

forms of slowly available nitrogen such as natural organic materials, sewage sludges, and tankages.

### Surface Active Agents

The effect of surface active agents on reaction phenomena in phosphate rock acidulation aroused considerable interest during the meeting. A paper on this subject by E. J. Fox, H. E. Batson, Jr., and A. V. Breen of USDA indicated that both anionic and nonionic agents tended to soften the dried product. Representative types of anionic surface-active agents had no significant effect on the extent or rate of reaction between ground phosphate rock and sulfuric acid. Proof of this was indicated by the rise in temperature during acidulation and by residual free acid being present immediately after mixing and after denning 20 hours at 70° C. Some of the nonionic types tested caused increased bloating of the charge during mixing operations but had no permanent effect on the volume of the raw mix.

In the discussion which followed his paper, Mr. Fox remarked that a small group of manufacturers told of their experiences in a private gathering earlier in the day. The more they discussed the subject, the more the listeners became confused. He believes that most of the controversial points arise from the fact that the effects of a surface active agent are influenced markedly by the nature of the phosphate rock. The problem is not merely one of reducing surface tension.

The most consistent and best results, said Mr. Fox, are obtained by putting the surface active agent into the superphosphate before the addition of rock, thereby gaining a more complete and faster wetting of the rock. A much greater initial evolution of gas is obtained. Some phosphate rock is floated

at the mines with surface active agents; and in many cases the rock is not washed afterwards. However, Mr. Fox does not think that the residual amount of surfactant present after flotation accounts for some of the wide deviations in results.

### Ammoniation of Superphosphates.

Under ideal conditions, the maximum amounts of neutralizing ammonia which react with superphosphates are 9.6 pounds per 20-pound unit of  $P_2O_5$  in ordinary superphosphate and about 6.0 pounds per unit of  $P_2O_5$  in triple superphosphate. In the early days manufacturers hesitated to ammoniate beyond three pounds of ammonia per unit of  $P_2O_5$  because of possible losses of nitrogen and available phosphorous during ammoniation and during subsequent storage of the ammoniated product. More recently, increasing demands for high-analysis fertilizers and the comparative low cost of neutralizing ammonia

have led the mixed fertilizer producer to attempt higher and higher rates of ammoniation.

According to R. Kumagai, H. F. Rapp, and J. O. Hardesty of USDA, high ammoniation rates are not conducive to efficient ammonia absorption. Denseness and hardness of superphosphate particles also contribute to poor absorption. On the other hand, absorption efficiencies are materially increased by an increase in moisture content and a decrease in particle size. An increase in the moisture content from 1 to 7% increased the ammonia absorption efficiency of ordinary superphosphate from 70 to 96%. A decrease in particle size of the superphosphate from 10 to -80 mesh increased the absorption efficiency from 84 to 100%. A rise in temperature (for triple superphosphate only) from 150 to 215° F. increased absorption from 79 to 90%.

## Food Packages Reflect Needs of Ultimate Consumer

Rodenticides, large outlet for chemical products, need more attention from chemical industry . . . Photosynthesis studies of sugar cane aided by radioactive tracers

CHICAGO.—Food stores and supermarkets today are dependent on the availability of packaged retail units which make possible improved efficiency and consumer service. This has made more important than ever the attention given by food packers to the selection of the proper packaging materials.

Current food packaging problems can be classified readily according to types of containers, reported L. W. Elder,

General Foods Corp., to the ACS Division of Agricultural and Food Chemistry in a Symposium on Technology of Food Packaging Materials. Attention was directed primarily to materials required for preserving food quality over long shelf life periods.

Tinned cans are the time-honored container for practically all types of foods. For economic reasons their use has been largely restricted to the "wet packs" such as fruits and vegetables. Glass bottles replace tin cans in many food packs where visibility of the contents develops consumer appeal. Among the new developments to be watched is the polyethylene "squeeze" bottle. Its unique utility for such foods as catsup and table sirup will certainly be further exploited as volume production reduces cost. Folding boxboard cartons may be rightfully called the backbone of the packaged food industry.

Recent statistics show that about 14 million tons of paper and paperboard are used annually for all types of packaging, of which possibly a third is used by food packers. It is impressive that more paper is used for packaging than for all printing papers, including newsprint. Bags, envelopes, and tubes appeal to food packers for many reasons, including substantial economies in many cases. Regardless of how they are produced, retail food packages are themselves further packed for shipment and han-



dling through wholesale and retail channels. Although many commodities are shipped in metal and fibre drums, wooden boxes, crates, or barrels, by far the most common shippers for packaged food products are corrugated cases and multiwall bags.

According to Gordon P. Dillon, Continental Can Co., who expressed the viewpoint of the converter, it is the converter's responsibility to survey all materials that offer promise and select the best one, or combination, for each packaging application. The converter, in fulfilling his role, frequently serves as package designer and engineer as well as package maker. In the case of the larger converters this has sometimes included the design and manufacture of the package machinery. The very definite way in which the converters have been able to perform these functions explains in part the terrific increase in sales during the past 30 years.

