½ cc per second, while the water was vigorously stirred by a powerful stirrer placed eccentrically. The crystals were observed microscopically and the process continued until some spherules appeared when stirring was stopped, crystals collected, the jar was emptied and the process repeated.

Although these observations do not solve the problem of dental decay, they are offered in the present form because a solution of that problem does not seem immediately forthcoming, and yet it seems to be very important, owing to the fact that the enamel of the teeth is subject to the most frequent lesions which have not, so far, been repaired by regeneration of the tissue.

J. F. McCLENDON
UNIVERSITY OF MINNESOTA

FLUORIDES VS. FLUOSILICATES AS INSECTICIDES

MARCOVITCH[1] reported that sodium fluosilicate undiluted is effective against the cotton boll weevil (*Anthonomus grandis* Boh.), and when mixed with nine parts by volume of hydrated lime is effective against the Mexican bean beetle (*Epilachna corrupta* Muls.), the Colorado potato beetle, the potato flea beetle, the bean leaf beetle and the tobacco hornworm.

There is nothing new in the use of sodium fluosilicate as an insecticide. Its use for that purpose was described nearly thirty years ago by Higbee (English Patent No. 8236, May 23, 1896). More recently Wille[2] has reported tests with sodium fluosilicate against roaches, and Cobenzl[3] mentions it as a common ingredient of rat and insect poisons.

During the past year entomologists have shown much interest in sodium fluosilicate (also known as silicofluoride) and have made many tests with it, particularly against the Mexican bean beetle. The results obtained have varied greatly, however, and foliage injury has been produced by its use. These variable results are not surprising in view of the fact that commercial grades of sodium fluosilicate contain varying quantities of the fluosilicate of sodium and fluoride of sodium, and often carbonate of sodium. The occurrence of sodium carbonate in commercial sodium fluosilicate is of particular significance because an alkali in solution in water quantitatively decomposes a fluosilicate into a fluoride. In fact, one of the commercial processes of manufacturing sodium fluoride[4] is based on this reaction, which is represented by the following equation:

$$Na_2SiF_6 + 2Na_2CO_3 + H_2O = 6NaF + H_2SiO_3 + 2CO_2$$

Sodium fluosilicate may not only be partially decomposed into a fluoride, owing to the presence of sodium carbonate, but it may be broken down by alkaline water used in spraying. Most waters are more or less "hard," because of the presence of soluble calcium and magnesium salts. Sodium fluosilicate would react when added to such a water to form calcium and magnesium fluosilicates, which in turn would break down partially into calcium and magnesium fluorides. When mixed with a large excess of hydrated lime, sodium fluosilicate, in the presence of water, would be converted into calcium fluosilicate, and this in turn into calcium fluoride. When a mixture of sodium fluosilicate and an excess of hydrated lime is applied as a dust, as was done by Marcovitch, this conversion would not be immediate but would proceed as the mixture became moistened by rain, dew or even the water vapor in the air.

Power and Chesnut[5] have shown that ammonia and trimethylamine are present in emanations from the living cotton plant. Smith[6] has shown that the dew on the leaves of the cotton plant has an alkaline reaction to litmus, due in part at least to the presence of calcium and magnesium carbonates and bicarbonates and potassium carbonate. All these compounds would favor the decomposition of a soluble fluosilicate into a fluoride.

As used under practical conditions in the field, therefore, the sodium fluosilicate in a commercial grade of the material, before coming into contact with the insects, might be largely if not entirely converted into a fluoride, owing to the action of (1) sodium carbonate originally present, (2) alkaline or "hard" spray water if sprayed or hydrated lime if dusted, (3) alkaline emanations or exudations from the plants to which it is applied. Even pure sodium fluosilicate in solution in pure water is hydrolyzed to some extent into sodium fluoride and silicon fluoride.[7]

When sodium fluosilicate is mixed with lime preparatory to its application as an insecticide an interesting cycle is completed. By the action of sulfuric acid on fluorspar (calcium fluoride) the chemical manufacturer obtains hydrofluoric acid. This added to sand forms "sand" acid (hydrofluosilicic acid). By the interaction of this and soda ash (sodium carbonate) sodium fluosilicate is formed. When the entomologist adds hydrated lime to this compound the

[1] *Ind. Eng. Chem.*, 16, 1249, 1924; SCIENCE, 61, 22, 1925; *J. Econ. Entomology*, 18, 122, 1925.

[2] Biologie und Bekämpfung der deutschen Schabe, *Phyllodromia germanica* L., Monographien zur angewandten Entomologie No. 5, Beiheft 1 zu Band 7, Ztschr. angew. Ent., Berlin, 1920, p. 126.

[3] Chem. Ztg., 45, 1116, 1921.

[4] Bishop, U. S. Patent No. 1,382,165, June 21, 1921.

