover.

"Recirculation will be utilized to hasten digestion and facilitate removal of organic components from the landfill. Recirculation will also be used to rapidly leach the mobile fractions, which will then be retained or degraded as they pass through the temporary soil layer on the surface of the above-ground landfill.

"The recirculation will allow a rapid improvement in the quality of leachate water without releasing undesirable components into the environment. Once the quality of the leachate has improved, a final clay cap designed to minimize the infiltration of water into the waste will be installed.

"The quality of leachate released after installation of the cap should decrease rapidly. If the cap is properly designed, the leachate will decrease to negligible amounts, thus sealing the residues in a stable environment out of contact with groundwater," Brown concluded.

News and Events

New Manual Available from IAMFES, Inc.

PROCEDURES TO INVESTIGATE ARTHROPOD - BORNE AND RODENT - BORNE ILLNESS Manual has just been published by the International Association of Milk, Food and Environmental Sanitarians.

This manual is companion to PROCEDURES TO INVESTIGATE FOODBORNE ILLNESS and PROCEDURES TO INVESTIGATE WATERBORNE ILLNESS published by the Association. It contains step-by-step procedures for sanitarians and other public health professionals to use in investigating cases and outbreaks of suspected or confirmed arthropod-borne and rodent-borne illnesses and in maintaining and improving surveillance of vector-borne disease.

The manual was prepared by the Committee on Communicable Diseases Affecting Man. The Chairman is Dr. Frank Bryan, who is with the U.S. Department of Health and Human Services, Centers for Disease Control, Atlanta, Georgia.

PROCEDURES TO INVESTIGATE ARTHROPOD – BORNE and RODENT - BORNE ILLNESS is available from IAMFES, Inc. at the single copy price of $2.00. This 93 page manual is also available at a reduced price for bulk orders.

For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010, 515-232-6699.

Food & Dairy Expo '83

A total of 161,310 net square feet of exhibit space has been reserved by 197 food and dairy equipment and supply companies for Food & Dairy Expo '83.

Expo '83 will be held October 22-26, at McCormick Place, Chicago, IL, marking the first time the giant equipment and supplies exhibition has opened on a Saturday.

"At least 135 more companies are expected to request space for the show in the months ahead," said Keith Stolldort, Director of Exhibits and Membership for the Dairy and Food Industries Supply Association. According to Stolldort, "All signs indicate a dramatic return of Expo to the food heartland of the country. past shows in Chicago have consistently drawn a better attendance than any other city we've visited," he said.

Major commodities to be shown will be processing systems and equipment; packaging machinery, containers and materials; ingredients; point-of-sale refrigeration equipment; industrial cleaning and sanitizing systems and products; transport refrigeration systems, chassis and insulated truck and trailer bodies; and a wide range of professional business and management services and general supplies.

Attendance at the Expo is international in scope. Expo '79 attracted upwards of 2,000 persons from more than 60 countries representing food, dairy beverage, and pharmaceutical manufacturing. Total attendance reached a ten-year high in Chicago - 1979, with 16,122 visitors.

See IAMFES and the 3-A Symbol Council exhibit during the Food and Dairy Expo, October 22-26, 1983, McCormick Place, Chicago, IL.

IFT Elects 16 New Fellows

The Institute of Food Technologists announced today it has elected 16 new Fellows from among its professional members. According to Dr. Owen Fennema, president of the scientific society, "The group represents an average of almost 30 years of individual service to IFT. These individuals have distinguished themselves through outstanding contributions to the fields of food science or food technology."

Each of the members elected has been cited for professional excellence in his specific field. Including this group, IFT has named 221 Fellows since the recognition program was begun in 1970.

The Fellows elected by IFT are Vigen K. Babayan, Robert R. Baldwin, Henri Cheftel, Donald L. Downing, Robert L. Henrickson, Paul Khan, Jack K. Krum, Elmer H. Marth, Richard Matthews, Charles W. Nagel, Tommy Nakayama, Alvin Nelson, Lowell D. Satterlee, Khem M. Shahani, Fred R. Tarver, Jr., and Joachim H. von Elbe.

Elmer H. Marth, an elected Fellow is a professor of food science and bacteriology, University of Wisconsin, Madison. Dr. Marth is cited "for his research efforts which have significantly contributed to the advancement of food microbiology and toxicology, for his outstanding contributions to the scientific literature and for his dedicated service to the food industry." Dr. Marth received his B.S., M.S., and Ph.D. degrees in bacteriology from the University of Wisconsin. Elmer H. Marth is also the editor of the Journal of Food Protection.

JOURNAL OF FOOD PROTECTION 1978

The IAMFES library is minus the February 1978 issue of the Journal of Food Protection. If anyone has an extra copy, or one he/she would like to donate, please contact: Jeanine Strodtman, IAMFES, Inc., PO Box 701, Ames, Iowa 50010. 515-232-6699.

Fourth Annual Joint Educational Conference

THE CHALLENGE OF CHANGE is the program theme for the Fourth Annual Joint Educational Conference, September 21-22, 1983 at the Olympic Spa & Resort, Oconomowoc, WI.

The program this year will feature an update of last years very popular Ground Water theme along with topics of interest to sanitarians from all walks of the profession.

For more information contact: Jon R. Dresser, PO Box 7883, Madison, WI 53707.

MN Dairy Study Tour

North Carolina's Blue Ridge Mountain area is the site of this year's Minnesota Dairy Study Tour to be held July 31 - August 6. The annual tour, sponsored by the Minnesota Agricultural Extension Service and the Department of Animal Science, is designed to give dairy farmers a chance to visit modern dairy facilities located across the country.

The cost of the tour is $599 per participant, which includes ground and air transportation, lodging, meals and insurance. For more information contact: Office of Special Programs, Agricultural Extension Service, 612-373-0725.

Ice Cream Promotional Month

"Ice Cream for America" is a month long celebration this month in promotion of America's most loved dessert and snack...Ice Cream.

Developed and sponsored by the International Association of Ice Cream manufacturers, the ice cream promotion will run throughout the month of July 1983, and is intended to remind consumers just how much they love ice cream.

Details may be secured from the International Association of Ice Cream Manufacturers: 910 17th St., NW, Washington, DC 20006, 206-296-4250.

Short Courses Announced by American Association of Cereal Chemists

The American Association of Cereal Chemists announces upcoming short courses in 1983 including; Dairy Products for the Cereal Processing Industry, November 3-4, 1983, Kansas City, MO; Gum Chemistry and Technology in the Food Industry, November 7-9, 1983, Chicago, IL; and Starch: Structure, Properties and Uses, December 8-9, 1983, Chicago, IL.
For more information contact: Dotty Ginsburg, Short Course Coordinator, 3340 Pilot Knob Road, St. Paul MN 55121, 612-454-7250.

Ectiban Insecticide Granted Federal Registration

The Environmental Protection Agency has granted federal registration for the use of Ectiban Insecticide on livestock to control a variety of insects. Ectiban, manufactured by ICI Americas Inc., is the first synthetic pyrethroid to receive federal registration for direct application.

The registration allows Ecitban to be sprayed directly on beef and dairy cattle, swine and poultry for control of face flies, horn flies, stable flies, ticks, mites and lice.

ICI Americas Inc., manufactures other products for agricultural use. Fusilade herbicide will soon be registered for use on cotton and soybeans. Fusilade provides highly effective postemergence control of a broad spectrum of grasses in broadleaf crops.
For more information contact: C.A. Stainback ICI Americas Inc., Agricultural Chemicals Div., Wilmington, DE 19897, 302-575-3031.

Park Appointed at Marigold Foods, Inc.

The appointment of Hong Sik (Peter) Park to the position of Vice President, Research and Development and Quality Assurance of Marigold Foods, Inc., was announced by Marigold President William B. Ramsay.

Park came to Marigold Foods in 1975. For the past five years he has directed quality control and expanded programs of research and development.

Prior to joining Marigold, he has been with Sealtest foods, the Borden Company and the Kroger Company.

A native of Seoul, Korea, Peter received his B.S.

Degrees in Dairy Industry from Iowa State University in Ames, in 1962, and his M.S. in Dairy Microbiology from Iowa State in 1964. He holds a Ph.D. in Food Science, earned in 1968 at the University of Wisconsin-Madison.

Marigold corporate offices are located at 2929 University Ave. SE, Minneapolis, MN 55414.

Raw Milk Consumption

"It doesn't seem to end," says Mary Darling, nutritionist with the Universiry of Minnesota's Agricultrual Extension Service.

"In spite of the proven benefits of pasteurized milk, throughout Minnesota the fact remains that there are still a small percentage of families who are drinking raw milk." Motivated by budget constraints and convenience, they persist in by-passing their grocer's dairy case for this alternative.

"Raw milk is a fine product," she adds, "but it's not recommended." Although many farmers who sell it are conscientious about cleanliness and very knowledgeable about how to handle milk, raw milk is not pasteurized milk. Pasteurization is important to reduce risk of spreading diseases through milk.

