Specific Cost Studies

Many associations, from time to time, make special studies of particular costs or groups of costs. This type of information is, of course, similar to general cost analyses in that it is used as a basis for study of costs in the individual concern.

The International Association of Ice Cream Manufacturers has made studies of this kind. One bulletin of the Association, for example, deals with trucking practices and costs in the ice cream industry. The survey of trucking practices was tabulated to show types of delivery, length of routes, etc., in the various regions. Trucking costs were studied on three principal bases—size of trucks, i. e., capacity; method of refrigeration, i. e., by ice and salt, solidified carbon dioxide, etc.; and by regions.

From this information, a member in any locality can judge how his trucking costs compare with those of his competitors, and whether some different method of delivery might be more economical.

Public utilities have problems which are considerably different from those found in the ordinary manufacturing industries, but there is some work being done in this field in regard to certain kinds of costs. The American Gas Association, for example, made an analysis of publicity and advertising expenses of gas companies. This study covered such topics as how appropriations are apportioned among various media, and percentages devoted to promotion and sale of new equipment and appliances, and other activities. Such figures give a point of departure in determining what amounts should be appropriated for promotional activity and in what ways these funds may be spent for maximum returns.

Labor Cost Statistics

In recent years, statistics pertaining to labor, as a cost of production, have been receiving a considerable amount of attention from trade associations. Labor statistics among associations of manufacturers cover such items as trends in total employment in the industry, trends in total payroll, average weekly and hourly earnings, average hours worked daily and weekly per employee. Payroll statistics are also broken down by regions and occupations.

The Hat Institute, in its monthly statistical bulletin, publishes figures on total number of employees and average weekly payroll and man-hours for the industry as well as average weekly wage, average hourly earnings, and average hours per week per employee. These statistics are given for various types of "productive" and "non-productive" employees during the particular month and corresponding month of the preceding year.

Another national association compiles similar figures, such as average daily hours of work, average hourly earnings, and average man-hours per ton of output by mills classified according to capacity and product. This classification of mill statistics gives members two bases of comparison; first, with mills of similar size; second, with mills manufacturing similar products.

Man-hour Costs

Industry labor statistics of this type compared with the figures of the individual concern show the relative labor costs of the concern on a "dollar-and-cents" basis; that is, whether the member unit's "man-hour" costs more or less than the industry average, or whether its "man-hour" cost is higher or lower than for similar units.

Labor cost statistics, in combination with production figures, may be used in the calculation of such indices of labor efficiency as "man-hours" per unit produced, and labor cost per unit, as averages for the whole industry. Industry indices of this type, compared with figures of an individual unit, convey an idea of a concern's labor efficiency. The management of the individual concern, in its efforts to keep labor costs and "man-hours" per unit at a minimum, is aided by such industry labor cost data in that they establish a standard of costs above which, it is felt, costs of the individual concern should not go.

Labor statistics of this sort, in conjunction with production, price, cost of living, and other data, have been used in the determination of fair and equitable wage rates.

Efficiency in Distribution

Trade associations publish several kinds of statistics and studies concerning the distribution and marketing of products. This

type of activity has become important because the cost of selling and distributing goods frequently absorbs an appreciable proportion of gross revenue realized from the sale of these goods, and thus has a direct bearing on profits. Trade association studies in this field aid the sales departments of members in maintaining a high level of efficiency.

Two types of studies are market surveys and analyses of the channels of distribution. Market surveys aid executives in planning sales promotion programs. The analyses of channels of distribution reveal inefficient distribution methods and point the way to more efficient ways of getting goods to consumers.

Market Surveys

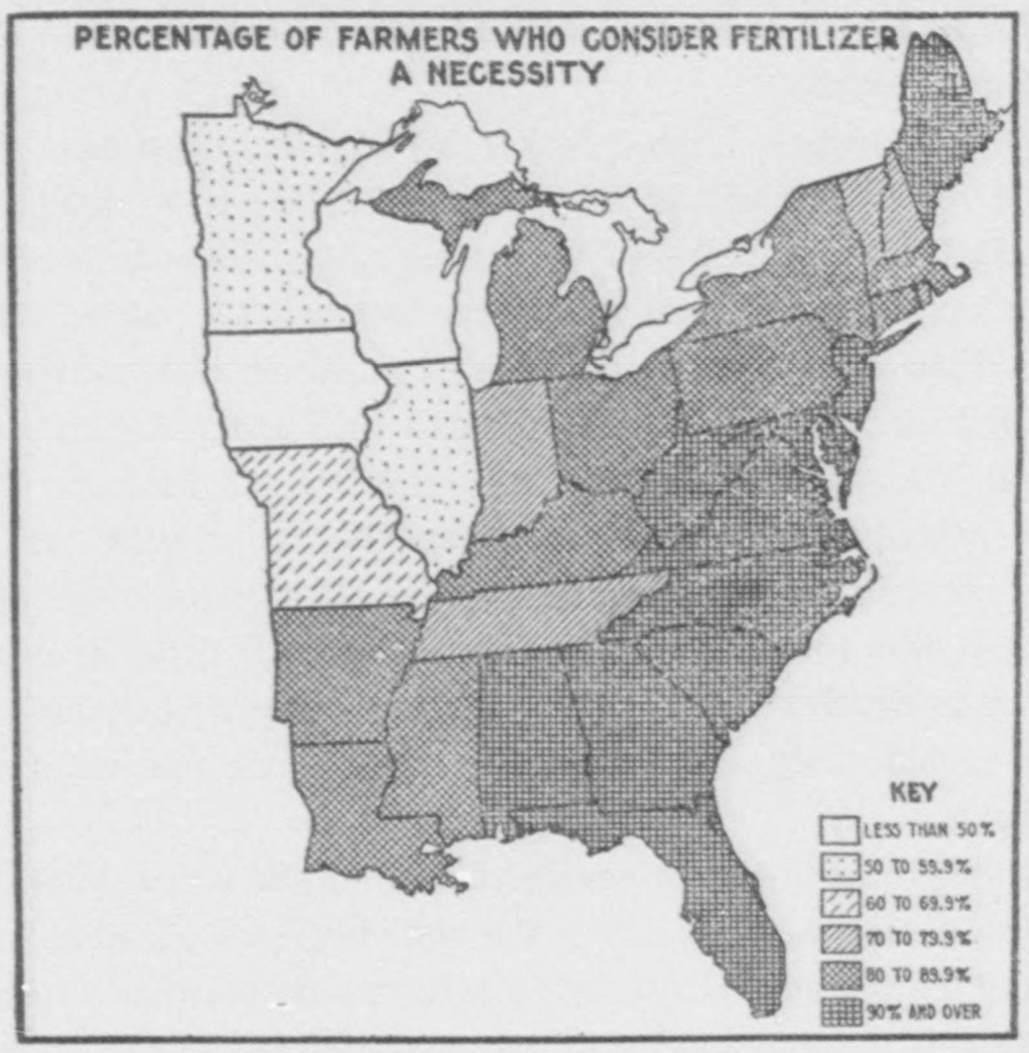
Naturally, costs of distribution and sales are lower in those localities where there is a demand for a particular commodity, where there is a purchasing power great enough to translate this demand into sales at a profitable price and where, in the case of consumers' goods especially, there is no prejudice against the product. Trade association market surveys disclose such regions, where, because of local conditions, a reasonable volume of sales may be expected and which will not require inordinate promotional efforts and expenditures to break down "sales resistance." Associations of manufacturers of industrial goods—that is, mill supplies, machine tools, and the like—likewise make market surveys. Surveys of this type locate manufacturing establishments which are actual or potential outlets for the products of members. Often, these establishments are grouped by locality and are classified according to value of product or capacity.

The National Fertilizer Association made a survey among farmers in thirty-five states. The purpose of this survey was, of course, to obtain dependable and representative information concerning the market for fertilizer. The tabulation of the results of this survey gave such useful data, by states, as percentage of farmers using fertilizer; estimated yield of various crops per acre with and without benefit of plant foods; considerations influencing farmers' choice of fertilizer; methods of financing purchases; and many other factors affecting the sale and distribution of fertilizer.

