ISSN:2249-5347
IJSID
International Journal of Science Innovations and Discoveries
An International peer Review Journal for Science

Nobel Prize in Chemistry 1948

Arne Wilhelm Kaurin Tiselius

The Nobel Prize in Chemistry 1948 was awarded to Arne Tiselius *"for his research on electrophoresis and adsorption analysis, especially for his discoveries concerning the complex nature of the serum proteins"*.

RESEARCH INFORMATION:

"Scheele analyses the universe on the hearth", it was thus that Tegnér on the occasion of the fiftieth anniversary of the Swedish Academy, described the most dazzling of the works of chemistry in our country in the 18th century. The works of Scheele could not be better summed up in a few words, for analysis, the separation of the components of a body, was the prime essential for him as it was for so many other chemists.

The art of separating the constituents of compounds, chemical analysis, has since been developed almost to the point of perfection. However, for a long time past, difficulties have been encountered in one particular field. The efforts of the research workers have not, in many cases, been able to separate substances composed of large molecules without changing the nature of these molecules in the course of the experiments. This failure was particularly keenly felt because these substances are of prime importance from the point of view of biology and of technology, and it is consequently on them, in our age, that the

attention of research workers has been concentrated. Among these substances are the proteins and the carbohydrate polymers which play a predominant part in the vital processes; the first in animal life, the second in plant life. Also among them are the substances composing modern synthetic materials, including the different kinds of synthetic rubber, isolating substances, plastics, pressed material, new textiles, and other products, the practical importance of which is increasing day by day.

At the Institute of Physical Chemistry of Uppsala, research work has long been directed towards the study of the properties of colloids and similar substances with large molecules. It was there that The Svedberg perfected his celebrated ultracentrifuge method, which makes it possible to determine the molecular weights of these substances. Finally, it was also there that the problem of the separation and the purification of substances with large molecules was resolved.

Two phenomena were made use of: electrophoresis and adsorption. In a liquid, particles in suspension or large molecules carry, as a general rule, electrical charges which differ according to the composition of the surrounding medium. These particles and molecules are consequently displaced if they are subjected to the influence of an electric field, that is to say, if an electric current is made to pass through the solution. This phenomenon is called electrophoresis. The rate of displacement depends not only on the potential difference and the charge of the particles, but also of course, on their size and shape. In this way, one has therefore a possibility to separate one from the other the different kinds of particles or molecules in solution, and one can, if one so wishes, purify them.

Many research workers have worked at this problem for a long time, although on the whole with little success. Electrophoresis is a complicated phenomenon: to use it as a basis for a general analytical method presented such difficulties that all hope of overcoming them had often been given up. It is to Arne Tiselius that we owe success. He began by thoroughly studying electrophoresis and the numerous disturbances which accompany it, and, on the basis of his study, he worked out a rational method. His first results were

published in his doctor's thesis in 1930. He has since then, more than once improved his experimental equipment and has in the end brought his method to a high level of perfection.

In this way, it has been possible to obtain exact determinations with regard to the electrophoresis of proteins and as a result these substances can be characterized with more certainty than heretofore. Thanks to the acquisition of an important basis of operations, the difficult chemistry of the proteins will be able to continue to develop.

Tiselius has made many discoveries of far-reaching effect by applying his method of electrophoresis; that globulin, a protein of blood serum, was not an entirely homogeneous substance, had already been supposed: Tiselius succeeded in separating this seroglobulin into three distinct parts, each comprising slightly different groups of molecules. This finding is at the root of research work of the utmost importance for practical medicine, which was carried out in the United States during the last World War - research work aimed at dividing human blood plasma into fractional parts. If American scientists had not had at their disposal Tiselius' method as a control, they would probably have failed when they tried to solve that problem. In the course of their research work on electrophoresis, Tiselius and his collaborators also carried out experiments of great medical value on the antibodies of a protein nature which are formed in the blood during immunization.

With the electrophoresis method, it is possible to study only colloids and substances with giant molecules. But it is equally necessary to possess a sensitive method of analysis for substances of slightly smaller molecular weight - one might say, of medium molecular weight; to this end, therefore, Tiselius perfected analysis by adsorption. This method has been known in principle for quite a long time. A little more than forty years ago, the Russian botanist Tsvett derived from it a process which is of practical use for separating plant pigments. In this first, somewhat primitive, form, the method can really only be said to apply to coloured substances and is therefore called chromatographic analysis.

Analysis by adsorption is founded on the phenomenon which also serves as a basis for the design of contemporary gas-masks. These, as you know, comprise a filter cartridge

of powdered carbon which keeps back toxic products when air is inhaled. In the same way, a solution which is made to pass through a powdery, compressed mass or through any porous mass, leaves behind it some of the substances in solution: these settle more or less on the surface of the solid medium, a phenomenon which is called adsorption. If there are several substances in solution at the same time, they are more often than not adsorbed in different ratios and this fact can be used to separate them. Tiselius, after systematic research work bearing on the conditions of analysis by adsorption, has established methods of operation differing in their principle. In these processes, the methods of observation are such that it does not matter whether one analyses coloured or colourless substances. It was also a decisive step forward when Tiselius discovered the means which allow analysis by adsorption to be used not only qualitatively but quantitatively. His research work in that field was fertile in new ideas and was conducted with great ingenuity. It is not yet finished but on the contrary is now entering a very promising phase. The method of analysis by adsorption will certainly be perfected in the future thanks to the efforts of Tiselius and his fellow workers. It has already developed to the extent of having become a research process of immense value.

Fine results have been obtained by Tiselius for the analysis of mixtures comprising amino acids, peptides, and sugars. His collaborator, Stig Claesson who, during these past years, has made a valuable contribution to the working-out of the method, has applied it with success to other groups of organic substances.

The value of the new methods which have been briefly described here, is especially brought to light by their use, which is nowadays general, in international research in biochemistry and in medicine. Tiselius' apparatuses for electrophoresis and analysis by adsorption nowadays form part of the normal equipment of a great number of laboratories and medical institutes not only in Sweden but also abroad. One notices continually in chemical periodicals new experiments made by using Tiselius' methods.

Therefore it is with the full conviction of acting in accordance with the opinion of international chemical circles that the Academy of Sciences has decided to award to Arne

ISSN:2249-5347
IJSID
International Journal of Science Innovations and Discoveries
An International peer Review Journal for Science

Tiselius this year's Nobel Prize for Chemistry on the grounds of his research work on electrophoresis and on analysis by adsorption and, in particular, for his discoveries concerning the heterogeneous nature of the proteins of the serum.

For more details please visit:

http://www.nobelprize.org/nobel_prizes/chemistry/laureates/1948/press.html