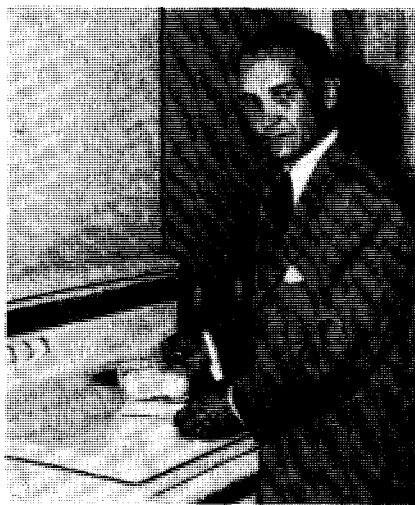
The product manufacturer is making more complex demands as he buys packaging materials. He is offering the consumer products that were undreamed of and which could not have been produced even if they had been thought of. Present day citrus concentrates, two-component angel food mixes, and dry soup stocks illustrate the point.

The converter needs to know the disadvantages and potential pitfalls connected with each type of material just as thoroughly as he is aware of the advantages. It is appropriate to point out that the converter can be uncomfortably caught in the middle between the producers of packaging films and the other raw materials going into the package on the one hand and the user of the package on the other hand. The converter needs the sympathetic and wholehearted cooperation of the suppliers of raw materials, and fortunately usually gets it.

With so much at stake in this highly competitive industry—product manufacturers are inclined to select converters not on a price basis but on a responsibility basis. Likewise responsible converters are forced to rely more and more on adequate research and development personnel and facilities.

### Rodenticides

Chemical repellents for rodents offer the chemical industry an increasing outlet for many new products, Jack Welch of the Fish and Wildlife Service of the U. S. Department of Interior told the rodenticides symposium. Most of the work on these products has been done during the past 10 or 15 years, he said. Of some 4000 compounds examined, Actidione, an antibiotic, has been found by far the most effective. Its toxicity,



**A. I. Totten, Jr., of Reynolds Metals testing aluminum foil for food packages in the laboratory. Merits of aluminum foil were explained before the symposium on food packaging**

cost, and limited availability limit its usefulness to make it only a standard of comparison. Effective materials now known are the complexes with trinitrobenzene, principally the aniline and *o*-anisidine derivatives. Other promising compounds include zinc dimethylthiocarbamate-cyclohexylamine complex, dithiuram disulfide, and hexachlorophene. Further work is needed, it was made clear, but the speaker expressed optimism over the future.

Ralph Heal, National Pest Control Association, Inc., put forth a plea to the chemical industry to give more attention to rodenticides. The margin of safety and the effectiveness of the anticoagulants have placed them in the lead, he said. Sodium fluoroacetate, highly poisonous, may bring a large rat population under control quickly. DDT runway treatments and zinc phosphide baits often bring mice under control more quickly than do anticoagulants and are less poisonous than fluoroacetate.

### Photosynthesis Studies

The development of paper chromatography and the use of radioactive tracers can furnish important tools in studying the mechanism of photosynthesis in plants. H. P. Kortschak reported to the Carbohydrate Division that experiments using these methods, conducted with G. O. Burr at the Hawaiian Sugar Planters' Association in Honolulu, have solved some of the difficulties of analysis for determining the role of organic phosphates in sugar cane plants.

In their work, cane plants were grown for 14 days in a medium containing phosphorus-32 and then were analyzed by paper chromatography. The phosphorus regions of the developed chro-

matograms were detected by a radioactive counter. By this technique they found that only about 50% of the phosphorus in the leaves was inorganic; 3-phosphoglyceric acid accounted for about 20% of the radioactive phosphorus, and another 15% was in the form of phospholipids. Similar analysis of stalk sections showed that the major organic phosphate there was also phosphoglyceric acid.

### Role of Methionine in Animal Diet Emphasized

A diet may contain sufficient quantities of methionine when adequately supplemented with folic acid and vitamin B<sub>12</sub>, but a deficiency of methionine may occur if the supply of these vitamins is low. It has been repeatedly shown that damage to the liver is produced experimentally by a lack of methionine. The clinical importance of a complete diet is, therefore, clearly emphasized, said Thomas H. Jukes of Lederle Laboratories, speaking before the ACS Division of Biological Chemistry at the Chicago meeting.

Methionine is of particular interest in the feeding of livestock, especially poultry, because animal sources of feed protein are becoming increasingly scarce. Such vegetable proteins as soybean meal, for example, are poorly supplied with methionine. Partly for this reason, methionine is now being produced synthetically for use in feeds.

Experiments with chickens have shown that their need for methionine is increased when either folic acid or vitamin B<sub>12</sub> is lacking in the diet. The reason for this is not fully understood, but it appears that, after methionine has given up its labile methyl group, it can reacquire this group from some other source of a single carbon unit. In this re-

**Thomas H. Jukes of Lederle Labs told the Division of Biological Chemistry about his research on the importance of methionine in animal diets**



generative process, folic acid and vitamin B<sub>12</sub> are required.

