Rev. CENIC Cienc. Quím.; Vol. 52. (2): 228-247. Año. 2021. e-ISSN: 2221-2450.

REVISION BIBLIOGRAFICA

Charles-Adolphe Wurtz (1817-1884) – the Eminent French Chemist of the Second Half of the Nineteenth Century (To the 205th Anniversary of His Birth)

Charles-Adolphe Wurtz (1817-1884) - el eminente químico francés de la segunda mitad del siglo XIX (Al 205 aniversario de su nacimiento)

Aleksander Sztejnberg [a-*]

[a-*] **Autor Principal** (0000-0003-2443-763X). Professor Emeritus, University of Opole, Oleska 48, 45-052 Opole, Poland : a.sztejnberg@uni.opole.pl

Recibido: 29 de septiembre de 2021; **Aceptado:** 15 de octubre de 2021;

ABSTRACT

Charles-Adolphe Wurtz (1817-1884) was an outstanding French chemist of the second half of the XIX century. He was one of the founders of of modern organic chemistry. He discovered many organic compounds. The purpose of this paper is to familiarize readers with important events in the life of Wurtz and his writing activities, in particular with the literature on his books in the field of chemistry and biochemistry. In addition, the literature on selected works is presented and the chemical reactions named after him are described.

Keywords: Ch.-A. Wurtz, Organic Chemistry, Wurtz reaction, Wurtz's books on chemistry and biochemistry, France – XIX – century.

RESUMEN

Charles-Adolphe Wurtz (1817-1884) fue un destacado químico francés de la segunda mitad del siglo XIX. Fue uno de los fundadores de la química orgánica moderna. Descubrió muchos compuestos orgánicos. El propósito de este artículo es familiarizar a los lectores con eventos importantes en la vida de Wurtz y sus actividades de escritura, en particular con la literatura sobre sus libros en el campo de la química y la bioquímica. Además, se presenta la literatura sobre obras seleccionadas y se describen las reacciones químicas que llevan su nombre.

Palabras claves: Ch.-A. Wurtz, Química orgánica, Reacción de Wurtz, Libros de Wurtz sobre química y bioquímica, Francia - siglo XIX

Este articulo no presenta conflicto de intereses.

INTRODUCTION

The important events in Wurtz's life

Charles-Adolphe Wurtz (1817-1884) (Figure 1), known simply as Adolphe Wurtz was called "an oustanding French chemist at a period when chemistry was undergoing rapid expansion" (Smith, 1949, p. 261), "one of the founders of modern organic chemistry" (Anonymous, 1884a), and "a successful university teacher" (Wall, 1951, p. 355).

One hundred and thirty-eight years have passed since his death, but during this time only a few articles about this interesting man were published. The American chemist Henry Monmouth Smith (1868-1950) wrote about Wurtz's research and achievements in his book, published in 1949:

Studied the acids of phosphorus; determined the constitution of hypophosphorus acid; discovered phosphorus oxychloride (1847), the primary aliphatic amines (1848) and the synthesis of hydrocarbons by the action of sodium on alkylhalides (1855). Estabilished the constitution of glycerine; prepared and studied glycol and many of its derivatives, including lactic acid from propylene glycol. Studied the condensation of aldehyde an discovered aldol (1872) (p. 261).

Adolphe Wurtz was born in Strasbourg on November 26, 1817 and he was the eldest son of Jean-Jacques Wurtz (1792-1845) and his wife Soph, née Kreiss (1795-1878) ("Wurtz, Charles Adolphe", 2019).

He spent the earliest years of his life in Wolfisheim, a small village near Strasbourg, where his father was a Lutheran pastor. "He spoke Alsatian with his family, but learned French and Hochdeutsch in his youth" (Rocke, 1993, p. 93).

From July 1826, he attended the Protestant Gymnasium in Strasbourg (Brooke, 1976, p. 529). In 1834, he graduated from Gymnasium and received the deegree of *Bachélier ès Lettres* (Wisniak, 2005, p. 348). Then he became a student of medicine at the Faculty of Medicine at the University of Strasbourg (Anonymous, 1884b). In 1839, he was appointed *Chef des Travaux Chimiques de la Faculté*. Until 1844 "he worked in the laboratory of Amedée Cailliot (1805-1884). He also spent five months (summer semester 1842) at [the German chemist Justus] Liebig's [(1803-1873)] laboratory in Giessen" (Rocke, 1993, p. 94). There he met August Wilhelm Hofmann (1818-1892), Liebig's assistant, who became his lifelong friend (Wall, 1951, p. 355).

In the fall of 1842, after leaving Giessen, he traveled to Strasbourg via Dresden, Prague, Vienna, Salzburg, and Munich. He also received from Liebig letters of recommendation to chemists in Paris, including Jean-Baptiste Dumas (1800-1884) (Rocke, 2001, p. 99).

