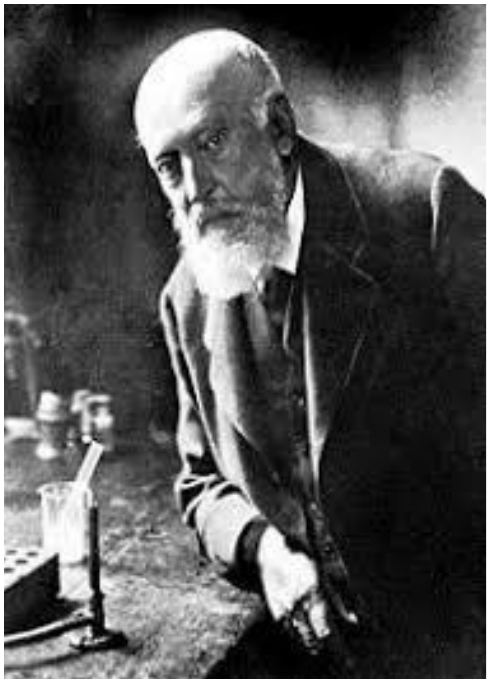
Al-Farabi Kazakh National University

NOBEL PRIZE WINNER IN CHEMISTRY

Introduction

Important discoveries in chemistry most certainly contribute to the industrial and economic developments and indirectly direct the course of history. A majority of Baeyer's research findings are of this kind. In the pursuit of synthesising a variety of organic compounds for more than half a century, Baeyer became the first chemist who can be considered as classical synthetic organic chemist.



Early Life and Education

Adolf Baeyer was born in Berlin on October 31, 1835, to Johann Jacob Baeyer and Eugenie Hitzig, both of whom belonged to highly respected and well-known families. Johann Jacob Baeyer served as lieutenant-general in the Prussian army and also taught in the army school.

He was a famous geodesist who started the European system of geodetic measurement and became the Director of Berlin Geodetical Institute. Eugenie's father, Julius Eduard Hitzig, was a jurist and distinguished himself in literature too. Hitzigs were Jews, but Eugenie converted to Evangelical Christianity. (However, Jewish records show that Adolf von Baeyer was the first Jew to get the Nobel Prize).

