CHEMISTRY

New Elements Synthesized

Four chemical elements, 43, 61, 85, 87, produced and investigated by tracer technique. Tracers seen as having unlimited possibilities in research and disease.

➤ THE PRODUCTION by artificial means of four chemical elements, numbers 43, 61, 85, and 87, now known to be extremely rare or non-existent in nature, was made known by Dr. Glenn T. Seaborg, professor of chemistry at the University of California and codiscoverer of the elements plutonium, 95 and 96 during atomic bomb research, in an address to the physical chemistry section of the Pittsburgh section of the American Chemical Society.

With the manufacture and investigation of the properties of these four elements, all the gaps in the table of chemical elements have been closed. Although all four of these elements have been reported discovered in earlier years by various experimenters, the researches reported by Dr. Seaborg call in question these earlier reports based on less positive methods of analysis.

Actually the experiments with these elements have been performed with unseeable and unweighable amounts by means of the "tracer" technique. The course of the elements in reactions is followed by their radioactivity instead of by chemical means.

Radioactive isotopes of element 43 were produced by the bombardment of molybdenum with deuterons, the nuclei of heavy hydrogen atoms. Experiments by Drs. C. Perrier and Emilio Segre showed that the chemical properties of 43 resembled those of its heavier homolog, rhenium, to a greater extent than they resembled those of manganese, the lighter element most resembling it.

Radioactive forms of element 61 were formed in experiments by both Drs. J. D. Kurbatov and Marion L. Pool and Drs. C. S. Wu and Emilio Segre. This element is a rare earth, with a behavior that is to be expected from a rare earth.

Radioactive element 85, whose isotope has an atomic weight of 211, was made by bombarding bismuth with 32,000,000 electron-volt alpha particles. Its general behavior is that of a metal, with little resemblance to the other halogens, of which iodine is typical. Drs. Dale R. Corson, K. R. Mackenzie and Emilio Segre investigated its properties.

A radioactive form of element 87, given the name AcK, has been discovered resulting from the decay of actinium. This isotope discovered by Dr. M. Perey has a mass of 223 and lives but a short time. It decays with negative beta particle emission with a half life of 20 minutes. As was expected, it behaves like a heavy alkali metal.

(Earlier reports of the discovery of these elements, now called in question, were made, in the case of 43, named masurium, in 1925, and element 61, named illinium, in 1926, while 85, called alabamine, and 87, called virginium, were announced in 1931. The chemical literature records several earlier claims of finding some of these elements.)

Rival Microscope

➤ UNLIMITED possibilities for the application of radioactive tracers to scientific problems and to the treatment of disease were foreseen by Dr. Seaborg.

"Many biologists believe that artificial radioactivity has given biology and medicine," said Dr. Seaborg, "what is probably the most useful tool for research since the discovery of the microscope because all the elements and compounds in biological system can be tagged and their course through living systems studied."

The chain reacting pile used in the production of plutonium for the manufacture of atomic bombs produces large amounts of neutrons of high intensity and as a result it is possible to produce in large quantity isotopes that are used as "tags" or "tracers".

One of the most useful of the isotopes thus made is radioactive carbon 14, which has a half-life of some thousands of years. Since carbon is so important in the living world, being able to tell where a carbon atom travels and what it does by spying upon it with an apparatus that spots its explosive decaying will give scientists new information on what happens during living and chemical changes.

Radioactive triple-weight hydrogen, atomic weight 3, can now be produced by means of the intense neutron sources in the atomic bomb manufacture. It has a half-life span of 30 years and it can be used effectively to label hydrogen in organic compounds both in chemical processes and in living things, normal or diseased.

Radiophosphorus, radiosulfur and radioiodine are among the other radioactive isotopes that, according to Dr. Seaborg, will offer many opportunities for important research.

One exciting finding is that radiophosphorus accumulates in leukemic tissues, thus opening the possibility that it can be used in the treatment of this cancer-like disease of the blood cells. The radiophosphorus would bombard the diseased tissues with beta rays to a greater degree.

The study of cancer is another possible use of tracers. As in the case of leukemia, Dr. Seaborg explained, "there is the therapeutic possibility of effecting the selective deposition of the radioactive material in the cancerous tissue."

"It has occurred to many investigators," he reported, "that it should be possible in the future to synthesize some compound containing a radioactive substance, this compound having the property of being selectively absorbed by the cancerous tissues so that the radioactive rays can act directly at this spot without giving harmful effects on the body's healthy tissue."

Tagging of bacteria with radioactive carbon 14 is a possibility, Dr. Seaborg declared. A beginning has been made by tagging the tuberculosis bacillus with radioactive phosphorus but the experiments have not yet been completed.

Radioactive iodine has been used in the treatment of patients suffering from hyperthyroidism by Drs. J. G. Hamilton and M. H. Soley, while Dr. J. H. Lawrence has been successful in the application of radioactive phosphorus to the temporary control of the blood disease, polycythema vera.

Industry will also benefit from radioactive materials resulting from the atomic bomb researches and the manufacture of plutonium, Dr. Seaborg predicted. Radioactive indicators will be used to follow the course of products and impurities in large industrial processes.

As an example of one chemical problem that could be studied with carbon 14, he cited the mechanism of catalytic cracking, isomerization and alkylation of hydrocarbons which are of profound interest to the oil industry.

Radioactive tracers may also help solve fundamental problems in genetics, such as the connection between the genes in the chromosomes that cause brown eyes and the actual deposition of the pigment in the cells of the iris.

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