On August 31, 1843, he defended his doctoral dissertation at the Faculté de Médecine entitled *Etudes sur l'albumine et sur la fibrine* and received the degree of Doctor of Medicine with honours (Anonymous, 1884b; Wisniak, 2005, p. 348).

He translated the two-volume book entitled *Précis De Chimie Organique* by the Alsatian chemist Charles Gerhard (1816-1856) (Gerhardt, 1844a; Gerhard, 1845) into German (Gerhardt, 1844b; Gerhardt, 1846). The American historian of chemistry Alan J. Rocke (2001) wrote why he took on the translation of the book and how long it took him to work on it:

Wurtz took the work not because he was a disciple of Gerhard (as is sometimes implied in the literature) but simply because it was a useful task that he could do well and get paid for. Wurtz, now, 26 year old, needed all the income he could get. This translation must have occupied a great deal of his time during his last 18 month [1842-1843] in Strasbourg (p. 100).

Este articulo no presenta conflicto de intereses.

In 1844, he removed to Paris, where first he worked in Antoine-Jérôme Balard's (1802-1876) laboratory at the *Faculté des Sciences*. One year later, he "was appointed Dumas' préparateur at the Faculté de Médecine" (Rocke, 1993, p. 94).

In the years 1846-1851, he was appointed Director of Chemistry at the Central School of Arts and Manufacture in Paris. In 1851, he became a Professor of Chemistry at the Agricultural Institute at Versailles (Anonymous, 1883).

On March 17, 1852, he married Constance Pauline Henriette Oppermann (1830-1906), daughter of the banker Chrétien Guillaume Oppermann (1777-1846), and Charlotte Constance de Luze (1791-1830). The couple had four children: two sons Robert (1858-1919), who became a doctor, and Henri (1862-1944), who graduated from *École polytechnique* and became an officer, and two daughters Marie (1854-1930) and Lucie (Sophie) (1855-1922) ("Wurtz, Charles Adolphe (1817", n.d.).

From 1858 he was the head of the Department of Chemistry at the Faculty of Medicine in Paris. He "was awarded the prize of 20,000 francs for his chemical research" (Anonymous, 1884b) in 1865.

In 1866, he has been appointed Dean (1866-1875) of the Faculty of Medicine (Pigeard-Micault, 2007). On February 7, 1866, one of the anonymous authors wrote about it in *the Chemical News* (1866) like this:

The appointment of the eminent chemist has been hailed with great delight. He is universally popular, an eloquent speaker, and has other recommendations for a post to occupy which satisfactorily requires the exercise of some hospitality. Although a doctor of medicine, M. Wurtz is only known in the profession by his toxicological researches, and a few contributions to physiological chemistry. He has devoted himself almost all his life to chemistry, for the progress of which he has done so much (p. 71).

In 1878, he became Professor at the Sorbonne (Anonymous, 1884b). On Tuesday, November 12 of the same year, he delivered the Faraday Lecture entitled *On the Constitution of Matter in the Gaseous State* before the Fellows of the Chemical Society at the Theatre of the Royal Institution in London (Wurtz, 1878a; Wurtz, 1878b; Wurtz, 1879a). His lecture "was illustrated by a series of brilliant experiments". The next day, the Fellows of the Chemical Society welcomed him for a dinner attended by about 400 guests (Anonymous, 1878).

Este articulo no presenta conflicto de intereses.

Fig. 1. *Charles-Adolphe Wurtz (1817-1884), as shown in Auguste Corlieu, Centenaire de la Faculté de Médecine de Paris (1794-1894) (Paris: Félix Alcan, … G. Steinheil, 1896).*

Friends began to notice in him the first signs of fatigue in the winter of 1883/1884. Dumas's death on April 10, 1884, was especially hard on his health. With great physical exertion, he delivered a vivid, deeply felt speech at the tomb of Dumas. On April 27, 1884, during the lecture, he fell ill and for the first time in 35 years was forced to stop working due to illness.

He died a month later, on May 12, 1884. He was buried in the *Père-Lachaise* Cemetery in Paris ("Wurtz, Charles Adolphe", 2019). An outstanding chemist is gone forever. The Russian chemist and historian of chemistry Yusuf Suleimanovich Musabekov (1910-1970) wrote about him in his book (1963):

Charles Adolph Wurtz – one of the most famous creators of the scientific foundations of chemistry. Excellent theoretician, author of many fundamental discoveries, underlying modern synthetic chemistry, consummate teacher and head of a scientific school, organizer and head of a number of chemical laboratories, author of numerous publications, of which most of the books served as the best guidance in the preparation of chemists in different countries, a remarkable popularizer of science and an excellent lecturer – here is an incomplete list of various aspects of Wurtz's multifaceted activities. His name is in the same row with the names of such his contemporaries as [the Russian chemist Aleksandr Mikhailovich] Butlerov [(1828-1886)], [the Russian chemist Dmitri Ivanovich] Mendeleev [1834-1907)], [the French chemist Marcellin] Berthelot [1827-1907)], Dumas, [the Italian chemist Stanislao] Cannizzaro [1826-1910)], [the German chemist August] Kekulé [(1829-1896)] (p. 7).