Another minus is that raw milk lacks the extra boost of vitamin D found in 'fortified milk.' Its absence may not be obvious until the family doctor discovers knobby, painful joint or rickets when a child starts to walk. "It's a problem that can be avoided if people are aware of the wide range of milk choices that are available in stores," Darling concludes.

Substitutes and imitations are now competing with dairy products, meat, fruit juices, eggs and bacon for space of their own on the marketplace shelf and from the consumer wallet.

The invention of substitutes has been a great boon for some people who couldn't experience the taste of the real product for some health limitation reasons.

The point to remember, says Vernal S. Packard, dairy products specialist at the University of Minnesota's Agricultural Extension Service, is that in trying to make a twin of the real product in flavor, texture and other sensory characteristics, nutritional composition often comes in second to the familiar, conventional food.

For instance some imitation milk formulations may contain only one-third or one-half as much protein as real milk. Vitamin and mineral levels may be inferior, he says.

Since Americans are said to rely on foods in the milk group to provide 20 percent of their protein, 72 percent of their calcium, 33 percent of their phosphorus, 20 percent of their magnesium, 36 percent of their riboflavin and 18 percent of their vitamin B-12, this is a focus of Packard's concern. "If imitation milk is substituted for real milk over an extended period of time and no compensation is made through other food choices, nutrition can be missing in the consumer's diet," he concludes.

Food-borne Illness

What do restaurant meals, church picnic suppers, and home-canned food all have in common? According to Mary K. Sweeten, a foods and nutrition specialist, they each hold the potential for spreading food-borne illness.

"Every year, we are particularly concerned that people who do home canning become aware of the dangers associated with poor food handling procedures," says Sweeten, who works for the Texas Agricultural Extension Service, Texas A & M University System.

"But the problem goes far beyond home-canners since medical authorities claim that food-borne disease is the second most common cause of short-term illness in the country," she adds.

Food-borne illnesses also have severe economic consequences.

According to the JOURNAL OF AMERICAN MEDICAL ASSOCIATION, March, 1983, the total cost of a 1978 outbreak of botulism among 34 New Mexico restaurant patrons is now estimted at 5.8 million dollars, reports Sweeten. Most of that money went for legal settlements and attorney's fees, she adds.

Outbreaks of serious food-borne illness linked to restaurants are more likely to lead to legal action than mild outbreaks or those resulting from social group epidemics, concedes Sweeten.

But she notes that food-borne illness from all sources is estimated to cost Americans millions each year in medical costs and lost work time.

The culprits in most food-borne illnesses of known cause are bacteria:

*Salmonellae bacteria can be found in red meats, eggs, dried foods and dairy products. Salmonellosis is transmitted by eating contaminated food or by contact with infected persons, insects, rodents, or pets.

*Clostridium perfrigens are somewhat heat resistant and may be found in stews, soups or gravies. The illness is transmitted by eating food in which unusually large numbers of the bacteria have multiplied because of inadequate cooking and/or cooling.

*Staphylococcus (or staph-) bacteria are transmitted by food handlers who carry the bacteria, and by eating food containing a heat stable toxin from the bacteria. The toxin can be formed in hams, custard-filled foods, cream pies, unrefrigerated cooked meat and dairy products.

*Clostridium botulinum bacteria are normally associated with inadequate heat treatment in home canned foods.

*According to Dr. Ranzell Nickelson, Extension Seafood Technology Specialist and Marine Project Supervisor, common factors contributing to food-borne disease are contaminated raw food; inadequate thermal processing, canning or cooking; an infected person touching cooked food; improper cooling or hot storage; and the lapse of a day or more between preparing and serving food.

*To prevent food-borne disease from contaminating home cooking, Sweeten recommends that you begin by examing all food cans and jars. Never buy food in leaking, bulging, or severely dented cans, cracked jars, or jars with loose or bulging lids, due to the risk of botulism.

Careful attention to food temperature, especially in warm weather, will also reduce the possibility of food-borne illness, says Sweeten.

"Cleanliness is extremely important in preventing food-borne illness," says Sweeten.

"Most people know to wash their hands before preparing food. But some people neglect to wash after handling raw meat or poultry and then go on to touch other foods, she says.

"The same principles apply to food eaten away from home," says Sweeten. She suggests selecting restaurants that have high standards of cleanliness.

Insecticide Tapes

Insecticide tapes designed to control horn and face flies on pastured cattle have been introduced. Replacing conventional insecticide ear tags, tapes are attached to existing identification tags, eliminating the need to double tag or cut out old tags.

The tapes use the same types of insecticides as insecticide ear tags. They are applied when cattle are turned out to pasture in the spring (late May in Minnesota) and should be effective throughout the summer fly season.

Flies on pastured animals are a problem for dairy and beef farmers, according to Roger Moon, livestock entomologist with the University of Minnesota Agricultural Experiment Station. "Horn flies can reduce both weight gain and milk production. Face flies may be carriers of eyeworms and pinkeye," says Moon.

Can insecticide tapes and ear tags control the fly problem? "Horn fly is quite easy to control with tapes or insecticide ear tags," says Moon. "These devices slowly release fly-killing chemicals that spread over the cow. Because horn flies live on the cow, they are exposed to enough chemical to effect control. Face flies, however, are much more difficult to control because they spend very little time on cattle. Research shows that less than 5 percent of the face flies in a pasture are on cattle at any one time."

"Researchers at the Iowa State University Agricultural Experiment Station at Ames have studied the effectiveness of insecticide ear tags in controlling flies on cows and heifers. They found that 99 percent tags provided 99 percent protection from horn flies and 56 percent reduction of face flies. ISU tests also showed that calves whose dams were tagged weighed in the average 11 pounds more at the end of the study than calves with unprotected dams," Moon adds. The Iowa study ran from the beginning of June to mid-September.

Moon feels that horn fly control is effective and justifiable. "One ear tag or tape on every third to fifth animal in the herd is enough to completely control horn flies. Only partial control of face flies has been achieved with two tags on every animal," he says.

"We don't know enough about what the face fly costs producers in lost milk or meat production and in higher veterinarian bills. At present prices, economic factors may not justify the extra labor and expense of attaching the additional tapes or ear tags to provide only partial face fly control." Moon concludes.

Sentenced in Slaughtering and Selling of Diseased Cattle

A U.S. District Court in Pittsburgh sentenced five Pennsylvania residents for their part in a scheme involving the slaughtering and selling of meat from diseased cattle that had not been inspected by USDA.

A jury found all five guilty, March 4, of conspiracy to violate federal meat inspection laws and related crimes associated with the clandestine operation.

The court handed down the following sentences:

Hughey P. Weyandt, owner of Weyandt's and Sons, Claysburg, PA to five years in prison and five years probation and a fine of $31,000; Jerome Davis, owner of Jerry Davis Packing Co., Dysart, PA to four years in prison and five years probation; Janet Davis, wife of Jerome Davis, to a three year suspended sentence and five years probation; Isaiah Fleck, a Weyandt employee, to four years in prison and four years probation.

"The illegal slaughter and stamping occurred at the Weyandt plant after normal work hours when federal inspectors were not present and at the Davis plant, a custom slaughter operation that did not require daily federal inspection," according to Donald L. Houston, administrator of USDA's Food Safety and Inspection Service.

"Information steming from the Dec. 17 indictments of the five individuals revealed that some of the diseased meat was transported to Philadelphia," Houston said. "However, USDA assured public heatlh officials in Pennsylvania that there was no evidence any of the suspect meat remained in commerce, nor was any human illness associated with the product."

A federal grand jury in Pittsburgh is continuing its investigation of the case.

Real vs. Imitation

Real versus imitations and substitutes: what does it all mean when talking about dairy and non-dairy products?

Dairy farmers naturally want their products recognized for what they are, favoring the designation "real" to set them apart from products that are non-dairy, but enough alike in packaging and appearance to be confusing to the consumer.

"Wisconsin is one state that has passed legislation to label substitute dairy products, as 'artificial'," says Vernal S. Packard, dairy products specialist with the University of Minnesota's Agricultural Extension Service. The Minnesota Legislature is considering the same type of legislation.

A 1978 U.S. Food and Drug Administration proposal - never finalized - would have required a dairy food substitute to be labeled imitation if it was nutritionally inferior. The label would have read "substitute" if the food contained appropriate levels of certain defined nutrients.

Ideally, substitutes or imitations should supply all the nutritional benefits of what they are displacing. Many just don't, according to Packard.

Imitation low-fat milk and non-dairy creamers often make such claims as "contains no cholesterol" or "no animal fat." These may be true, but consumers may believe this means they are acceptable for use in low-cholesterol, fat-modified diets. However, these products may contain hydrogenated coconut oil and 90 percent to 95 percent of the fatty acids of hydrogenated coconut oil are saturated and not recommended for use in low-cholesterol diets. Skim or possibly low-fat milk would be the better choice for consumers concerned with cholesterol and saturated fat intake. With the skim and low-fat milk come important nutrients such as calcium, riboflavin and protein, Packard emphasizes.