The members of the Association thus obtain information relative to the factors which influence the buying of fertilizer; which districts are responsive to sales efforts; and which districts require intensive education. These statistics, showing farmers' experience of increased yields because of the use of fertilizer are a strong sales argument. In general, this survey supplies a factual

MARKET SURVEY

National Fertilizer Association



Where Is the Market?

background for mapping out special or permanent selling programs.

Channels of Distribution

The International Association of Ice Cream Manufacturers has made studies of the relative importance of the various kinds of retail outlets for ice cream. The results point out that certain types of outlets, fairly large in number, account for little of the

industry's sales volume. The attention of members is called to the fact that the cost of selling and servicing dealers of this type are more per gallon than for outlets having larger sales volumes. It is further indicated that there is a relationship between the size of ice cream plants and the size of outlets they serve. Over a period of years, there is an increasingly large percentage of "unprofitable" accounts among all classes of producers, especially among the smaller manufacturers. The producer is therefore urged "to study carefully his new dealers and make sure he is not loading up" with dealers less profitable than those he is serving at present.

The cost study published by the National Confectioners' Association of the United States includes a survey of distribution methods and their relation to operating ratios. The results of this survey show that manufacturers producing a specialized line of goods distribute these goods through channels most adapted to the qualities of the particular product. While manufacturers of a general line of confectionery, as a whole, sell through wholesalers principally, they also sell appreciable amounts of their goods through other channels. Among this group of manufacturers, it was found that operating ratios vary considerably according to which channel is the principal outlet, operating profit being considerably smaller among those using one channel in particular.

Trade association cost statistics, like other association data, have as their purpose aiding the individual in forming sound management policies. Cost data establish a standard as a measure of competitive advantage, and give material aid to the executive in keeping costs at a minimum.

Association Cost Data Render Service to The Public

Trade association cost statistics, by aiding management in its efforts to reduce costs of all types and to eliminate sources of inefficiencies and waste, render a direct service to the public. As the members of an industry discover methods of producing and distributing goods at lower costs, savings are passed along to consumers in the form of lower prices which greater efficiency makes possible.

III

Price Statistics

SUMMARY

TRADE association price statistics come under four general classifications:

Price Indices
Open Prices
Average and Quoted Prices
Price Studies

Price Statistics:

(1) Are used by management in appraising general business conditions;
(2) Reveal the relationship of prices of the industry with the general price level, bringing to light trends in the purchasing power of the sales dollar;
(3) Disclose competitive advantage or disadvantage arising from changes in the relationship of the prices of the products of the industry and prices of substitute commodities;
(4) Provide a means whereby management is able to estimate whether the price policy of the individual concern gives it a competitive advantage over other units in the industry;
(5) Aid management in determining the price to be placed on specific articles, and whether existing differentials should be raised or lowered;
(6) Are used in conjunction with production and sales figures in arriving at production policies, thus assisting in budgeting purchases of materials and accumulation or depletion of stocks and inventories;
(7) Are of value, when used with sales estimates and "cost yardstick," in setting up a budget of expenditures;
(8) Identify most profitable lines or price ranges in which to concentrate;
(9) Aid management in forecasting profits or losses.

Price Statistics

FOR purposes of treatment, it is desirable to distinguish between prices received for merchandise and prices paid for raw materials and semi-finished goods. In the first case, prices of goods offered for sale are correlated to revenue; whereas, in the second case, prices of goods purchased are correlated to cost of production. Statistics relating to prices of materials purchased are considered in the previous section dealing with trade association cost statistics. The uses of trade association data concerned with *prices received* are described briefly in the following pages.

Price data published by trade associations fall into four general classifications: price indices, average prices and quotations, studies of prices and trends, and various kinds of price information issued in connection with "open-price" systems.

The Value of Price Information

Prices received by an industry reflect, in a general way, the relationship between demand and supply, and fluctuate when this relationship is seriously altered. Conversely, price movements themselves exert an effect upon production, sales, income, and profit. It is because of these considerations, of course, that trade association price information is of value to business executives. Such data convey to management, in a factual form, knowledge of developments under which business is being carried on and which are the basis of competition. These statistics, then, form a background for modifying individual business policies to meet new conditions.

Prices and Business Conditions*

The movements of a wholesale price index, computed from prices of primary materials such as copper, lead, pig-iron, cotton, rubber, etc., are frequently interpreted as forecasting prospects in general business. Changing conditions in the traditionally sensitive basic industries, it is claimed, foreshadow similar develop-

*See also "Price Indices"—Report of Domestic Distribution Department Committee, Chamber of Commerce of the United States, Washington, D. C.—1932.

ments in the secondary phases of business and are indicative of trends in national production and sales, employment, etc.

The National Fertilizer Association compiles and publishes a wholesale price index which is derived from the prices of such basic commodities as farm products, fertilizers, textiles, fuels, and metals.

The use of such an index in planning expansion or curtailing operations to parallel business activity is somewhat limited because of the fact that a general price index may also reflect changes in bank credit policy, speculation, and government monetary and fiscal policies. Nevertheless, movements in the general price level, even though not engendered by productive activity are significant. The setting in of what, from all points of view, seems to be a definite trend in prices may often be the signal for expansion or contraction, refunding and refinancing capital structures, on the basis that savings will thus be realized by anticipating such price movements.

The Industry and the General Price Level

The effects of trends in the general price level are more easily seen when such an index is compared with the sales price of the products of a specific industry.

The Rubber Manufacturers' Association includes in its regular statistical bulletin a wholesale price index compiled by a government agency. In conjunction with this index, the Association also publishes an index of rubber tire and tube prices, as well as average tire and tube prices in dollars and cents. This information supplies members with current knowledge of the relationship of prices of the principal products of the industry and prices as a whole.

The importance of this relationship lies in the fact that when prices of an individual concern are falling, as compared with prices as a whole, the prices received for products buy less than previously. On the other hand, when the prices received are rising relative to the general level, the sales dollar buys more. Thus net profit, even though it remain the same in dollars and cents, is directly affected by such relative changes, for it represents more or

less purchasing power, as the case may be. In some cases, depending on the nature of the market, relative changes in prices affect the industry's sales volume itself, sales becoming easier as the product becomes relatively cheaper, and falling off as it becomes more expensive in relation to other commodities.

Of course, the effects of changing price relationships pass with little notice when the change is slow, but, over a period of time, the profitableness of an industry is occasionally seriously affected. During periods of rapid price movements, the effects of relative industry price changes are especially apparent.

Trade association data bring relative price trends to the attention of management and aid in the determination of whether a particular development is favorable or unfavorable to the individual concern. With such information at hand, existing policies may be modified to meet new situations.