In discussing the history of research on the metabolism of single carbon units, Dr. Jukes indicated that, about 22 years ago, Best and collaborators at the University of Toronto discovered that choline was needed by rats for the prevention of fatty livers that developed on diets low in protein and high in fat. It was soon observed that the amino acid, methionine, had the same beneficial

effect as choline on rats receiving the low-protein diet. Moreover, choline and the related compound, betaine, were found effective in enabling animals to produce methionine from homocystine, a related amino acid. These changes involved the transfer of a labile methyl group.

The availability of radioactive carbon has permitted the metabolism of the labile methyl group to be studied intensively, said Dr. Jukes. Several investigators have shown that a single

carbon unit is transferred in various biochemical systems and, in some instances, becomes a labile methyl group. Formate, the CH<sub>2</sub> group of glycine, and the CH<sub>2</sub> OH group of serine are among the many sources of the single carbon unit. Moreover, the two vitamins, folic acid and vitamin B<sub>12</sub> have been found essential for many of these biochemical transformations—processes that are of such tremendous importance in normal growth and metabolism, said Dr. Jukes.

## Algae Might Find Indirect Use as Fuel

Probably could be fermented to produce methane for use as fuel in conventional equipment

MADISON, WIS.—The possibility that algae may be grown for later fermentation to produce methane was voiced by R. L. Meier of the University of Chicago at the Symposium on the Utilization of Solar Energy held on the campus of the University of Wisconsin here Sept. 12 to 14. The propagation of algae was one of the broad topics discussed by the approximately 40 scientists invited to the symposium to discuss long-range research plans for the application of solar energy in the future. The general consensus of opinion at the meeting seemed to be that eventually man must resort to solar radiation rather than fossil and nuclear fuels as his primary source of energy.

The advantage of converting algae into methane would be that methane is a conventional fuel which could be used with existing equipment. From published data on the composition of algae Dr. Meier has concluded that it could be fermented by the ordinary microorganisms employed in sewage disposal and thus produce methane. Some of the pigments found in the algae, such as chlorophyll, are not fermentable but there is no reason to believe that these pigments should cause any difficulties. It is generally agreed that such a process is technically feasible, but much investigation would be needed to make it economically attractive.

The discovery some months ago by Jack Myers of the University of Texas that an alga similar to chlorella grows at an optimum temperature of 40° C. instead of about 25° C., (the optimum temperature for most algae) may change the economics involved in growing algae on a large scale. One of the important costs encountered in operating the Arthur D. Little, Inc., chlorella pilot plant was for supplying sufficient cooling water to keep the algae at the optimum temperature. The use of organisms growing at 40° C. would lessen the need for much of the

cooling water and thereby lessen the cost of the process. As far as it is known there is no large scale algae experimentation under way in this country since Arthur D. Little finished its research project for the Carnegie Institute. Hiroshi Tamiya of Tokugawa Institute in Japan is at present carrying on large scale work.

**Natural Ponds.** Another possible means of cultivating algae is the use of natural lakes or ponds rather than the plastic tubes currently described in most pilot plants. An investigation of Lake Maricabo in Venezuela, has been carried out by a Venezuelan group. This large lake is the natural habitat of abundant quantities of algae. The findings of the group indicate that changing salinity in the water in this particular lake has upset the ecological equilibrium. This fact renders harvesting of the algae unlikely, but it is not impossible that there are other lakes where such a project might some day become profitable.

**Weather.** The meteorologist can contribute much towards the effective use of sunlight. He can do this, according to R. A. Morgan of the National Science Foundation, not only by making long-range weather predictions, but also by actually changing the local weather by cloud seeding, etc. If it were possible to cause the snow to melt as little as two weeks earlier in the spring, the advantage to the farmer in earlier planting time would be immense. This might not be as difficult as it sounds. It might be accomplished by sprinkling some substance on the surface of the snow.

**Solar Cooking.** Solar energy is now being used for cooking in India. Preliminary results indicate that a cheap device recently placed on the market there is practical, according to M. L. Ghai, National Physical Laboratory of India. At the present time cow dung is used extensively in India as a cooking fuel.

By diverting this material back to the land as fertilizer agricultural productivity would be increased. While solar cooking is probably desirable in India where fuel is scarce and the percentage of sunny days is high, it would not be so in the United States today.

### Industry

#### Monsanto Forms Agricultural Chemicals Department

Two new reorganization moves in the field of agricultural chemicals have been recently announced by Monsanto Chemical Co. One is formation of a new department combining the sales groups of soil conditioners, agricultural chemicals, and special chemicals into a single agricultural chemicals department. The new department will handle sales of insecticides, herbicides, and soil conditioners. Herbert C. Koehler will be the manager of the department. Since 1945 he has been manager of the agricultural and special chemicals sales group.

Roy L. Brandenberger, general manager of the Monsanto's merchandising division has announced the formation of an application research department and an increase in the activities of the development department of the merchandizing division.

The research group will study the formulation of new products for the home gardener and agricultural chemical fields, as well as products for household use.

The development department will study new markets for soil conditioners and also evaluate other new products for consumer sale.

#### NAC Planning Program to Promote Use of Herbicides

The National Agricultural Chemicals Association has announced a program aimed at expanding the use of herbicides in the United States. The program is expected to get under way as soon as NAC finds a herbicide specialist to join its staff.