Nutritional values of half-and-half, lacking in the non-dairy creamers, won't be missed if the creamer is merely used in a cup of coffee a couple of times a day. But it will be missed if it is being substituted as a replacement for milk on cereal and fruit. The non-dairy product provides energy (calories), but often lower amounts of the various nutrients found in milk.

If consumers find all this confusing on trips to the grocery, health professionals, too, are confused about the nutritional content of imitation and substitute foods, according to the February issue of Nutrition News, a National Dairy Council publication. It reports that recently four children in Los Angeles developed kwashiorkor (severe malnutrition such as that found in

African children and characterized by anemia, potbelly, loss of skin pigmentation and loss of hair or hair turning red) after their physician prescribed a non-dairy creamer to treat a suspected milk-protein sensitivity. After six weeks to six months on this non-dairy creamer, all children in this instance developed hypoproteinemia, edema and liver abnormalities.

Packard says it illustrates how inappropriate use of such foods can have bad results. "The consumer should be cautioned not to use non-dairy products for purposes for which they were never intended." Someone out of work might see a quart of frozen coffee creamer as a less expensive substitute for fluid milk, might dilute it and use it as milk. "They need to be aware of the pitfalls, the potential nutritional hazards," he says. He suggests letting tests be the guide on whether to use dairy or non-dairy toppings, but not to substitute any of it for a staple such as milk.

He mentions that cheese substitutes could have an effect on the nutritional profile of Americans. Some of the processes used in producing cheese substitutes are less expensive so the price to consumers can be less. "Curing cheese is a process that takes 3 to 12 months and there are costs involved," he describes. A frozen cheese pizza could contain no natural cheese, rather imitation or substitute cheese. Cheese served in salad bars, tacos or cheeseburgers may or may not be natural cheese.

Existing requirements for nutritional labels are not explicit enough for consumers to know exactly what nutrition they are buying. Nutritional labels on real, imitation and substitute products must list their contents for only eight of more than 40 known essential nutrients, says Packard.

If conventional foods are being displaced by imitations and substitutes, the result can be a quite different nutrient content in the diet.

Swine Diets Based on Amino-Acid Digestibility

In the future, it may be possible to formulate more efficient diets for swine that are based on amino-acid digestibility, according to scientists at Texas A & M University.

Nutritionists have been aware for many years that not all the nutrients in feedstuffs, as determined by chemical analyses, are biologically available to the pig.

"This is most important in amino-acid nutrition," according to Drs. T.D. Tanksley and Darrell Knabe, swine nutritionists with the Texas Agricultural Experiment Station," since diets, because of cost factors, are usually formulated to meet the requirement for the first limiting amino acid, on a total amino acid basis.

"However, if the digestibility of amino acids, particularly the first two or three most limiting in practical diets, differ among feedstuffs, formulations may not provide the levels needed for optimum growth."

A rough comparison would be if you filled your car's tank with gasoline of the wrong octane.

"This is the reason," Knabe says, "that during the past two decades much work has been directed toward determining amino acid digestibility.

The first most commonly used procedure for determining amino acid digestibility for pigs was the fecal-index method.

"Using this procedure, digestible amino acid values represent the amount of amino acids in the feedstuff that disappear over the total digestive tract.

Such values for a wide range of feedstuffs have been used extensively in formulating diets, particularly in Europe and the Scandinavian countries.

However, Tanksley says recent experiments show that when protein and free amino acids were infused into the pig's large intestine, most of the nitrogen that disappeared was not retained, indicating that the compounds are not used for protein synthesis by the pig.

The main thrust of present research is to conduct feeding trials to determine the value of using digestible, rather than total amino acid values, in formulating diets, using a wide range of feedstuffs. Preliminary results look promising.

Tanksley and Knabe both caution that they need to determine digestibility for several samples of the same feed before recommending widescale application of the data. They point out that obtaining digestibility values at the end of the small intestine requires much time and effort, therefore their future goals are to:

1. Predict amino acid digestiblity in a feedstuff from nitrogen digestibility (nitrogen digestibility is relatively easy to obtain and amino acid digestibilities in a given feedstuff can be related to N digestibility accurately).
2. Predict nitrogen digestibility in a feedstuff from rapid, economical in vitro tests.

Much work will be required to make all this possible, but it is a realistic goal to which the A & M researchers are dedicated. When this new series of standards are widely available, our feeding resources for swine will be expanded and costs reduced.

For more information contact: Science Writer, Dept. of Agricultural Communications, Texas A & M University, College Station, TX 77843.

NMC Accomplishments

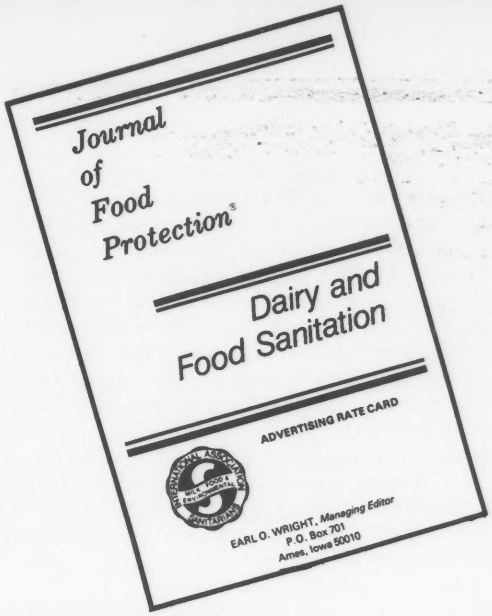
One of the important functions of NMC is to encourage and facilitate mastitis research. Through its Research Committee, NMC has undertaken many projects. Several have dealt with standardization of laboratory methods. A major achievement was the development of the Direct Microscopic Somatic Cell Count, a method now accepted as the standard for somatic cell counting.

Another key effort was the publication, "Microbiological Procedures for the Diagnosis of Bovine Mastitis." Now in its second edition, this book outlines accepted procedures for bacteriological diagnosis and is used widely in diagnostic and research labs around the world.

A worthwhile research thrust has been to develop standard methods for evaluating mastitis control products. A goal is to help dairymen know that products they buy are safe and effective. To meet this need, NMC developed three protocols for testing teat dips. Today, nearly all U.S. testing of teat dip effectiveness is done using these protocols.

In various ways, NMC has tried to bring together and summarize available information on mastitis. "Current Concepts of Bovine Mastitis," is a concise summary of practical information dealing with mastitis. It has helped assure that dairy farm advisors provide consistent and reliable information.

Ask Earl.



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Major Responsibilities

Milk and Food Quality Control	49.20%
General Sanitation	18.50
Laboratory	15.20
Teaching, Research	9.70
Industry (other than quality control)	7.40
	100.00%

The circulation of the *Journal* is international and averages 4000 copies per month. *Dairy and Food Sanitation* circulation averages 2500 copies per month.

Dairy Quality

This DAIRY QUALITY column will discuss the presence and effect of thermoduric psychrotrophic bacteria in milk. Thermoduric psychrotrophic bacteria are those organisms that will survive pasteurization and grow at refrigeration temperatures. The term, psychrotrophic bacteria, is used to describe organisms that are capable of growth at refrigeration temperatures regardless of their optimum growth temperature. Psychrophilic bacteria is the term used to describe bacteria that grow best at refrigeration temperatures. However, organisms that are capable of growth at refrigeration temperatures can cause quality defects regardless of their optimum growth temperature.

During the past 20 years there has been a change in the microflora in raw and pasteurized milk. Every-other day farm pickup, long distance hauling, silo storage of raw milk, and higher pasteurization temperatures are responsible for this change. In addition to these changes, a longer refrigerated storage before consumption of pasteurized milk has brought about a concern for the thermoduric psychrotrophic bacteria in milk.

Early studies report that psychrophilic bacteria found in milk were destroyed with proper pasteurization. However, recent studies have reported that a small percentage of the thermoduric bacteria found in milk are pschrotrophic. For example, Mikolajcik and Burgwald (3) found that 5% of thermoduric isolates were capable of growth at 7.2C. Also, Boyde et. al (1) found that 17% of thermoduric isolates were capable of growth at 5C. Washam, et al. (6) found that 135 of 700 thermoduric isolates survived 72C for 16 seconds, and were able to re-establish growth at 7.2C.

While these studies showed a small percentage of thermoduric bacteria to be psychrotrophic, their mere presence in milk is reason for concern. With a need for extended shelf-life in milk, very small numbers of thermoduric psychrotrophic organisms can cause quality defects. For example, Shehata, et al (5) found strains of *Bacillus circulans* and *Bacillus laterosporus* and *Bacillus coagulans* to have generation times of 5.0, 5.5, and 7 hours; respectively, in milk at 7.2C. Therefore, with an initial population of 1 organism per 100 mls of milk, one could expect populations near 130,000,000, 10,000,000 and 120,000/ml in 7 days given these generation times. These bacterial populations are estimated by using the formula (log b log a N log 2), assuming that the cells are in the exponential growth phase. However, more common generation times might be 15-20 hours, in which case it would take additional time to reach populations over 1,000,000. The point is however, that it is not the quantity of thermoduric psychrotrophic organisms in milk, but their generation time that is the key factor in determining the effect of thermoduric psychrotrophic organisms on product quality.