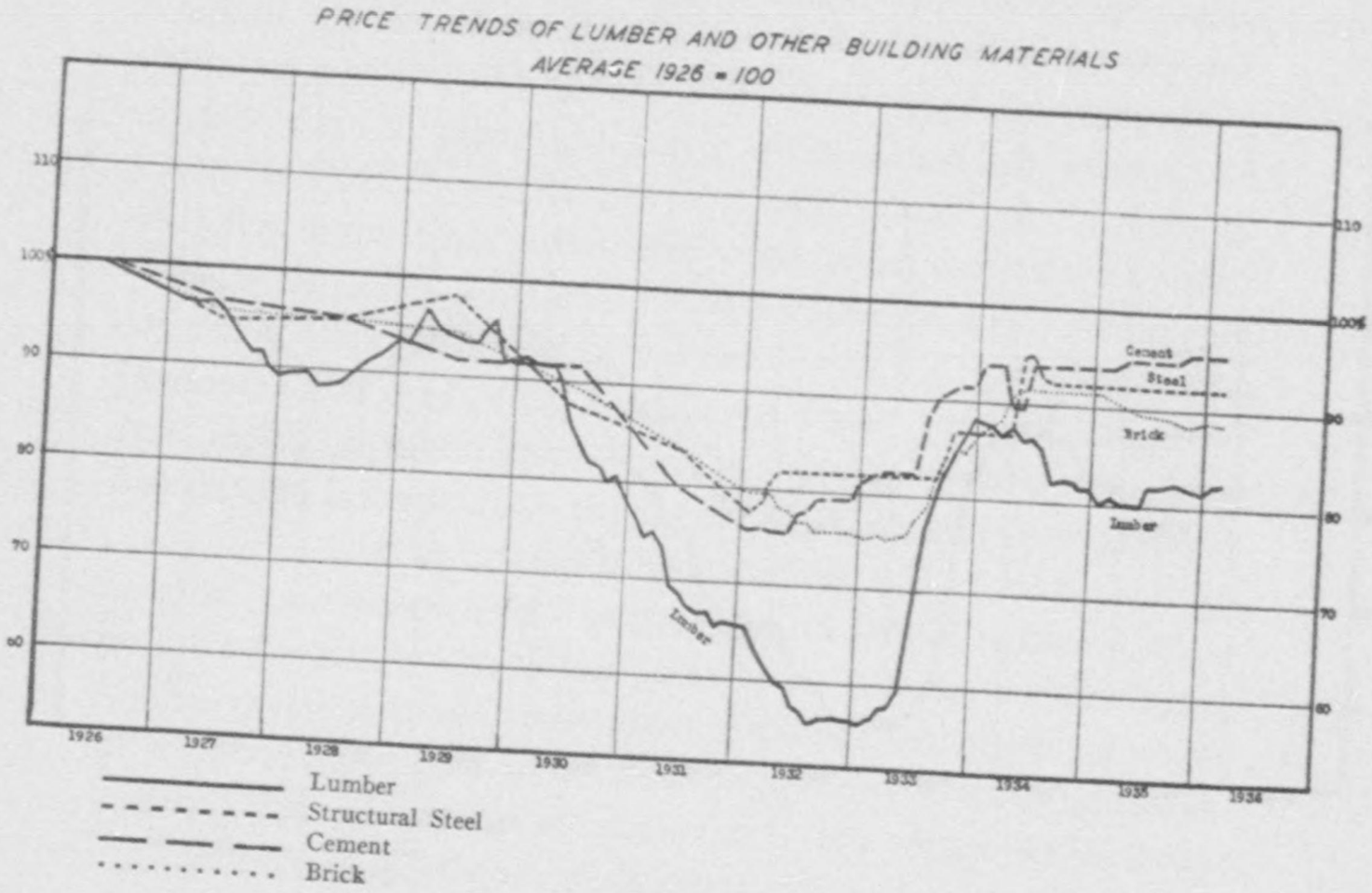
Prices of Competitive Commodities

In addition to being in competition with members of their own trade, manufacturers are often in competition, more or less direct, with other industries. This situation develops between groups of industries, the products of which are interchangeable for certain purposes to an appreciable degree. Inasmuch as price is an important factor in inter-industry competition, trade associations frequently publish data concerning prices of the competing products as well as their own. The National Lumber Manufacturers' Association, for example, has prepared a graphic study of price trends, over a number of years, of lumber and several competitive and semi-competitive building materials. A statistical agency in the textile field includes in its monthly bulletin information concerning the prices of several textile fibres.

Price data concerning competing industries reveal to management competitive advantages or disadvantages which may be developing as the result of changing relationships between the prices of "interchangeable" commodities. Ratios between the prices of competing commodities are established which reflect, in a general way, the relative values placed upon them by buyers. Under normal conditions, these prices fluctuate together so as to maintain these ratios or price differentials. From time to time, how-

ever, there are departures from these price ratios, so that one commodity is relatively cheaper than previously, or so that one commodity is "not worth the extra difference in price" over one that is cheaper. Of course, the new ratios may or may not be permanent, but inter-industry statistics distributed by trade associations aid executives in planning adjustments which they consider best in the light of attending circumstances.

NATIONAL LUMBER MANUFACTURERS ASSOCIATION



Prices of Competitive Commodities

Prices in the Industry

Trade association statistics of industry prices are of interest to management because, taking into account differentials arising from quality, patent-rights, good-will, and other considerations, price is one of the principal bases of competition.

Inasmuch as the relationship of price to competition is peculiar to every industry, the methods utilized by trade associations in presenting their price statistics vary considerably.

In cases where the products of the industry are not homogeneous, and the "per unit" price varies widely, the trade association is generally concerned with trends of prices rather than actual quotations. The Writing Paper Manufacturers Association includes in its statistical service to members a price index based on the prices of several kinds and qualities of writing paper. This index is presented in graphic form, extending back over a period of years so that trends become easily discernible. The Gray Iron Founders' Society utilized another method of showing price trends. Its survey disclosed the number of manufacturers who raised or lowered prices in each of the three years covered by the study.

On the other hand, where prices tend to be uniform, or nearly so, because the homogeneity of the commodity is such that the product of one manufacturer is very similar to that of others, trade associations frequently collect actual prices, or compile average prices. The American Dry Milk Institute publishes monthly the average f. o. b. factory and f. o. b. job point prices of its two principal products. The Evaporated Milk Association recently released a study of monthly maximum and minimum prices, over a period of twelve years, in New York. A statistical background of this nature facilitates the study of present trends.

Information issued in conjunction with "open-price" systems keeps members posted on current price developments. According to two government studies,* trade associations in many manufacturing fields have used, at one time or another, this device to provide members, and occasionally customers as well, with a picture of the market situation of the commodities in question.

Uses of Industry Price Information

The uses of association price statistics of various kinds are almost without number. Broadly speaking, such data are used by management in determining price, production and sales policies, and as a basis for budgeting costs. Statistics of prices in relation to other factors are adaptable to specific uses, such as forecasting, or give tangible confirmation to "hunches."

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*1. "Open-price Trade Associations"—Senate Document No. 226, 70th Congress, 2nd Session. Government Printing Office—1929.
2. "Price Filing under NRA Codes." National Recovery Administration—Division of Review. Work Materials No. 76.

Competitive Advantage

The most obvious use of trade association price data is the comparison by the individual concern of its prices with those of its competitors. The result of such a comparison indicates whether the concern is securing a more or less advantageous competitive position. Information so obtained casts a light on the desirability of the revision of the company's price policies. This comparison also helps to solve such questions as, "Are we losing possible sales because our prices are too high?" or, "Could we raise our prices without losing our sales volume, and thereby increase gross receipts and net profits?"

Putting a Price on the Product

A business concern sometimes adopts a policy of maintaining price differentials between their products and similar goods on the market. These differentials are very often determined by the class of consumers catered to—those who demand highest quality, or those who require a serviceable article at minimum cost.

Association price statistics are used in a similar manner by concerns which have a preeminent position due to reputation or other advantages, and are consequently able to ask higher prices than would otherwise be the case. The reverse of this situation is also found. New concerns and those whose goods have not yet built up "brand good-will" frequently follow a practice of selling under the generally prevailing prices. In all such cases, association price statistics are of value in the determination of the price which the individual seller will put on an article in order to sell it most advantageously.

Correlation of Statistics

The full significance of price developments, as registered by statistics, is frequently not apparent until these movements are studied in the light of other trends occurring within the industry and within competitive industries. For this reason, price statistics are examined in conjunction with other data collected by associations for the use of individual members.

Prices and Production

Through statistics, production and sales within the industry are studied to determine what effect price changes due to changing costs, for example, are having on sales volume. Likewise, trends in production are studied so that their effects on prices can be estimated. As the result of such an examination of available data, policies are adopted which are best suited to promoting the welfare of the individual concern.

Prices and Inventory Losses

The problem of the relationship of price trends and the accumulation or depletion of inventories is one which frequently confronts management. Executives must decide whether at a particular time stocks should be built up or disposed of in order that losses may not be incurred by selling at low prices goods manufactured during a period of high costs. Trade association statistics supply a factual basis upon which each individual concern can make decisions with a greater measure of assurance.

Prices and Capacity

The problem of prices in relation to utilization of capacity has been mentioned. In some industries it is especially important that the individual unit adopt prices which will enable it to maintain maximum sales volume and avoid the heavy losses arising from idle capacity. Thus, production and price policies of the concern must be coordinated if the maximum return under existing circumstances is to be realized.