[5] *J. Am. Chem. Soc.*, 47, 1751, 1925.

[6] *J. Agr. Research*, 26, 191, 1923; SCIENCE, 61, 572, 1925.

[7] Hudleston and Bassett, *J. Chem. Soc.*, 119, 403, 1921.

original calcium fluoride is regenerated. Why not use calcium fluoride (or some other slightly soluble fluoride) in the first place?

Three years ago I discovered that certain fluorides whose solubility in water is less than that of barium fluoride are effective stomach poisons to leaf-eating insects and are so insoluble in water that they do not injure even such delicate foliage as that of the peach tree. Garman, of the Connecticut Agricultural Experiment Station, who collaborated in this investigation, found, for example, that strontium fluoride has a toxicity to the tent caterpillar (*Malacasoma americana* Fab.) comparable to that of lead arsenate.

The solubility in water of the more common inorganic fluorides is as follows:[8]

Fluoride	Formula	Grams soluble in 1 liter water
Ammonium fluoride	NH_4F	Very soluble
Potassium fluoride	KF	923.0
Sodium fluoride	NaF	40.0
Lithium fluoride	LiF	2.7
Barium fluoride	BaF_2	1.63
Strontium fluoride	SrF_2	0.117
Magnesium fluoride	MgF_2	0.087
Calcium fluoride	CaF_2	0.016

The results of the tests with the insoluble fluorides as insecticides have been very encouraging and will be reported in detail in due time. Meanwhile, it is suggested that the insecticidal action of the less soluble fluorides be utilized rather than that of the fluosilicates, as it is believed that not only will more uniform insecticidal action be obtained, but injury to vegetation will be avoided.

R. C. ROARK

U. S. DEPARTMENT OF AGRICULTURE

THE TULSA MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE seventy-first general meeting of the American Chemical Society was held at Tulsa, Oklahoma, from Monday, April 5, to Friday, April 9, inclusive. The council meeting was held on the 5th; a general business meeting on the morning of the 6th; special divisional meetings and symposiums on the afternoon of the 7th, and regular divisional meetings all day Wednesday and Thursday morning.

At the business meeting on the morning of April 6 the following were unanimously elected honorary members of the American Chemical Society: Bohuslav Brauner, Guiseppe Bruni, Ernst Cohen, Frederick G. Donnan, James C. Irvine, W. Lash Miller, Charles Moureu, Ame Pictet, Ira Remsen, Theodore W. Richards, Paul Sabatier, Joji Sakurai, Edgar Fahs Smith, Frederic Swarts. The certificates of honorary membership will be presented in person to most of these gentlemen at a special ceremony at the semi-centennial of the American Chemical Society.

Upon recommendation of the council, the general meeting voted that the name of Emil Fischer be restored to the list of deceased honorary members of the American Chemical Society.

It was also announced at the general meeting that the second award of the Priestley Medal for distinguished service to chemistry had been made by the Priestley Medal Committee to Edgar F. Smith. The medal will be presented at the Philadelphia meeting.

The registration showed 431 members and guests present. The society was welcomed by Cyrus S. Avery, chairman of the Oklahoma Highway Commission, and was followed by a response by President Norris. Professor B. S. Hopkins presented to the general meeting his announcement with details of the discovery of Element No. 61. Messrs. J. Allen Harris and L. S. Yntema were associated with Professor Hopkins in this discovery.

On Monday evening following the council meeting a reception and a dance were held at the Mayo Hotel.

On Tuesday evening A. D. Little, of Boston, presented a public address on "The Romance of Carbon" before an audience of some 700 people.

On Wednesday evening a special entertainment and smoker was enjoyed by all.

On Tuesday afternoon there was a general symposium by the division of petroleum chemistry on "Lubrication," of which R. R. Matthews was chairman, and also one by the division of chemical education on "Orientation and Segregation as applied in Chemical Education," of which W. Segerblom was chairman. The division of agricultural and food chemistry joint with the divisions of biological, cellulose and industrial and engineering chemistry held a symposium on Wednesday morning and afternoon on "Cotton and Its Products and Vegetable Oils," with David Wesson as chairman. The division of water, sewage and sanitation held an unusually large meeting and had a special excursion on Wednesday to the plants supplying water for Tulsa. The division of physical and inorganic chemistry, division of organic chemistry, division of gas and fuel chemistry and the section of history of chemistry held successful meetings.

Thursday afternoon and Friday were given up to excursions to refineries and to lead and zinc plants in Oklahoma. The meeting was naturally of especial interest to petroleum chemists, and by far the majority of those present were especially interested in the chemistry of this important raw material.

CHARLES L. PARSONS,
Secretary

[8] Comey and Hahn, "Dictionary of Chemical Solubilities, Inorganic," 2nd ed., 1921.