A large percentage of the thermoduric psychrotrophic organisms found in milk are sporeformers (2,4,6). Sporeforming bacteria are those bacteria, which under certain conditions, can develop into a resistant form (spore) which permits their suurvival to heat treatments or other environmental stresses. Therefore, these organisms are able to survive pasteurization and; in fact, may be heat activated during the pasteurization process. Sources of psychrotrophic spore-formers would include...mud, dirt, water and dust on the farm, as well as soiled equipment. These organisms are usually responsible for a quality defect known as sweet curdling. However, these organisms can also cause fruity, bitter, and unclean flavors.

Spore-forming bacteria are gram positive rods, therefore, if microscopic examination of colonies obtained from 7-day counts (plate counts) reveal a high percentage of gram positive rods, one could speculate that thermoduric psychrotrophic bacteria are responsible for quality defects. This could also be further supported by the presence of sweet curdling as a quality defect. Another laboratory procedure that may help identify this problem is suggested by Mikolajcik (2), that involved lab pasteurization of 100-200 mls of milk at 176F for 10 minutes. Following this heat treatment, a Standard Plate Count is performed and the plates incubated at 45F for 10 days. The remainder of the lab pasteurized milk is incubated for 7 to 14 days at 45F and replated. If large populations are observed in these incubated milk samples, one can speculate that a psychrotropic thermoduric problem exists. Also, observe the flavor, odor and possible sweet curdling formation.

The significance of gram positive thermoduric psychrotrophic organisms becomes increasingly important as the dairy industry is able to control the post-pasteurization contaminants and extend the shelf-life of milk to 15-20 days. Generally speaking, if a dairy is experiencing post-pasteurization contamination, gram negative organisms will be responsible for poor quality products. Therefore, the first task of the dairy industry is to control the post-pasteurization contaminant. However, one must maintain a concern for the thermoduric psychrotrophs.

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St. Louis — in the heart of it all

You are invited to attend the 70th Annual Meeting of IAMFES, August 7-11, 1983 at the Marriott Pavillion in beautiful St. Louis, MO. Educational meetings, interminglings with fellow professionals and entertainment has been planned for this yearly event. You'll also enjoy the Ralston Purina Farm outing and dinner. Spouse's entertainment is once again an outstanding attraction. Don't miss it!

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New Product News

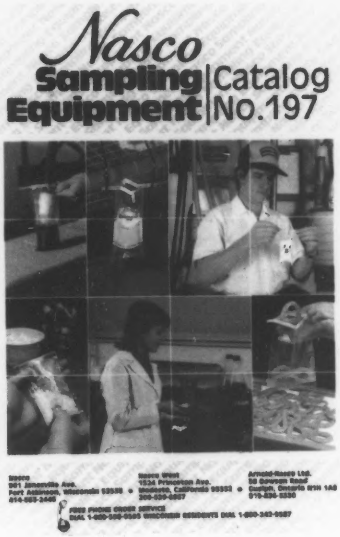
•The latest Sampling Equipment Catalog is now available from Nasco, Fort Atkinson, WI. This updated catalog includes equipment and materials for dairy, DHIA, veterinary, food, medical, water, sewage, soil, and forage sampling.

The catalog features Nasco's Whirl-Pak Bag, and describes it basic features, advantages, and uses. It also provides pertinent facts concerning sampling, laboratory facilities, and methods of application for Whirl-Pak Bags.

The 36-page catalog also includes the Whirl-Pak Sodium Thiosulfate Sampling Bag, recently approved by the Environmental Protection Agency for testing potable water. Official use approval of Whirl-Pak Bags for other uses is also included.

Educational materials from the National Mastitis Council are also available through this catalog. Choose from selected brochures, publications, and slide programs. Several slide programs developed by Nasco for instruction on Whirl-Pak Bags are also listed.

This comprehensive catalog also includes sampling spoons, scoops, and dippers; sediment testers; bottle brushes; water bath racks; carrying racks; thermometers; test bottles and pipettes; Babcock test calipers; dairy lab equipment; and grain probes and samplers.



Nasco Sampling Equipment Catalog

•Babson Bros. Co., builder of Surge dairy farm equipment, has designed a heat exchanger specifically for small-scale dairy producers, who want to reduce milk cooling and water heating costs.

The "Half" Kube Kooler is half as big as the original Kube Kooler, but it is just as efficient. It circulates well water or ice water through a copper waterway which surrounds the stainless steel milkway. The water pre-cools the milk, while the milk heats the water.

The unit is ideal for small milkrooms - it measures just over 12 in. deep. It can be suspended from the ceiling or mounted on the wall to upgrade present milk cooling systems or reduce the initial cost of the condensing units for a milk cooling system. The Half Kubes can also be used as the third heat exchanger in large instant cooling systems or side-by-side to reduce height requirements.

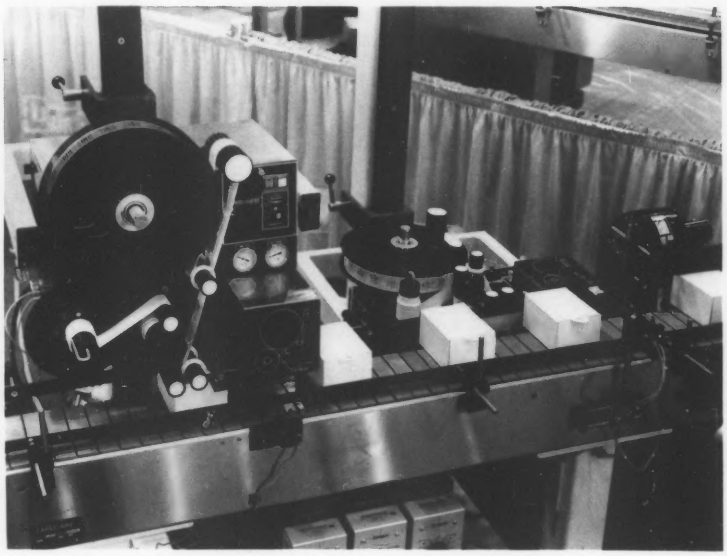
For more information contact your Surge dealer, or write: Babson Bros., Co., 2100 S. York Rd., Oak Brook, IL 60521.

•Manufacturers of health care and food products can meet new FDA packaging requirements faster because of Label-Aire's quick turnaround in producing and shipping new tamper-evident labeling systems.

The new equipment can apply inexpensive, permanent seals to boxes or bottles as they pass in the normal flow of operations. Manufacturers need not alter current package design since Label-Aire's application method ensures accurate placement over both top and bottom box edges and around uneven bottle neck and caps surfaces. A wide range of adhesives and materials is available, including destructible vinyls, acetates and mylars to match packaging materials with end-use requirements. Pressure sensistive materials may be printed with the "distinctive design" mandated by the new ruling.

Label-Aire systems are available to apply the required warning label, advising that the product should not be used if the tamper-evident seal is broken.

For more information contact: Label-Aire, 3801 Artesia Blvd., Fullerton, CA 92633. 800-854-0469 or 714-994--5400.



New tamper-evident labeling systems from Label-Aire.

High-persistance teat dip introduced by Monarch Chemicals Div. of H. B. Fuller Co.

•PROTEK, a new ready-to use, extrastrength, high-persistance teat dip has been introduced by the Monarch Chemicals Division of H. B. Fuller Company, St. Paul.

A chlorhexidine-based teat dip, PROTEK, has proved to be 99.999 percent effective against six major mastitis-causing organisms on both the AOAC Germicidal and Detergent Sanitizer Test, as modified by the National Mastitis Council, and the NMC excised teat model.

PROTEK teat dip has been fortified with a low level quaternary ammonia chloride specifically developed to be effective against gram-negative organisms.

The formulation also includes a thickener to hold the chlorhexidine on the teat to maintain protection, and emollients to condition teat skin at levels in line with NMC guidelines.

Manufactured with soft water to insure effectiveness, PROTEK is packaged at ready-to-use strength and requires no dilution. It is produced under strict quality control specifications, and tested four times before packaging. PROTEK teat dip is suppplied in convenient one and five gallon packages with safety labels.

For more information contact: Monarch Chemicals Division, 3900 Jackson Street NE, Minneapolis, MN 55421.

•A tunnel type case washer from Girton Manufacturing Company washes, scrubs and rinses up to 50 dairy or beverage cases per minute.

Model GCB40-BD is equiped with four long bristle brushes which are drenched with detergent as they rotate around the top, bottom, and sides of soiled cases. The brush treatment is preceded by a large volume, high pressure detergent washing which loosens accumulated soil. The detergent solution is removed by a pressurized rinse.

The washing, scrubbing and rinsing compartments are designed with lift-off covers and clean-out doors for easy access.

Girton Manufactures other models to wash from five to 120 cases per minute.

For more information contact: Earl Trump, Girton Manufacturing Company, Millville, PA 17846. 717-458-5521.