Budgeting to Meet a Price

Trade association price statistics used in combination with a "cost yardstick," such as described in the previous section, are a valuable aid in budgeting costs. On the basis of sales and price statistics, a rough estimate of gross revenue for, say, the next six months, is obtained. The amount of this revenue to be absorbed by each of the various costs is then tentatively budgeted on the basis of "cost-yardstick" percentages. This budget, of course, is modified from time to time in the light of subsequent developments.

Sales by Price Ranges

Among consumers' goods especially, it is frequently found that an industry manufactures similar articles of varying quality designed to sell at various price ranges which represent the various income levels. In such industries, figures of sales volume are most useful when broken down to correspond with these established price ranges. The Automobile Manufacturers' Association makes a study of the trend of sales volume in each of the several wholesale automobile price ranges.

This type of statistical information frequently illustrates trends according to price ranges, some levels becoming more popular at the expense of the sales volume of others. Such figures aid management in deciding in which price ranges it will be most profitable to concentrate.

Prices and Profits

Profits, of course, are related to prices as well as costs. This relationship varies from one industry to another, depending on the way sales volume reacts to price fluctuations; that is, whether small reductions in price give rise to appreciably greater sales, or, whether sales are uncorrelated to price variations. The Tanners' Council of America recently made a study based on figures of a number of concerns to determine how prices and income are related in the tanning industry. It was found that over a number of years relatively small price variations caused large fluctuations in profits. If the mechanism of this relationship is known, earnings can be forecast on the basis of trends illustrated in the price statistics of the association.

Putting Price Data to Work

The opportunity to use price statistics in solving complex management problems arising from changes in production, sales, costs, and prices, is illustrated by the situation in one industry. Association data show that prices received for the products of the industry are rising, the prices of quality goods at a considerably faster rate than those of standard goods. However, except among a few high-

quality lines, costs of production are increasing more rapidly than sales prices.

It has been the experience of this industry that during periods of recovery increases in sales volume are most pronounced in quality lines; sales of ordinary goods, while increasing in total volume, do not rise proportionately. Through figures on stocks, it is shown that production and sales are well coordinated.

Taken together, these correlated trade association statistics indicate, according to a prominent executive in the industry, that most favorable possibilities for profit in this particular instance lie in concentrating on lines in the higher price ranges. Both sales volume and sales prices of quality goods can be expected to increase materially.

On the other hand, manufacturers of goods of ordinary quality, it is contended, will find it especially necessary to curtail costs and to utilize every opportunity for economy and savings inasmuch as costs of production are rising faster than sales prices. Since greater consumption will be reflected in a large measure by greater sales of quality goods, sales of standard goods, while mounting, may not be great enough to offset fully prospective narrower margins of profit. In the cases of both quality and standard goods, it is held that conditions of rapidly rising costs necessitate aggressive measures for efficiency.

Summary

Trade association price statistics thus aid management by bringing to light trends which might otherwise be overlooked. In that price statistics substitute fact for rumor, they aid in eliminating price fluctuations due to mere speculation. Price data, especially when used in conjunction with information bearing on supply and demand, provide executives with a factual background of conditions prevailing in the industry and are therefore of value in finding satisfactory solutions to the problems of management.

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April, 1937.
2M.

Reprint
April, 1940
3M

HYAMINES

1622 and 10-X

THE ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

HYAMINES

1622 and 10-X

HYAMINES

1622 and 10-X

INTRODUCTION

HYAMINE 1622 and 10-X are pure crystalline quaternary ammonium germicides and deodorants. They are colorless, odorless, stable, non-poisonous as used and effective at high dilutions against a wide variety of pathogenic micro-organisms.

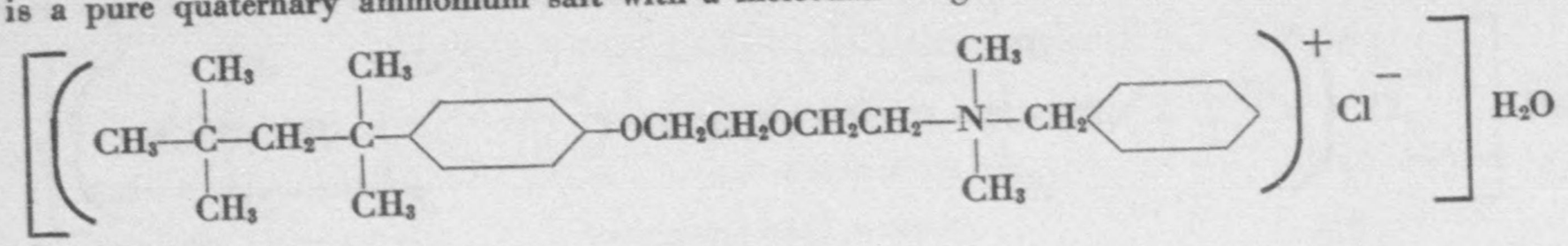
These crystalline germicides are readily formulated into solutions, powders, tablets, and proprietary pastes or ointments.

In suitable formulations, the HYAMINES contribute germicidal and deodorant properties to a variety of products. They are used in homes, restaurants, dairies and other food processing plants, and for general industrial or veterinary disinfection. In proprietary pharmaceuticals, the HYAMINES contribute both deodorant and antiseptic properties.

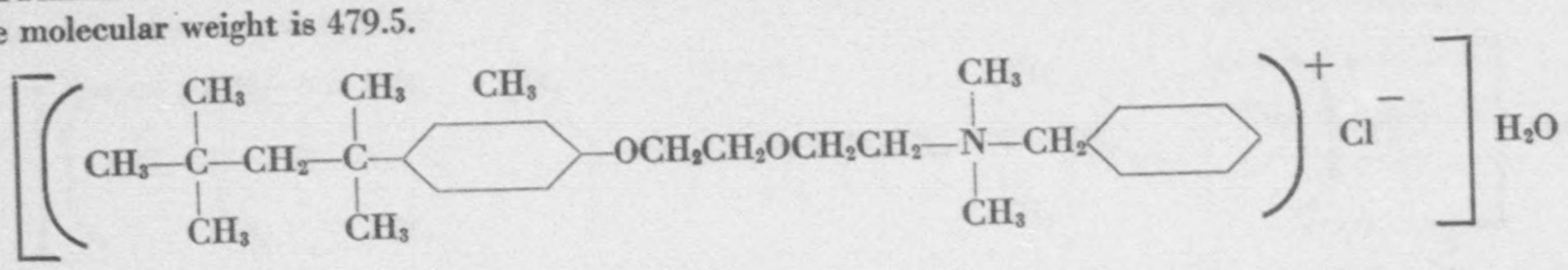
The range of uses for the HYAMINES is almost unlimited. Specific details for many applications can be supplied.

COMPOSITION

HYAMINE 1622 is di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride, monohydrate. It is a pure quaternary ammonium salt with a molecular weight of 465.5.



HYAMINE 10-X is di-isobutyl cresoxy ethoxy ethyl dimethyl benzyl ammonium chloride, monohydrate. The molecular weight is 479.5.



It will be seen from these structures that the HYAMINES do not contain *such corrosive elements* as phenol, iodine, hypochlorite, mercury or other metals. *They are, therefore, free from the disadvantages of such compounds.*

FORM AND AVAILABILITY

HYAMINE 1622 and 10-X are readily available in quantity as the pure crystalline monohydrates.

The HYAMINES were developed as the result of an extensive cooperative research program. There is an exclusive patent license agreement which restricts their use in the field of medicine but HYAMINE 10-X is available for use in antiseptic washes, mouth washes, tooth pastes, personal antiseptics and deodorants.

Both HYAMINE 1622 and 10-X are available for general food plant and industrial sanitation, disinfection and deodorization. Both are available for veterinary uses. Disinfection of surgical instruments may be recommended where this is not a primary label claim.

SOLUBILITY

Solutions containing over 25% by weight of the HYAMINES can be prepared with water, methanol, ethanol, isopropanol, propylene glycol, triethylene glycol, cellosolve, and methyl cellosolve. Additional solubilities in organic solvents are given in Table I.