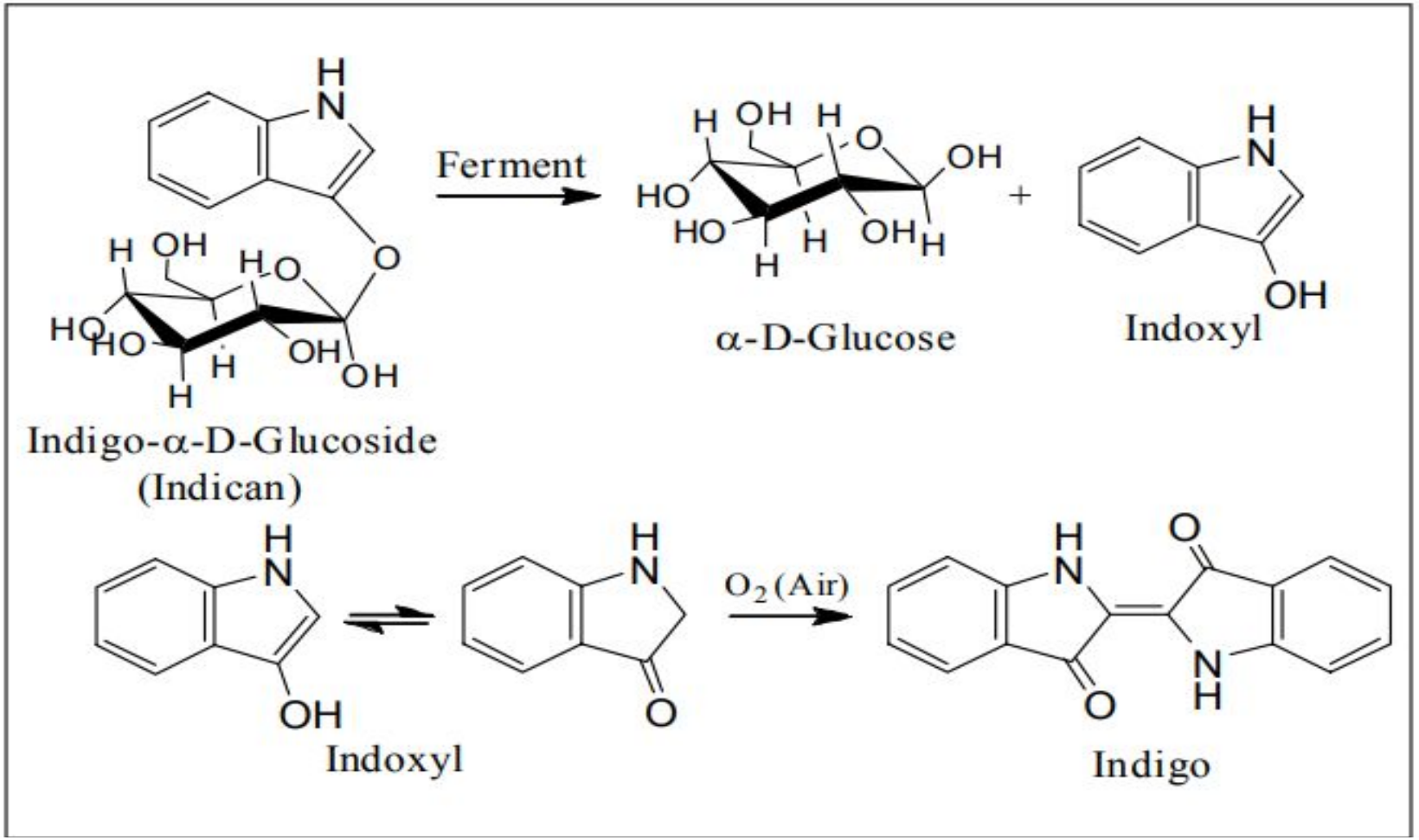
Awards and Honours

The impact of Baeyer's work in different areas of organic chemistry on contemporary and later research and German chemical industry was enormous. The methodology he developed for determining the structures of a large number of organic molecules was highly systematic, and the crowning glory was solving the structure and the synthesis of the so-called 'king of dyes', indigo, (which was considered at that time as a tough task) accomplished with great skill, perseverance and hard work. It was the first natural product molecule whose structure was solved systematically by degradative reactions followed by analysing the products formed, which culminated in developing several logical routes by him and others for its synthesis. The procedure became a model for natural products studies.

Indigo

- Indigo, also called indigotin and indigo blue, is found in indigofera plants in the form of glycoside of indoxyl, called indican. When these plants are boiled with water and the mixture is allowed to ferment, indican is released and further converted into indoxyl and then to indigo by air oxidation.

Indigo from natural source, indicant



Bayer was able to carry out the reverse process - to get indigo from simpler isatin. Already by 1883, the scientist was able to decipher the structure of indigo. Much later, in 1900, in an article on the history of indigo synthesis, he wrote: “Finally, I have in my hands the main substance for the synthesis of indigo, and I feel the same joy that Emil Fisher probably experienced (about this Nobel laureate Indicator.Ru already wrote) when he, after 15 years of work, synthesized purine - the starting material for the production of uric acid ”.

The development of industrial production of synthetic indigo had a special implication for Indian agriculture, and the economic, social and political setting in the early part of the 20th century. These accomplishments naturally attracted recognition by the academic, scientific and industrial community and Baeyer was honoured with awards, prizes and in other ways. In 1905, he was given the Nobel Prize "in recognition of his service in the advancement of organic chemistry and the chemical industry, through his work on organic dyes and hydroaromatic compounds". The accolades had started pouring in much earlier. In 1881, the Royal Society of London honoured him with the prestigious Davy Medal. In 1884, he was elected foreign honorary member of the American Academy of Arts and Sciences.

On his 50th birthday (in 1885) Bayer, like his predecessor Justus von Liebig, was bestowed with the status of hereditary nobility by the Bavarian ruler, and since then his family name got the prefix of honour 'von'. In 1891, the Bavarian government conferred him with its highest civilian award 'Order of Maximilian'. Likewise, in 1894, the Prussian government granted 'Order pour leMerite'. Baeyer's students celebrated his 70th birthday and the occasion was commemorated by the publication of two volumes of *Collected Works (Gesemmellte Werke), a collection of his research papers* classified in sixteen groups (more on this later). On his 75th birthday, an endowment was created in his honour by Carl Duisberg, who, once Baeyer's assistant in Munich, became one of the outstanding industrial chemists of the 20th century. With the proceeds of this endowment, the Society of German Chemists presents the Adolf von Baeyer Medal once in 2–3 years to a distinguished organic chemist.

Baeyer's Scientific Achievements

Baeyer's research activity spanned almost sixty years of the eighty-two years of his life, though the last ten years were not quite productive, as he published only two of his 305 papers in this period. The range of topics he worked on is amazingly varied and spread over many different classes of organic compounds.

The two volumes of the *Collected Works brought out at his 70th* birthday celebrations together consisted of sixteen different areas of research: (1) Organic arsenic compounds, (2) Uric acid group, (3) Indigo – indigo researches, (4) Pyrrole and pyrrole bases, (5) Condensation reactions, (6) Phthaleins, (7) Hydroaromatic compounds and structure of benzene, (8) Terpenes, (9) Nitroso compounds, (10) Furfural, (11) Acetylene compounds and strain, (12) Peroxides, (13) Basic properties of oxygen and oxonium salts, (14) Dibenzalacetone and triphenylmethane, (15) Aromatic series, and (16) Aliphatic series. Most of them were of fundamental importance in advancing the progress of organic chemistry. Although each one of these topics became significant, the ones that made the greatest impact on the contemporary chemistry include indigo, hydroaroamtic compounds and strain theory of ring compounds.

Before Baeyer started his work on indigo, his major research activity during 1860–1865 was in the area of uric acid and related compounds. The analysis of the components and characteristics of urine had engaged the attention of scientists and medical men since a long time. From the time Walter Scheele isolated it from kidney stones, many leading chemists worked on various aspects of its properties, reactions and structure.