A classified guide to the capabilities and services offered by more than 175 food testing laboratories and consulting organizations has just been made available by the Institute of Food Technologists.

The 1983 IFT "Classified Guide to Food Industry Services" is organized into 16 categories of services, such as chemical components, quality assurance, nutrition and toxicology. Each supplier is assigned a code number, which is then listed under the appropriate categories.

The description of each organization listed includes a discussion of the testing capabilities and consulting services offered by the organization. The guide also carries the name and phone number of the director or contact person of each organization, as well as the full address of its headquarters location.

The 52-page two-color directory is available from IFT Regional Guide, Lockbox 94332, Chicago, IL 60690 for $10 per copy, postpaid.

•A new 17 page brochure featuring a complete line of butterfly valves with in-line adjustable seats for sanitary and industrial applications is being offered by Bay State Controls Corporation of Worcester, MA.

The Bay State Control Disc-O-Seal Butterfly Valve Brochure is available at no cost from Bay State Controls Corporation.

For more information contact: Bay State Controls Corporation, Robert Prescott, Marketing, 51 Union St., Worcester, MA 01608.

AFFILIATE NEWSLETTER . . .

Iowa Association Meeting Highlights

The Iowa Association of Milk, Food and Environmental Sanitarians annual meeting was held March 24, 1983 at Little Amana, Iowa.

Newly elected officers were; Ray Ormond, President; President Elect, Derward Hanson; First Vice-President, Ralph Sander; Second Vice-President, Monty Berger and Secretary-Treasurer, Jeanette Weber.

Twenty year membership awards were given to Arthur J. Eckerman, Dr. William S. LaGrange and Gregory L. Mauman.

Topics of speaker presentations ranged from Sodium in Our Diet...Dairy Support Program Potentials, to Computers on the Farm.

Virginia Association Meets in Blacksburg

The Virginia Association of Sanitarians and Dairy Fieldmen met March 1-2, 1983 at the Donaldson Brown Continuing Education Center in Blacksburg, VA.

Honorary Members elected were: James Schools, Lewis Fraughnaugh, Francis Schockey, H.E. Snidow, and Russell Jameson.

Officers for the upcoming year include: President, Wendell Smith; First Vice President, Joe Satterfield; Second Vice President, Greg Snow; and Secretary-Treasurer, W. J. Farley, Jr.

The program includes such timely topics as HOW MANY GRADES OF MILK? by Dr. Joe Meiser, Director, Dairy Inspection Branch, Ontario Ministry of Agriculture and Food, Toronto, Canada; and a panel discussion on Antibiotics which included very interesting remarks by dairy farmer, Edgar Garnet, Charlottesville, VA.

Meeting Highlights from South Dakota

The South Dakota Environmental Association met at Howard Johnson's Motor Lodge in Sioux Falls, SD, April 20-22, 1983.

Officers elected were: Mr. James F. Lawler, President; Ms. Cathy Meyer, President Elect; and Mr. Morris V. Forsting, Secretary-Treasurer.

The Sanitarian of the Year Award was presented to Mr. Bruce W. Baren, and a scholarship was awarded to Ms. Shayna Dickey.

Topics presented during the 35th Annual Educational Conference included: Containment and Isolation of Toxic Chemical by Terry Dosch; Insect Pests of Public Health Importance and Their Control by Dr. Emmett Easton; and Aflatoxin I & II, The Problem and What's Being Done by Dr. George Torrey.

The 1984 meeting is scheduled for April 25-27, 1983 at the Staurolite Inn, South Dakota State University, Brookings, SD. For more information on the 1984 conference contact: Morris V. Forsting, Secretary-Treasurer, 1320 S. Minnesota Ave., Room 101, Sioux Falls, SD 57105.

Left to right, James F. Lawler, President; Morris Forsting, Sec/Treas.; Cathy Meyer, President Elect.

Doug Kozel (left) 82-83 President and Harold Schultz, S.D.E.H.A.'s delegate to the 1982 IAMFES meeting, displaying '82 Shogren Award, awarded to S.D.E.H.A.

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Bruce Hamilton
Economics Laboratory
Toronto, Ontario, Canada

Calendar

1983

East Tennessee State University's twenty-seventh annual Environmental Health Institute will run June 6- August 12, 1983, and will offer both Graduate and Undergraduate credit for the two summer sessions. Subjects covered are: Water Supplies and Wastewater Treatment, Air Pollution, Solid Waste Management, Toxicology, Water Pollution, Hazardous Waste Management, Biological Analysis, Food Sanitation, Environmental Health Practice, Ergonomics, and Environmental Health Planning. The first session begins June 6th and the second session begins July 12. For further information, contact: Dr. Vay Rodman, Department of Environmental Health, Box 22960A, East Tennessee State University, Johnson City, TN 37614.

July 3-8, 1983---67TH ANNUAL SESSION OF THE INTERNATIONAL DAIRY FEDERATION, Oslo, Norway. For further information, contact Harold Wainess, Secretary U.S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093, 312-446-2402.

July 9-14, 1983-ANNUAL EDUCATION CONFERENCE, National Environmental Health Association, Holiday Inn Scope, Norfolk, VA. Contact: Leon F. Vinci, Director of Health, City of Middletown, Middletown, CT 06457-1300.

July 16-23, MICROBIOLOGY WORKSHOP, Kansas State Univ. For more information contact: Dr. Daniel Fung, Call Hall, KSU, Manhatten, KS 66506, 913-532-5654.

July 18-22, 1983 BAKING PRODUCTION TECHNOLOGY FOR SPANISH SPEAKING BAKERS, Manhatten, KS. For more information contact: Donna Mosburg 913-537-4750.

July 25-29, 1983 SECONDARY PROCESS AND INGREDIENTS IN COOKIE PRODUCTION, Manhattan, KS. For more information contact: Donna Mosburg 913-537-4750.

August 1-5, 1983-"BIOTECHNOLGY: MICROBIAL PRINCIPLES AND PROCESSES FOR FUELS, CHEMICALS AND INGREDIENTS" Massachusetts Institute of Technology, Cambridge, MA 02139. Contact: Director of Summer Session, MIT, Room E 19-356, Cambridge, MA 02139.

Aug. 7-11, 1983---70th ANNUAL MEETING OF IAMFES. Marriott Pavilion, St. Louis, MO. For more information contact: Kathy R. Hathaway, IAMFES, PO Box 701, Ames, IA 50010, 515-232-6699.

Aug. 7-11, 1983---23rd ANNUAL MEETING, THE HOSPITAL, INSTITUTION, AND EDUCATIONAL FOOD SERVICE SOCIETY. Fairmont Hotel, New Orleans, LA. HIEFSS Expo '83 will be open on August 9 and 10. For more information contact: Carolyn Isch, Assistant Executive Director, HIEFSS, 4410 West Roosevelt Road, Hillside, IL 60162, 312-449-2770.

Aug. 14-19, 1983---5th WORLD CONFERENCE ON ANIMAL PRODUCTION, Nihon Toshi Center, Tokyo, Japan. For more information contact: The 5th WCAP Conference Secretarial, c/o National Institute of Animal Industry, Tsukuba Norindanchi, PO Box 5, Ibaraki 305, Japan.

Sept. 7-9---SYMPOSIUM ON LACTIC ACID BACTERIA IN FOODS: GENETICS, METABOLISM AND APPLICATIONS. Wageningen, The Netherlands. Organized by The Netherlands Society for Microbiology. For more information contact: Dr. P. M. Klapwijk, Unilever Research Laboratory, P. O. Box 114, 3130 AC Vlaardingen, The Netherlands.

Sept. 14-15, 1983 NEBRASKA DAIRY INDUSTRIES ASSOCIATION 29TH ANNUAL CONVENTION, Bellevue, NE. For more information contact: T. A. Evans, Executive Secretary, 134 Filley Hall, East Campus, UN-L, Lincoln, NE 68583.

Sept. 18-23---SIXTH WORLD CONGRESS OF FOOD SCIENCE & TECHNOLOGY, Dublin, Ireland. For more information contact: Sixth World Congress of Food Science and Technology, Congresses & Exhibition Ltd. 44, Northumberland Rd., Dublin, 4, Ireland.

Sept. 20-22---NEW YORK STATE ASSOCIATION OF MILK AND FOOD SANITATION ANNUAL MEETING. Hotel Syracuse, Syracuse, NY. For more information contact: David Bandler, Stocking Hall, Cornell University, Ithaca, NY 14853.

Sept. 21-22, 1983 FOURTH ANNUAL JOINT EDUCATIONAL CONFERENCE, Olympic Spa & Resort, Oconomowoc, WI. For more information contact: Jon R. Dresser, PO Box 7883, Madison, WI 53707.

Sept. 30, 1983 FOCUS ON FOOD SYMPOSIUM V: Practical Food Flavor Analysis, Kansas State University. Emphasis on recent developments in flavor analysis by instruments and sensory panels. For more information contact: Dr. Richard Bassette, Dept. of Animal Science and Industry, 913-532-5654.