TABLE I

Solubility of HYAMINE 1622

Solvent		*Temperature° C*	*Grams per 100 grams*
Xylene		10	0.01
		30	0.02
Tetrachlorethane		10	25.1
		30	54.1
Deodorized petroleum solvent		10	0.09
		30	0.02
Stoddard's solvent		10	0.01
		30	0.01
Ethylene dichloride / Carbon Tetrachloride	50–50	10	2.0
		30	18.9

COMPATIBILITY

The high molecular weight cation of the HYAMINES combines with some anions to form insoluble salts, removing the quaternary from solution and reducing the germicidal activity. Table II lists the order of

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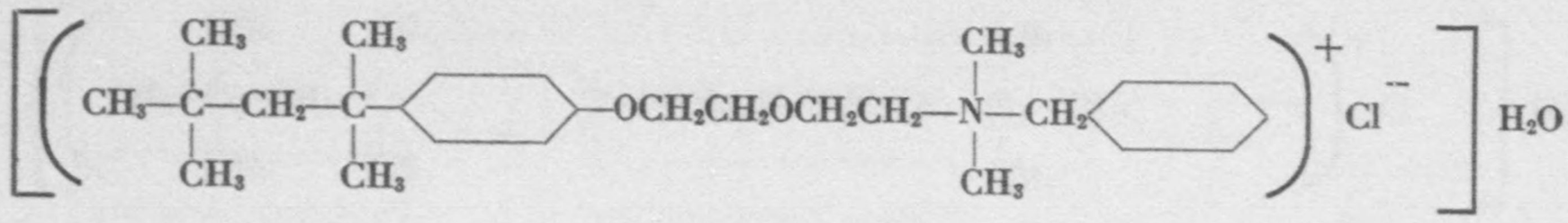

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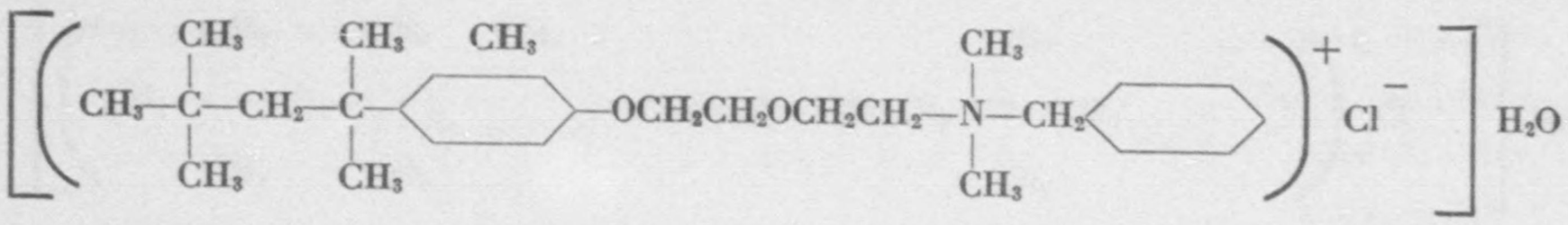

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		30	54.1
Deodorized petroleum solvent		10	0.09
		30	0.02
Stoddard's solvent		10	0.01
		30	0.01
Ethylene dichloride / Carbon Tetrachloride	50–50	10	2.0
		30	18.9

COMPATIBILITY

The high molecular weight cation of the HYAMINES combines with some anions to form insoluble salts, removing the quaternary from solution and reducing the germicidal activity. Table II lists the order of

TABLE II

Compatibilities of HYAMINE 1622

Compatible	*Partially Compatible*	*Incompatible*
Sulfuric Acid	Potassium iodide	Potassium Dichromate
Acetic Acid	Sodium Tetraphosphate*	Potassium Chromate
Hydrochloric Acid	Sodium Hexametaphosphate*	Sodium Metasilicate
Sodium Hydroxide	Sodium Tripolyphosphate*	Sodium Heptaphosphate
Potassium Hydroxide		Soaps
Aluminum Chloride		Anionic wetting agents
Calcium Chloride		
Zinc Chloride		
Sodium Acetate		
Sodium Sulfate		
Citric Acid	*Only in the presence of sufficient non-ionic wetting agent or other suitable solubilizer	
Sodium Nitrite		
Sodium Carbonate		
Sodium Bicarbonate		
Borax		
Trisodium Phosphate		
Tetrasodium pyrophosphate		
Non-ionic wetting agents		

compatibility with a number of compounds. Care must be taken to avoid the inclusion of incompatible materials in new formulas. Preparations should be checked to insure that the anti-microbial activity is sufficient to justify the label claims. Usually the absence of a precipitate in solution is good evidence of compatibility.

ANALYSIS

Analytical procedures are available for determination of the HYAMINE content of solutions and powders. Some of these are suitable for the field determination of the strength of sanitizing rinses. Details will be furnished upon request.

WETTING PROPERTIES

The HYAMINES are "invert soaps" having both detergent and wetting properties which can be enhanced by the addition of compatible alkaline detergents.

The surface tensions of various aqueous solutions of HYAMINE 1622 are recorded in Table III. Use solutions (100-200 ppm) have surface tensions of approximately two-thirds that of water, enabling the sanitizing solution to wet surfaces and to contact and kill organisms more readily than ordinary germicides.

Although the HYAMINES are not corrosive per se, commercial concentrates (1–10%) accelerate the rusting of steel and imperfectly galvanized or tinned steel or iron. This is due to their wetting ability. Aqueous solutions are usually shipped in glass or lacquer lined drums, although the addition of triethanol amine phosphate decreases rusting tendencies.

Use solutions (100–200 ppm) are generally no more corrosive than water. For such applications as the sterile storage of surgical or dental instruments, the addition of 0.5 to 1.0 percent sodium nitrite to the use solution is recommended.

TABLE III

Surface Tensions of HYAMINE 1622 Solutions

Per Cent *% solids*	*Parts per Million*	*Dynes per sq. cen.*
0.5	5000	34
0.1	1000	34
0.03	300	46
Dist. water		72

GERMICIDAL ACTIVITY

While most workers in the germicide field agree that the phenol coefficient method, as outlined in Circular 198 of the U. S. Department of Agriculture, is not entirely suitable for the evaluation of the germicidal activity of quaternary ammonium germicides, it remains the most generally accepted measure of bactericidal potency.

The phenol coefficient expresses the ratio of bactericidal potency of a substance to that of phenol when the two disinfectants act under identical conditions of time and temperature upon the same culture of organisms. This test shows the HYAMINES to be several hundred times more active than phenol against most pathogenic bacteria. Table IV presents the bactericidal dilutions of HYAMINE 1622 and the calculated phenol coefficients determined by the F. D. A. method. Table V records the bactericidal dilutions of HYAMINE 1622 against a variety of bacteria at several time intervals and temperatures as determined by another group of workers using the same method.

The antibacterial action of the HYAMINES has been evaluated by several other more or less empirical procedures. The high dilutions in which HYAMINE 1622 is bacteriostatic and bactericidal have been demonstrated by incorporating the germicide directly in a series of dilutions in a suitable broth medium, and inoculating with the culture of bacteria under investigation. The *bacteriostatic* titer was taken as the highest dilution which did not allow growth of bacteria after incubation for 24 hours. Those dilutions which still showed no growth after an additional 24 hours' incubation were subcultured in fresh sterile broth and incubated for 72 hours. If no growth occurred in the subculture tube, it was assumed that a *bactericidal* action had been obtained in the original tube. Results obtained by this procedure are presented in Table VI.

Among various objections to the F. D. A. test have been those that enough of the quaternary solution is carried from the medication tube to the subculture tube so as to produce bacteriostasis in the latter, and that because bacteria migrate to the walls of the container, the survivors are not picked up when transfers to the subculture tube are made. To overcome these objections a test was devised in which the antibacterial action in the medication tube was stopped after a 10-minute exposure period by the addition of a "quaternary-neutralizer" (sodium oleate). Ten times as much neutralizer as quaternary was added. The walls of the tube were thoroughly rubbed by means of a sterile cotton-tipped swab, and a portion of the mixture plated in nutrient agar. The results obtained with HYAMINE 1622 and phenol are given in Table VII. Even by this test, with stasis and interfacial tension effects eliminated, high dilutions are still extremely effective. It may readily be seen from the following tables that the HYAMINES exert a powerful germicidal action in high dilutions. They not only destroy the bacteria, but they do so rapidly.