Oct. 2-5, 1983 EASTERN FOOD SCIENCE AND TECHNOLOGY CONFERENCE, Planning Today for Tomorrow's Foods. Host Farms, Lancaster, PA. For more information contact: Gary L. Hargus, Registration Co-Chairman, Campbell Soup Company, Campbell Place, Box 57B, Camden NJ 08101. 609-964-4000 Ext. 2882.

Oct. 22-26 FOOD AND DAIRY EXPO '83, McCormick Place, Chicago, IL. For more information contact: Dairy and Food Industries Supply Association, 6245 Executive Blvd., Rockville, MD 20852, 301-984-1444.

October 26-28---WORKSHOP IN FOOD FLAVOR: A HANDS ON COURSE IN FLAVOR DEVELOPMENT, MANUFACTURE, AND USE. For more information contact: G. Reineccius, Department of Food Science and Nutrition, Univ. Of MN, St. Paul, MN 55108.

Nov. 2-4, 1983 9TH ANNUAL FOOD MICROBIOLOGY RESEARCH CONFERENCE, Chicago, IL. For more information contact: Dr. J. M. Goepfert Canada Packers, Ltd., 2211 St. Clair Avenue West, Tornonto, CN M6N 1K4.

1984

April 25-27, 1984 SOUTH DAKOTA ENVIRONMENTAL HEALTH ASSOC. ANNUAL MEETING. Staurolite Inn, South Dakota State University, Brookings, SD. For more information contact: Morris V. Forsting, Secretary-Treasurer, 1320 S. Minnesota Ave., Room 101, Sioux Falls, SD 57105.

August 3-9, 1984---IAMFES ANNUAL MEETING, Edmonton, Alberta, Canada.

Nov. 22-24, 1984---14th ANNUAL SYMPOSIUM ON THE ANALYTICAL CHEMISTRY OF POLLUTANTS, 3rd International Congress on Analytical Techniques on Environmental Chemistry-Expoquimia, Barcelona Spain. For more information write: Av. Reina Ma. Christina Palacio No. 1, Barcelona-4 Spain.

JFP Abstracts

Abstracts of papers in the July Journal of Food Protection
To receive the Journal of Food Protection in its entirety each month call 515-232-6699, ext. A.

Influence of Processing on Bacteriological Quality of Frozen Shrimp, Rabia Zuberi, R. B. Qadri and Pirzada M. A. Siddiqui, Marine Food Division, Pakistan Council of Scientific and Industrial Research, Karachi-39, Pakistan and Department of Microbiology, University of Karachi, Karachi, Pakistan

J. Food Prot. 46:572-577

Line and finished product samples (668) from two shrimp processing plants located at the Karachi fish harbor were collected and examined bacteriologically. Frozen shrimp samples (100) collected from Plant A had the following bacterial profile: average (geometric) total aerobic plate count 9.4×10^6 CFU/g; MPN coliforms 94/g; and MPN fecal coliforms 41/g. The bacterial profile of 114 frozen shrimp samples from Plant B were 8.3×10^6 CFU/g, 180/g and 133/g for total plate count, MPN coliform and MPN fecal coliforms, respectively. Samples (126) of raw and laboratory-processed (simulating commercial processing) shrimp were also examined. Processing conditions of Plant A were better and resulted in a better quality end-product as compared to that of Plant B. Three of 338 samples from Plant B yielded *Salmonella*. The composition of microbial flora was nearly the same for both species of shrimps from both plants. Pseudomonads were the predominant microflora followed by *Micrococcus* sp. When shrimp were handled expeditiously under good sanitary conditions in the laboratory, the bacterial counts were significantly lower than on shrimp from the plants. Laboratory-processed shrimp had an average (geometric) total aerobic plate count of 8.1×10^5 CFU/g and average (geometric) coliform and fecal coliform MPNs were <3/g.

Effect of Reduction and Replacement of Sodium Chloride on Rancidity Development in Raw and Cooked Ground Pork, K. S. Rhee, G. C. Smith and R. N. Terrell, Department of Animal Science, Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas 77843

J. Food Prot. 46:578-581

Ground pork (raw and cooked) was treated with NaCl, KCl or $MgCl_2$ at ionic strengths of either 0.70 or 0.35, and stored at 4 or -20°C. Regardless of storage temperature, NaCl and $MgCl_2$ increased rancidity of both raw and cooked samples, whereas KCl increased rancidity of raw samples only. In raw pork samples, NaCl increased rancidity the most. In cooked samples, $MgCl_2$ increased rancidity more than NaCl when samples were stored at 4°C, but the opposite was true for samples stored at -20°C. Discoloration was most severe for raw, frozen samples treated with NaCl. Replacement of NaCl with KCl was most effective for decreasing rancidity in both raw and cooked samples.

Microanalytical Quality of Wheat Flour, John S. Gecan and John C. Atkinson, Division of Microbiology and Division of Mathematics, Food and Drug Administration, Washington, DC 20204

J. Food Prot. 46:582-584

A survey was made to determine the sanitary quality of wheat flour. Samples were collected and analyzed by the USDA Federal Grain Inspection Service under the quality check program for contract government purchases. The Association of Official Analytical Chemists' method for light filth in flour was used to extract fragments of insects, feathers and rodent hairs; insect heads, larvae, mites and psocids. Insect fragments were most frequently encountered: 83% of the samples contained insect fragments, with counts ranging from 0 to 721 and a mean of 12.52. Ranges of other counts were rodent hair fragments, 0 to 75; feather barbules, 0 to 3; insect heads, 0 to 2; mites, 0 to 2; insect larvae, 0 to 3; psocids 0 to 1.

Gamma Irradiation Effects on Carbohydrate Composition, Growth of Microorganisms and ESR Spectra of Gum Arabic (*Acacia senegal L.*), H. A. Bokhary, A. M. Hassib and A. A. A. Suleiman, Department of Botany and Department of Physics, College of Science, King Saud University, Saudi Arabia

J. Food Prot. 46:585-588

Natural gum Arabic (*Acacia senegal* L.) showed appreciable growth of microorganisms in different growth media. Fungi isolated were three species of *Aspergillus, Alternaria* sp., *Curvularia* sp., and *Helminthosporium* sp., and dominant bacteria isolated were four species of *Bacillus, Serratia marcescens* and *Micrococcus varians*. No algal growth was observed. Gamma irradiation with ^{60}Co (53 Kr/h) eradicated all fungi isolated except *Alternaria* sp. which required 13.25 Krad irradiation and *Alternaria* was sp. completely eradicated with 39.75 Krad irradiation. Bacterial growth was reduced dramatically with 13.25 Krad and with 39.75 Krads of irradiation, and was completely stopped with 106 Krads. Hydrolyzed carbohydrates showed very little change, quantitatively, in both natural and irradiated gum, and paper chromatographic separation showed the presence of glucuronic acid, galactose, rhamnose and arabinose. The unirradiated gum did not show any ESR signal. The irradiated samples gave resonance lines that increased in intensity as the irradiation dose was increased. The g-value of the resonance lines was calculated as 1.004 ± 0.001. Use of gamma irradiation as a means of irradiating microorganisms without severe damage to the carbohydrate composition, but with minor changes in the ESR spectrum of gum is discussed.

Comparison of Restructured Chops Manufactured from Prerigor and Postrigor Pork, N. G. Marriott, P. P. Graham, and K. P. Bovard, Departments of Food Science and Technology and Animal Science, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061

J. Food Prot. 46:589-591

Restructured chops from prerigor (P) and conventionally boned (C) pork were unsalted (U) or salted (S) with 2.0% sodium chloride (NaCl) and 0.25% sodium tripolyphosphate (STP). After storage for 5, 14 and 42 d, samples were subjectively evaluated for amount of discoloration, consumer desirability, juiciness, tenderness and flavor. Objective measurements included Hunter color difference meter readings and TBA values. Generally, objective and subjective appearance traits and flavor deteriorated ($P<0.05$) with increased storage time. No consistent differences ($P>0.05$) in subjective and objective appearance traits and flavor were found between P and C samples. Objective and subjective evaluations revealed that salted P and C chops were generally inferior ($P<0.05$) in appearance but not different ($P>0.05$) from unsalted P and C samples in flavor. No differences ($P>0.05$) in tenderness and juiciness existed between P and C samples, whereas salted (P and C) chops were generally more ($P<0.05$) tender and juicy than unsalted counterparts. Samples with higher juiciness scores usually had superior tenderness scores. No consistent differences ($P>0.05$) were found between chops manufactured from prerigor pork and conventionally boned counterparts.