TABLE IV

Bactericidal Activity of HYAMINE 1622

Organism	*Dilution bactericidal in 10 minutes @ 20° C.* *HYAMINE 1622*	*Phenol*	*Phenol Coefficient*
Eberthella typhosa	1:18,000	1:90	200
Staphylococcus aureus	1:25,000	1:60	410
Escherichia coli	1:20,000	1:70	285
Streptococcus pyogenes (C203)	1:30,000	1:90	330
Streptococcus fecalis	1:10,000	1:50	200
Shigella sonnei	1:30,000	1:80	375
Salmonella pullorum	1:18,000	1:90	200
Salmonella paratyphi	1:10,000	1:80	125
Listerella monocytogenes	1:60,000	1:60	1000
Brucella abortus	1:40,000	1:100	400
Salmonella suipestifer	1:17,500	1:90	165

TABLE V

Bactericidal Activity of HYAMINE 1622

Organism	*Dilution of HYAMINE bactericidal in 5 min. @ 20° C.*	*in 5 min. @ 37° C.*	*in 10 min. @ 37° C.*
Eberthella typhosa	12,000	20,000	20,000
Escherichia coli	12,000	15,000	15,000
Staphylococcus aureus	25,000	50,000	90,000
Streptococcus pyogenes	30,000	60,000	100,000
Pseudomonas aeruginosa	1,000	3,500	4,500
Diplococcus pneumoniae	80,000	120,000	180,000
Corynebacterium diphtheriae	45,000	90,000	120,000
Neisseria gonorrheae	.....	100,000	100,000
Neisseria intracellularis	.....	70,000	120,000
Hemophilus pertussis	.....	20,000	20,000

TABLE VI

Bacteriostatic and Bactericidal Titers of HYAMINE 1622

Organism		*Highest Dilution*	
Type	*Species*	*Bacteriostatic*	*Bactericidal*
Gram positive coccus	*Staphylococcus aureus*	1:2,000,000	1:32,000
Gram positive coccus	*Streptococcus pyogenes*	1:2,000,000	1:1,000,000
Gram positive coccus	*Streptococcus fecalis*	1:512,000	1:16,000
Gram negative coccus	*Neisseria catarrhalis*	1:2,000,000	1:512,000
Gram positive bacillus	*Clostridium welchii*	1:512,000	1:256,000
Gram negative bacillus	*Brucella suis*	1:256,000	1:128,000
Gram negative bacillus	*Eberthella typhosa*	1:32,000	1:32,000
Gram negative bacillus	*Proteus vulgaris*	1:16,000	1:4,000
Gram negative bacillus	*Pseudomonas aeruginosa*	1:4,000	1:1,000

TABLE VII

Survival Number of Staphylococcus aureus after Neutralization and Swabbing of Medication Tube

HYAMINE 1622 Dilution	*Number of Surviving Bacteria*	*Phenol Dilution*	*Number of Surviving Bacteria*
1:1,000	0	1:50	0
1:2,500	0	1:60	0
1:5,000	0	1:70	18,000
1:7,500	0	1:80	466,000
1:10,000	3,600	1:90	3,340,000
1:12,500	210	1:100	8,570,000
1:15,000	160,000		
1:17,500	471,000		

INFLUENCE OF ORGANIC CONTAMINANTS

Most germicides lose a portion of their activity in the presence of organic matter. This varies with the chemical nature of the germicide and the type and concentration of organic matter. As chlorine germicides depend on an oxidizing reaction to kill microorganisms, their effectiveness is greatly reduced by the presence of oxidizable organic matter. The HYAMINES are not oxidizing agents and therefore are not affected in this manner. However, as noted in Table VIII, from 40 to 80% of their activity may be dissipated under severe conditions of organic contamination. Each product should be tested for germicidal activity in order that label statements be accurate.

A series of tests were conducted comparing the germicidal activity of HYAMINE 1622 and succinchlorimid against *E. typhosa* under standard phenol coefficient conditions and in the presence of an added 0.2% peptone. Tests were made when the solutions were 0, 8, and 24 hours old. HYAMINE 1622 did not lose germicidal activity on standing and retained more than 50% of its activity in the presence of added peptone. Aqueous solutions of succinchlorimid lost 25% activity on standing 24 hours. The addition of peptone immediately decreased germicidal activity by 70%, and by 88% in 24 hours. Succinchlorimid is one of the most stable of the chlorine-liberating germicides. Less stable chlorine preparations would naturally be more adversely affected.

Tests have also been made which demonstrate the effect of soap and anionic wetting agents on the germicidal activity of HYAMINE 1622. It was found that although an equivalent of these substances reduced the germicidal activity, the HYAMINE was not completely inactivated until several times excess soap was present.

INFLUENCE OF pH

The killing dilutions of HYAMINE 1622 and phenol against *E. typhosa* at several pH values are given in Table IX. In these tests, the usual phenol coefficient procedure was used except that both the test organism and the test dilution were adjusted to the desired pH. It will be seen from Table VII that the activity of phenol decreases in the alkaline range while that of HYAMINE 1622 increases. As a result the phenol coefficient increases from 56 in the acid range to 370 at pH 10 against *E. typhosa* and from 80 to 1,000 versus *S. aureus*.

This is quite advantageous, as the waters with which most sanitizing rinses are prepared are alkaline in reaction. In addition, powdered sanitizing agents are readily compounded from crystalline HYAMINE with soda ash, tri sodium phosphate, and tetra sodium pyrophosphate.

TABLE VIII

Effect of Contaminants

(U. S. D. A. Bulletin 198 Phenol Coefficient Test Method)

HYAMINE	*Organism*	*Temperature*	*Diluent*	*Dilution killing in 10 minutes*
1622	*E. typhosa*	20° C.	Dist. water	1:20,000
1622	*E. typhosa*	20° C.	1% hen manure	1:10,000
1622	*S. aureus*	20° C.	Dist. water	1:25,000
1622	*S. aureus*	20° C.	1% skimmed milk	1:10,000
1622	*S. aureus*	20° C.	1% cow manure	1:14,000
1622	*S. pullorum*	20° C.	Dist. water	1:18,000
1622	*S. pullorum*	20° C.	1% hen manure	1: 7,000
10-X	*S. aureus*	37° C.	Dist. water	1:50,000
10-X	*S. aureus*	37° C.	10% saliva	1:30,000
10-X	*S. aureus*	37° C.	10% serum	1:12,000
10-X	*S. aureus*	37° C.	10% blood	1:10,000

TABLE IX

Effect of pH on the Germicidal Activity of HYAMINE 1622

Dilution bactericidal to E. typhosa in 10 minutes @ 20° C.

pH	4	5	6	7	8	9	10
Phenol	140	140	130	120	100	80	70
HYAMINE 1622	8,000	10,000	15,000	17,000	20,000	22,000	26,000
Phenol Coefficient	57	70	115	140	200	275	370

Dilution bactericidal to S. aureus in 10 minutes @ 20° C.

pH	4	5	6	7	8	9	10
Phenol	100	110	100	90	80	60	50
HYAMINE 1622	8,000	10,000	20,000	26,000	30,000	40,000	50,000
Phenol Coefficient	80	90	200	290	375	665	1,000

TABLE X

Acute Toxicity of the Anhydrous HYAMINES in Milligrams per Kilogram of Body Weight

Administered as 2.5% Aqueous Solutions

Animal	*Route of Administration*	*LD-50 HYAMINE*	
		1622	*10-X*
Mice	Oral	500	750
Rats	Oral	765	800
Mice	Subcutaneous	310	185
Rats	Subcutaneous	1040	1000

TABLE XI

Acute Toxicity of HYAMINES in Milligrams per Kilogram of Body Weight

Animal	*Route of Administration*	*Lethal Dose (90–100%) HYAMINE*	
		1622	*10-X*
Chicks	Drinking Water	Over 1000 ppm	Over 1000 ppm
Guinea Pigs	Intraperitoneal	40	20
Rabbits	Intravenous	17.5	15
Dogs	Intravenous	37.5	75

TOXICITY

Extensive studies have been made on the toxicology of HYAMINES 1622 and 10-X which show a wide margin between germicidally effective concentrations and concentrations likely to be toxic or irritating.