Quantitative Determination of Colorants in Dried Shrimp and Shrimp Paste Using Ion-Exchange Extraction and High Performance Liquid Chromatography, Yasuhide Tonogai, Amara Kingkate and Chaweewon Halilamian, National Institute of Hygienic Sciences, Osaka Branch, 1-1-43, Hoenzake, Higashiku, Osaka, Japan and Division of Food Analysis, Department of Medical Sciences, Yod-se, Bangkok 10100, Thailand

J. Food Prot. 46:592-595

A method is proposed for extraction of colorants from proteinous foods (dried shrimp and shrimp paste) and for their determination by high performance liquid chromatography (HPLC). Water-soluble colors were extracted by liquid-liquid partition with the aid of a liquid anion exchange resin (Amberlite LA-2) after elution with an ethanol-ammonia mixture from the sample, where colors were released from protein. Colors were then re-extracted from the resin layer into an aqueous solution, followed by HPLC determination. The HPLC conditions using a reverse-phase partition type column (Zorbax C_8) and ammonium acetate as eluant, were acceptable for various kinds of colorants. The proposed method gave recovery values of more than 62.0% for color at 100 ppm and of more than 76.0% for color at 1,000 ppm; an actual survey of colorants was carried out for 44 samples.

Shelflife Characteristics of Bacon Processed with Various Levels of Sodium Nitrite and Potassium Sorbate, B. W. Berry, J. A. Quick, L. W. Douglass and I. N. Tennent, Meat Science Research Laboratory, ARS, S&E, USDA, Beltsville, Maryland 20705 and Department of Dairy Science, University of Maryland, College Park, Maryland 20742

J. Food Prot. 46:596-600

Shelflife characteristics of lean color, lean surface discoloration and off-odor were evaluated on vacuum-packaged sliced bacon processed under commercial operations in four separate plants. In addition to the normal processing variations at each plant, three formulations with various levels of sodium nitrite and potassium sorbate were used: (*a*) 0 ppm sodium nitrite, (*b*) 40 ppm sodium nitrite-2600 ppm potassium sorbate and (*c*) 120 ppm sodium nitrite. Bacon was evaluated after 0, 2 and 4 d of simulated retail conditions following 10, 30, 50 and 70 d of storage under refrigerated dark conditions. Bacon processed with 0 ppm sodium nitrite underwent more lean surface discoloration than bacon processed with the other two formulations. The amount of lean surface discoloration, presence of undesirable colors and off-odor scores were similar between the 40 ppm sodium nitrite-potassium sorbate formulation and the 120 ppm sodium nitrite formulation except for the plant which employed a low salt-high sugar formulation. In this situation, especially with longer periods of storage and retail display, the 120 ppm sodium nitrite formulation yielded less surface discoloration, a lower frequency of undesirable colors and less off-odor than the 40 ppm sodium nitrite-2600 ppm potassium sorbate formulation. The occurrence of off-odor generally increased uniformly as a function of longer storage time regardless of sodium nitrite-potassium sorbate levels and processing plant variations.

Acetoin and Diacetyl Formation by *Streptococcus lactis* subsp. *diacetylactis* DRC3, S. M. El-Gendy, H. Abdel-Galil, Y. Shahin and F. Z. Hegazi, Department of Food Science, University of Assiut, Assiut, Egypt

J. Food Prot. 46:601-604

Cells of *Streptococcus lactis* subsp. *diacetylactis* DRC3 which had been grown on lactose in the presence of citrate were unable to form acetoin and diacetyl (AD) from citrate when suspended in succinate buffer, pH 4.4. Inclusion of both a source of energy and nitrogen in the buffer was necessary for AD formation. Concentrations of AD and D at pH 4.4 were about five and three times the concentrations at pH 6.4. The amounts of AD and D from citrate were about eight and two times those from pyruvate, calculated on a molar basis. It appears that D, at least, is formed not only from pyruvate arising during citrate cleavage, but also from acetyl-CoA resulting from a probable citrate breakdown in a reversible reaction of a citrate synthetase. The rate of AD formation, under optimum conditions, was 0.047 μmoles mg (dry wt^{-1}) cells ml^{-1} min^{-1}. Pyruvate-grown cells produced little AD from pyruvate. AD production was inhibited partly by acetate and completely by acetaldehyde. Cetylpyridinium chloride at a concentration higher than μg ml^{-1} suppressed AD production from citrate because of the absence of interfering compounds normally present in milk.

Bacteriological Evaluation of Meat Processor Sanitation Practices, Robert R. Williams, Carroll W. Farmer, Moohi Park, Leo A. Pokorny and H. Michael Wehr, Oregon Department of Agriculture, Agriculture Building, Salem, Oregon 97310

J. Food Prot. 46:605-609

One hundred eleven meat processing establishments were randomly selected and surveyed using standardized bacteriological swabbing and inspection procedures. A major objective of the survey was to determine if differences in equipment sanitation exist between processors classified by frequency of regulatory inspection, i.e., federal > retail > custom processors. Swabs were taken of five equipment categories, including cutting tables, bandsaws, grinders, knives and miscellaneous items, using three

swab sets per equipment item, fifteen swab sets per processor. Each swab set consisted of three swabs to test for the aerobic plate count (APC, 35°C), coliform and *Escherichia coli*, and coagulase-positive *Staphylococcus aureus*. Overall swab scores and APC means indicate that processors receiving the greatest frequency of inspection have the lowest bacterial contamination of equipment. Processors receiving the least inspection have the highest contamination. The APC means for all equipment items were excessive. Failure to properly clean and/or sanitize equipment was determined to be the primary cause of excessive bacterial contamination. The survey results indicate that programs based on visual inspection alone may not result in acceptable equipment sanitation.

Attenuation of Microbial Growth on Modified Atmosphere-Packaged Fish, R. J. H. Gray, D. G. Hoover and A. M. Muir, Department of Food Science and Human Nutrition, University of Delaware, Newark, Delaware 19711

J. Food Prot. 46:610-613

Four species of fish from Atlantic waters, *Meronia americanus* (perch), *Cynoscion regalis* (seatrout), *Micropogon undulatis* (croaker) and *Pomatomus saltatrix* (bluefish), were processed (gutted or filleted), packaged under carbon dioxide and refrigerated. Stability of the fish under the modified atmosphere preservation (MAP) system was compared to that of fish stored conventionally. Use of the MAP system resulted in a 45 to 55% increase in stability, primarily due to an extension in the lag phase of psychrotrophic organisms and to their reduced growth rate in the logarithmic phase. By the 10th day of storage, the conventionally packed fish always exhibited a 100-fold higher psychrotroph count than the CO_2-packed fish. Levels of *Vibrio parahaemolyticus* were negligible in this MAP system and no *Salmonella* spp. or *Staphylococcus aureus* was detected, even at an abuse temperature (10°C) of storage. Positive evidence for preformed *Clostridium botulinum* toxin was lacking.

Evaluation of Inosine Monophosphate and Hypoxanthine as Indicators of Bacterial Growth in Stored Red Meat, Nicholas Parris, Samuel A. Palumbo and Thomas J. Montville, Eastern Regional Research Center, Philadelphia, Pennsylvania 19118

J. Food Prot. 46:614-617

Newly developed high performance liquid chromatography (HPLC) methods demonstrated that changes in inosine monophosphate (IMP) and hypoxanthine occurred during storage of beef held at 5°C. The inability of a spoilage organism *(Pseudomonas fluorescens)* to metabolize nucleotides in broth culture suggested that there was not a causal relationship between bacterial growth and these changes. Experiments designed to selectively inactivate (a) the bacteria flora of meat but not its enzymes (treatment with γ-irradiation or ethylene oxide), (b) meat enzymes (inoculating autoclaved meat with pure cultures of bacteria) or (c) both bacteria and meat enzymes (uninoculated autoclaved meat) demonstrated that changes in IMP and hypoxanthine levels were the result of activity of endogenous meat enzymes.

Comparison of Rappaport-Vassiliadis Enrichment Medium and Tetrathionate Brilliant Green Broth for Isolation of Salmonellae from Meat Products, V. Kalapothaki, P. Vassiliadis, Ch. Mavrommati and D. Trichopoulos, Department of Hygiene and Epidemiology, University of Athens Medical School, Goudi, Athens 609, and the Hellenic Pasteur Institute, Athens 618, Greece

J. Food Prot. 46:618-621

The effectiveness of Rappaport-Vassiliadis enrichment medium (RV medium) and Difco's tetrathionate brilliant green broth (TBG) for detection of *Salmonella* in 553 samples of meat products was compared. All samples were preenriched for 20 h in buffered peptone water. Then 0.1 ml of the preenrichment was inoculated into 10 ml of RV medium, 1 ml was added to 9 ml of TBG broth, and 1 ml was inoculated into 10 ml of Muller-Kauffman (MK) tetrathionate broth. All enrichments were incubated at 43°C for 24 h, except for MK broth which was incubated for 48 h, and all were subcultured onto brilliant green deoxycholate agar and bismuth sulfite agar. The Rappaport-Vassiliadis medium was superior to Difco's tetrathionate brilliant green broth, being considerably more sensitive and more specific. The superiority of RV medium concerned the number of positive samples (36% and 28%, respectively), and also the number of *Salmonella* serotypes and strains. The RV medium inhibited the lactose- and sucrose-negative competing organisms much more than the Difco's tetrathionate broth. The performance of Difco and Muller-Kauffman tetrathionate brilliant green broths was similar. Addition of the brilliant green solution after boiling the tetrathionate broth slightly increased its efficacy. The effectiveness of brilliant green deoxycholate agar and bismuth sulfite agar was similar, whether after enrichment in RV medium or in any of the studied tetrathionate brilliant green broths.