Acute single dose toxicity toward mice and rats by several methods of administration are given in terms of "LD-50's" in Table X.

In Table XI intraperitoneal and intravenous toxicities for rabbits, guinea pigs and dogs are expressed in terms of doses required to kill 90–100% of the test animals.

Dogs given up to 50 mg/kg as a 20% solution perorally generally showed no reaction.

Aqueous HYAMINE 1622 (1:1000) as the only source of liquid for mice over a three weeks period caused no deaths or toxic degenerative changes. Amount consumed corresponded to 484 mg of anhydrous HYAMINE per kilogram of body weight.

The toxicology laboratory concluded from the studies with the HYAMINES in drinking water that mice should survive daily doses of 100 mg/kg of HYAMINE 10-X and somewhat higher daily doses of HYAMINE 1622.

Analogous results were obtained with guinea pigs, drinking 1:1000 HYAMINE 1622 for three weeks. They consumed 575 mg of crystalline HYAMINE per kilogram of body weight.

A series of tests was conducted with HYAMINES 1622 and 10-X in the drinking water of chickens. In several series day-old chicks were used. In another set of experiments the HYAMINE drinking water was given to 14 day old chicks. Experiments ran from three to six weeks. At 1:1000 concentration the chickens did not drink as much nor gain weight as fast as the controls, presumably due to the bitter taste of the water. At 1:2500, 1:7500 and 1:10,000 concentrations the experiments showed higher water consumption and greater gains in weight than in the case of chickens consuming plain tap water.

Irritation studies were made by direct application of solutions to the cornea of mice and observing for local erythema and inability to open eyelids for a time. The cornea is generally considered more sensitive to irritants than other mucosa generally subjected to antiseptic washes. Similar studies were also made with direct application of solutions into the mouth and noting salivation and other symptoms of local irritation.

Starting with 1:4 solutions and increasing the dilutions the results in Table XII were obtained.

TABLE XII

Hyamine	*Tissue*	*Non-Irritating*	*Irritating*
1622	cornea	1:500	1:250
10-X	cornea	1:1000	1:770
1622	mouth	1:1000	1:500
10-X	mouth	1:770	1:500

In these tests irritation persisted from several minutes to several hours depending on concentration but no irritation was noted in any of the animals after 24 hours.

The solutions reported as threshold concentrations for irritation are considerably stronger than recommended for general antisepsis.

General conclusions were drawn that HYAMINE 1622 and 10-X are generally similar in pharmodynamic behavior; that they are of a low order of acute or chronic toxicity for animals; and that the concentrations used as antiseptic or germicidal solutions are not expected to cause untoward effects in animals. Such concentrations are not irritant and do not present any significant toxicity hazard.

USES

1. RESTAURANT SANITATION

HYAMINE 1622 provides an ideal means for sanitizing dishes, glasses, silverware, and other food utensils after cleansing. Rapid germicidal action is maintained over long periods of use. Sanitizing rinses prepared from HYAMINE 1622 do not impart taste or odor to the sanitized utensil. In addition, they are not irritating to the hands of the operator, are non-corrosive, and do not darken silverware. Although hot water increases germicidal activity, solutions at room temperature may be used satisfactorily.

The U. S. Public Health Service and the American Public Health Association have adopted standards for the cleansing and sanitization of food utensils. A dish or beverage glass is considered to be effectively sanitized if less than 100 bacteria are present on a

4 square inch surface or glass rim. Several series of field trials have demonstrated that glasses rinsed in a 150 ppm HYAMINE 1622 solution meet this standard. This corresponds to 1 ounce of a 10% solution in 5 gallons of water.

Mallmann, Kivela, and Turney (36) compared sodium hypochlorites, chloramine T and several quaternaries, including HYAMINE 1622 at the same dilution indicated above. A three sink arrangement was used to wash, rinse, and sanitize the glasses. Chloramine T gave unsatisfactory results. Sodium hypochlorite and the quaternaries effectively sanitized the glasses. In further series of 700 glasses the running water rinse was omitted and detergents were chosen which are known to inactivate quaternaries. All except a few glasses were effectively sanitized; this was believed due to improper washing.

Other restaurant uses include the sanitization of coffee urns, refrigerators, food storage cabinets, trays, tables, etc. HYAMINE 1622 is an outstanding deodorant for garbage pails and lavatories.

HYAMINE 1622 is often sold to the restaurant trade as a 10% aqueous solution. However, packets containing crystalline HYAMINE, powders containing HYAMINE and proper alkaline salts, and HYAMINE-containing tablets have several advantages over the liquid preparations and are increasing in popularity. Complete information on preparation of products, label recommendations, and field data will be sent on request.

The addition of 2% TRITON X-100 to 10% HYAMINE solutions provides improved drainage properties and results in better looking glassware.

Towelling is unnecessary and is to be avoided as a likely source of recontamination.

2. DAIRY SANITATION

HYAMINE 1622 possesses several physical and chemical characteristics which are advantageous for use in the dairy field. In contrast with chlorine, which is readily reduced to an inert form by organic matter, HYAMINE retains a large proportion of its germicidal effectiveness in the presence of moderate milk solid contamination. The normal killing dilution of 1:25,000 against *S. aureus* @ 20° C. (F. D. A. Bulletin 198 Method) is reduced to 1:10,000 when dilutions are made with 1% skimmed milk instead of distilled water.

In common with the other germicides, the bactericidal activity of HYAMINE 1622 is increased at elevated temperatures. Advantage may be taken of this characteristic because HYAMINE 1622 is a stable compound. It is not volatile and does not lose its strength on exposure to heat or light.

Use dilutions of HYAMINE 1622 are not corrosive to metals, rubber, plastics, or glass lined equipment. It is not caustic or irritating and is recommended for rinsing the milkers' hands and cows' teats and udders at 150–200 ppm.

The wetting and penetrating properties of HYAMINE solutions enable it to contact and kill microorganisms which would not be reached by ordinary germicides.

Inasmuch as the germicidal activity of HYAMINE is increased in alkaline solution, such alkalis as trisodium phosphate, tetra sodium pyrophosphate and soda ash may be incorporated in HYAMINE solutions and powders to enhance both detergency and germicidal efficacy.

HYAMINE 1622 can be formulated for sale to the dairy trade in several forms.

1. Small glassine or cellophane envelopes containing 3 grams of HYAMINE crystals, which are sufficient to prepare 4 gallons of 200 ppm solution.
2. Powders containing 10 to 20% HYAMINE 1622 blended with compatible alkalis and sequestering agents to provide water softening and increased detergency.
3. A 10% solution may be supplied.

On dairy farms HYAMINE is used to sanitize pails, strainers, milk cans and other equipment. Solutions containing 200 ppm HYAMINE are prepared by diluting 1 oz. of a 10% solution or 10% powder in 4 gallons of water.

In the milk or ice cream plant weigh tanks, dump tanks, storage tanks, sanitary piping, vats, homogenizers, churns and bottling equipment may be sanitized with HYAMINE.

Equipment is thoroughly cleaned with detergent and rinsed with water. A solution containing 200 ppm HYAMINE 1622 is then pumped through so that all surfaces which contact the milk are sanitized. If preferred, the solution may be sprayed directly onto the equipment, thoroughly wetting the surface.

Because of their low surface tensions, HYAMINE

solutions readily spread and wet equipment surfaces, assuring thorough sanitization.

Some milk can and milk bottle washers are equipped to spray chlorine into the container. In these machines the application of a solution containing 200 ppm HYAMINE 1622 will provide satisfactory bactericidal treatment. With those machines where hot air, hot water or steam are relied upon for the bactericidal treatment, lower bacterial counts may be obtained by incorporating HYAMINE 1622 into the steam spray by means of an injector or proportioning device in such a way as to obtain thorough wetting of interior surfaces. Since the germicidal effectiveness of HYAMINE is markedly increased at elevated temperatures, this method provides effective treatment.