Impedance Measurements to Detect Post-pastuerization Contamination of Pasteurized Milk, R. G. Bossuyt and G. M. Waes, Government Station for Reserach in Dairying, Brusselsesteenweg 370, B-9230 Melle, Belgium

J. Food Prot. 46:622-624

Investigated was whether, or to what extent, impedance measurements are suitable to detect post-pasteurization contamination of pasteurized milk by gram-negative bacteria. Results were compared with those obtained with the benzalkon-crystal violet-ATP method (BC-ATP method). When 1-L portions of milk, containing agents selective for gram-negative bacteria (0.06% benzalkon and 0.002% crystal violet), were incubated at 30°C, a detection time of less than 24 h was found for post-pasteurization contaminated milk. When post-pasteurization contaminating gram-negative bacteria were absent in pasteurized milk, the detection time varied between 26 and 52 h. In total, 83 samples were investigated. This study shows that impedance measurements are useful to trace post-pasteurization contamination of pasteurized milk. The detection time obtained as such for 1-L portions does, however, not give sufficiently reliable information on the degree of contamination. Suitable information could be obtained by investigating different milk portions, as in the BC-ATP method.

Use of Radioimmunoassay to Determine the Nature, Quantity and Source of Allergenic Contamination of Sunflower Butter, John W. Yunginger, Mary B. Gauerke, Richard T. Jones, Mary Jo E. Dahlberg and Steven J. Ackerman, Department of Pediatrics and Internal Medicine (Allergy), Mayo Medical School, and Allergic Diseases Research Laboratory, Mayo Clinic and Foundation, Rochester, Minnesota 55905

J. Food Prot. 46:625-628

A girl known to be allergic to peanuts experienced a mild allergic reaction after eating sunflower butter, a peanut butter facsimile prepared from sunflower nuts. After learning that the same manufacturing plant also produced peanut butter, we examined several sunflower butter preparations for peanut butter contamination by a solid-phase radioimmunoassay which used naturally-occurring immunoglobulin E (IgE) antibodies from known peanut-sensitive individuals. Peanut butter contamination, ranging from 0.3 to 3.3%, was found in six of eight sunflower butter samples, including both creamy and chunky varieties, and including lots prepared with either peanut oil or palm oil. We concluded that inadequate cleaning of food processing machines following peanut butter production permitted the contamination by peanut butter of subsequent jars of sunflower butter in amounts which could pose risks to peanut-sensitive individuals.

Immediate and Residual (Substantive) Efficacy of Germicidal Hand Wash Agents, A. Z. Sheena and M. E. Stiles, Department of Food Science, Foods and Nutrition, and Microbiology, The University of Alberta, Edmonton, Alberta, Canada T6G 2M8

J. Food Prot. 46:629-632

A range of commercial hand wash agents was compared against 4% chlorhexidine gluconate (Hibitane) for immediate and residual (substantive) germicidal effect in hygienic hand disinfection. Chlorhexidine gluconate (4%) liquid detergent gave an immediate and residual reduction in number of microorganisms released from finger tips after a short exposure (15-s) hand wash. An iodophor product containing 0.75% available iodine gave comparable results for the immediate reduction of microorganisms released, but it did not give a residual effect. Other products, including those containing Irgasan DP 300, *para*-chloro-*meta*-xylenol (PCMX), or low concentration iodophor (0.005% available iodine) as the active ingredient, did not give an immediate or a residual reduction in microorganisms released from finger tips.

Stability of Aflatoxin M_1 During Manufacture and Storage of a Butter-like Spread, Non-fat Dried Milk and Dried Buttermilk, Dana W. Wiseman and Elmer H. Marth, Department of Food Science and The Food Research Institute, University of Wisconsin-Madison, Madison, Wisconsin 53706

J. Food Prot. 46:633-636

Butter-like spread, non-fat dried milk and dried buttermilk were prepared from cream, skim milk and buttermilk that were naturally contaminated with aflatoxin M_1 (AFM_1). Four batches of butter-like spread were prepared from pasteurized cream in a home-style churn. Cream, buttermilk, spread and water from two rinses were monitored for weight and AFM_1 content. Most of the AFM_1 appeared in buttermilk or water from the first rinse. Butter-like spread and water from the second rinse had only small quantities of AFM_1. During refrigerated storage for 1 month and frozen storage for up to 2 months, the AFM_1 content was variable but toxin remained in the butter-like spread. Variability probably resulted from the analytical procedure rather than from actual changes in content of AFM_1. Four batches of skim milk and three of buttermilk were freeze-dried and then stored at 22°C for up to 4 months. Both non-fat dried milk and buttermilk were reconstituted with water and were then extracted to recover AFM_1. The AFM_1 content remained stable in both products through drying and 4 months of storage.

Epidemiology of Milk-Borne Diseases, Frank L. Bryan, Department of Health and Human Services, Public Health Service, Centers for Disease Control, Atlanta, Georgia 30333

J. Food Prot. 46:637-649

Secular trends in milk-borne diseases in the U.S.A. show numerous outbreaks associated with ingestion of raw milk in the early 1900s until the end of World War II. Diseases common in this period, but no longer milk-borne, were typhoid fever, scarlet fever, septic sore throat, diphtheria, tuberculosis, shigellosis, and milk sickness. Milk-borne and milk-product-borne diseases rarely reported somewhere in the world were botulism, *Escherichia coli* enteritis, *Pseudomonas aeruginosa* enteritis, listeriosis, *Clostridium perfringens* enteritis, *Bacillus cereus* gastroenteritis, Haverhill fever, Q fever, hepatitis A, poliomyelitis, toxoplasmosis, histamine intoxication and hypertension. After most milk was pasteurized, outbreaks decreased dramatically. Milk-borne diseases of contemporary importance in the U.S.A. are salmonellosis, campylobacteriosis, staphylococcal intoxication, brucellosis, and yersiniosis. These have usually been associated with ingestion of raw milk, certified raw milk, home-made ice cream containing fresh eggs, dried milk, pasteurized milk which was contaminated after heat processing, or either cheese made from raw milk or cheese in which starter activity was inhibited during its manufacture.

Foodborne Disease in Canada - a 5-year Summary, E. C. D. Todd, Foodborne Disease Reporting Centre, Bureau of Microbial Hazards, Food Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 46:650-657

Five years of foodborne disease surveillance in Canada were examined. Microorganisms, particularly *Salmonella* spp., *Staphylococcus aureus* and *Clostridium perfringens,* were the main etiologic agents, but diseases also resulted from contamination of food with chemicals and parasites or food containing naturally-occurring plant and animal toxins. The foods involved were, in general, potentially hazardous items, such as meat and poultry. Where information is known, most of the problems associated with foodborne illness occurred at foodservice establishments, but the impact of mishandling in homes and food processing establishments was also great. The kinds of data accumulated were similar to those from the United States for the same time period. In order to reduce the prevalence of foodborne disease, specific educational and enforcement programs have to be initiated. Similar approaches could be taken for both countries.

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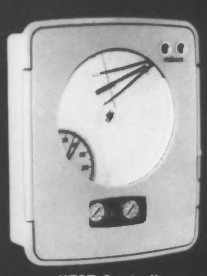
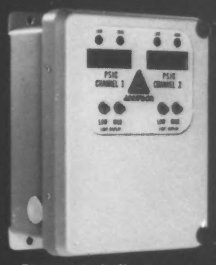
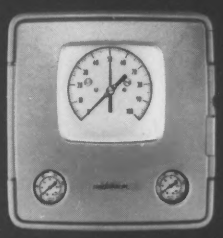


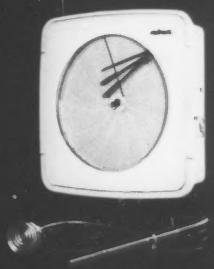
HTST Controllers



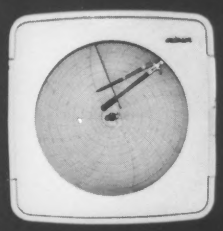
Electronic Indicators



Indicating Controllers



CIP Recorders



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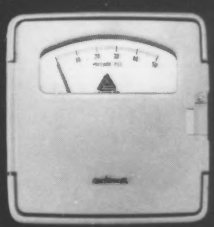
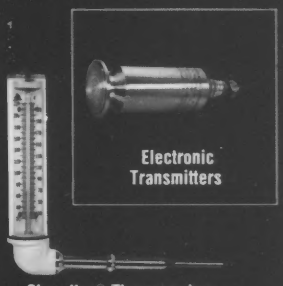


Pneumatic Transmitters

Pressure Gauges



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Reliability... we build it in and back it up

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The way we look at it, the Surge MQA man has earned his Masters in the dairy business. As the business gets more and more competitive in the years to come, he could come in mighty handy in helping you—or your neighbor—get ahead.

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