From 24 to 48 hours often elapse between the time that milk cans leave the can washer and the time they are filled with milk. During warm weather this provides an incubation period during which residual bacteria may multiply profusely and the can may become quite contaminated. This trouble can be avoided by the proper use of HYAMINE 1622. A residual film remains which because of its high bacteriostatic activity retards bacterial growth, helping the cans to remain "sweet".

With the development of rapid pasteurization methods, thermoduric type organisms have become increasingly important in the dairy field. These organisms survive short exposures to pasteurization temperatures, and many public health officials are therefore regulating the number of bacteria that may be present in the raw milk supply.

It has been demonstrated by several workers that germicidal detergents based on quaternaries can be used effectively in milking machine sanitation to keep thermoduric counts as well as total counts at low levels. Typical formulations that have given good results are:

HYAMINE 1622	10%	10%
TRITON X-100	10%	10-18%
Tetrasodium pyrophosphate	25%	6%
Tri Sodium phosphate	30%	—
Soda Ash	25%	—
Water	—	74-66%
	100%	100%

The first is a powder, the second a liquid. Both are used at one ounce to 4 gallons of water to give 200 ppm HYAMINE 1622 in the use solutions. Other sequestering agents than tetrasodium pyrophosphate may be used providing there is sufficient TRITON X-100 in the formula to maintain clear solutions on standing.

General practice is to rinse the machines with water after the evening milking, then flush with the germicidal-detergent and allow to air dry. In the morning, water is used to rinse out residual compound before milking. After morning milking, again rinse with water, flush, and soak in germicidal detergent solution. Then scrub all parts using a brush, flush with clean solution, and allow to air dry until evening. Prior to the evening milking, again rinse with water, removing residual sanitizing agent.

3. DEODORIZING—General

HYAMINE 1622 and 10-X present an entirely new approach to the problem of deodorizing. It has been customary to alleviate the sensation of an obnoxious odor by masking or disguising it with another odor which was more pleasing to the olfactory organs. Such practices have been followed because true *deodorants* were not available.

HYAMINE 1622 and 10-X are true deodorants in that they rapidly destroy obnoxious odors without contributing a scent of their own. Many odors are caused by the putrefaction of organic matter, through the growth of a variety of micro-organisms. Because the HYAMINES are potent germicides and fungicides, their application to an odorous area helps prevent the redevelopment of odors which are due to microbial putrefaction.

With an odorometer which makes possible a more precise evaluation of the deodorizing potency of various chemical compounds, and in large scale practical trials, HYAMINE 1622 has been found effective against a number of common disagreeable odors.

In public rest rooms the application of a 1:1000 HYAMINE 1622 solution gives excellent control of the obnoxious odors, making it possible to eliminate the use of deodorant blocks or pine oil and cresol disinfectants. The odors of these so-called "deodorants" are disagreeable to many people who would welcome a truly odorless deodorant.

The odors of garbage pails, onions, garlic, cabbage

and fish are readily controlled by sponging or mopping with a 1:100 solution of HYAMINE 1622 or spraying with a 1:1000 solution.

The public transportation companies have a definite need for an effective deodorant. Persons frequently become ill on buses, trains, and airplanes making it necessary to remove the conveyances from service to be cleaned and deodorized. During railroad and airplane trips it is often necessary to do an immediate job of deodorizing. The use of HYAMINE 1622 can prevent a disagreeable journey for the other passengers. Waiting rooms and stations provide another area for use.

1:1000 HYAMINE solution is effective in deodorizing fishing boats.

In certain hospital wards, obnoxious odors become a very serious problem. Attempts to disguise these odors with pine oil or cresylic acid disinfectants result in "hospital odor". Such odors can be eliminated by use of a solution of HYAMINE 1622, 0.1% for spraying or 1% for sponging or mopping.

4. VETERINARY USES

HYAMINE 1622 has many applications in the veterinary field. Several years of use and extensive clinical testing for human use have proven the effectiveness and safety of a 3 percent aqueous solution for topical antisepsis. Likewise, buffered 1:1000 to 1:5000 solutions have been used extensively for treatment of denuded areas, internal irrigations and general antisepsis of body cavities and mucous membranes.

The HYAMINES are also used for sterile storage of surgical instruments, pre-operative hand disinfection, flank and udder wash, and poultry drinking water disinfection. Antiseptic, germicidal, and deodorant properties can be developed in a variety of veterinary products.

The combination of high germicidal activity and stability make HYAMINE 1622 the basis of an excellent disinfectant for poultry drinking water. Information on the preparation and labelling of tablets is available. Complete toxicity studies have demonstrated its safety. Recent publications indicate effectiveness against the virus of Newcastle's disease, (51) and *possible* effectiveness against the protozoan microorganisms causing Black Head in Turkeys (5).

A combination of HYAMINE 1622 and TRITON X-100 is being recommended as a lubricant, disinfectant and deodorant in connection with artificial insemination of cattle.

5. LAUNDRY APPLICATIONS

Although disinfection is obtained by heat and occasionally by bleaching in the normal laundry procedure, they do not provide residual germicidal action.

The HYAMINES are substantive to cellulosic fibers; i.e., act as colorless dyestuffs. They are strongly absorbed and are not removed by leaching with running water. Actual scrubbing with soap is required for complete removal. Fabrics treated with HYAMINE at ½ ounce per 100 lbs. of fabric show bacteriostatic properties until relaundered. The earliest commercial usage of quaternary ammonium compounds was for softening cotton fabrics.

HYAMINE treatment is recommended as a final step after washing and thorough rinsing for hospital clothing and linen and for diapers. It has been demonstrated that HYAMINE 10-X treated diapers effectively prevent diaper rash (4).

6. ALGAE CONTROL

The growth of algae and related plant life in several types of water systems is quite objectionable because of the turbidity and odor developed and because of the reduction in operating efficiency. The problems become rather acute during warm weather when the growth of the algae is more rapid and the systems are in greater use.

In outdoor swimming pools, algae is quite unsightly and causes the filters to become fouled. Water-cooled refrigeration systems operate less efficiently when algae are present because of reduced heat transfer and "channeling" of the water.

HYAMINE 1622 is an effective algicide and algistat.

The treatment consists of two phases, algicidal and algistatic. In the first it is necessary to add sufficient HYAMINE to kill all existing algae growth and to satisfy the cation-demand of the system. This will vary in each case depending upon the degree of contamination and construction of the system. In general, the addition of 1 gallon of a 10 percent HYAMINE 1622 solution to each 10,000 gallons of water is adequate. Because of the powerful foaming action of the HYAMINE it may be necessary

to add this dose over a period of several hours. After the algicidal treatment is complete, further growth is prevented by maintaining a HYAMINE concentration of 2 parts per million. This corresponds to 1 gallon of 10% HYAMINE 1622 solution per 50,000 gallons of water. Analytical methods are available for determining these low concentrations of HYAMINE in water (10).

7. PHARMACEUTICAL USES

Pharmaceuticals possessing antiseptic, and deodorizing properties can be formulated with HYAMINE 10-X, providing such products are intended for direct sale to consumers for self administration. Due to the patent license agreement previously mentioned, only HYAMINE 10-X is available for uses of this type. There are no appreciable differences in germicidal activity, toxicity, or purity between the two HYAMINES.

Suggested preliminary formulations for mouth washes, antiseptic after shave lotions, products for feminine hygiene, antiseptic tooth paste, antiseptic shampoo and personal deodorant can be furnished upon request. Results of in vitro bacteriological tests on these formulae can also be provided.

No attempt is made to recommend color, odor, or flavor since these properties provide the basis of individuality of such products. Many modifications of the basic suggested formulae are possible.

Since the Food and Drug Administration requires clinical investigation of the final consumer item, including color and perfume or flavor we have not conducted such tests. Nevertheless, to the best of our knowledge the suggested formulae are safe and effective. The Food and Drug Administration does have a complete file of available toxicological and germicidal data on HYAMINE 10-X. We can request them to refer to this file in connection with any new drug application submitted.

PACKAGING AND AVAILABILITY

Crystalline HYAMINE 1622 and 10-X are shipped in standard 100 lb. and 200 lb. moisture resistant drums to manufacturers of disinfectants, sanitizing agents, deodorants, antiseptic washes, etc. They are not supplied for direct consumer use.

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