Wurtz's obituaries have been published in German and English scientific journals. In 1884, his obituary by A. W. Hofmmann was published in the *Berichte der deutschen chemischen Gesellschaft* (Hofmanan, 1844). In the same year, his necrology

Este articulo no presenta conflicto de intereses.

appeared in *The Chemical News* (Anonymous, 1884) The English chemist Alexander Wiliam Williamson (1824-1904) published his obituary notice in 1885 in the *Proceedings of the Royal Society* (W[illiamson], 1885). In 1886, his necrology by A. W. Hofmann appeared in the *Sitzungsberichte der mathematisch-physikalischen Classe der k. b. Akademie der Wissenschaften zu München* (Meeting Reports of the Mathematical-Physical Class of the k. b. Academy of Sciences in Munich) (Hofmann, 1886).

Wurtz's works

The list of Wurtz's published works includes one hundred and forty papers that appeared in print for forty-three years from 1841 to 1844 (Friedel, 1885a). These are articles published in French journals, in *Annales de Chimie et de Physique*, *Bulletin de la Société chimique* and *Comptes rendus hebdomadaires de l'Académie des Sciences*.

His first paper, published in 1841, was *Du gaz de l'éclairage* (Wurtz, 1841). "He worked in 1842 on hypophosphorous acid in Liebig's laboratory" at the University of Giessen (Partington, 1964, p. 477). His paper entitled *Sur la constitution de l'acide hypophosphoreux* (On the Constitution of Hypophosphorous Acid) was published in 1843 in the *Annales de Chimie et de Physique* (Wurtz, 1843). A year later, this journal published his two articles: on copper hydride (Cu_2H_2) (Wurtz, 1844a) and on the transformation of fibrin into butyric acid ($C_4H_8O_2$) (Wurtz, 1844b).

His paper on the formation of urethane by the action of cyanogen chloride gas on alcohol was published in 1846 (Wurtz, 1846). Three year later, his article on preparation and properties of methylamine (CH_3NH_2) and ethylamine ($C_2H_5NH_2$) was published in the *Comptes rendus hebdomadaires de l'Académie des Sciences* (Wurtz, 1849a). In the same year, this journal published his paper on a series of organic alkalis homologous with ammonia (Wurtz, 1849b).

In 1856, his paper on glycol ($C_2H_6O_2$) appeared in the *Comptes rendus hebdomadaires de l'Académie des Sciences* (Wurtz, 1856). A hundred years later, the American chemist and historian of chemistry Eduard Farber (1892-1969) wrote in his article (1956):

The birthday of glycol is March 24, 1856, the day when Adolphe Wurtz (1817-84) first prepared it. … He converted ethylene into its iodide, which Faraday had discovered, and mixed it with two equivalents of silver acetate. A rather violent reaction occurred, and among its products was the new substance. Wurtz had predicted its existence as the missing link between alcohol and glycerine, which M. Berthelot had shown to be a three-atom alcohol (p. 117).

His paper on synthesis of glycol with ethylene oxide and water was published in 1859 (Wurtz, 1859a). In the same year, his article on ethylene oxide (C_2H_4O) appeared in the *Comptes rendus hebdomadaires de l'Académie des Sciences* (Wurtz, 1859b). The results of his further research on this oxide were published in the years 1860-1862 (Wurtz, 1860; Wurtz, 1862a), and on its polymerization in 1878 (Wurtz, 1878c).

In 1866, his paper on synthesis of thionyl chloride ($SOCl_2$) was published in the *Comptes rendus hebdomadaires de l'Académie des Sciences* (Wurtz, 1866). Six years later, two of his articles were published in the same journal: on chloral (CCl_3-CHO) (Wurtz & Vogt, 1872) and aldol ($C_4H_8O_2$) (Wurtz, 1872a).

In 1873, his *Nouvelles recherches sur l'aldol* was published (Wurtz, 1873a). Three years later, his article on paraldol, polymeric modification of aldol, was published in the *Comptes rendus hebdomadaires de l'Académie des Sciences* (Wurtz, 1876a).

Este articulo no presenta conflicto de intereses.

In 1880, his two papers on papain were published (Wurtz, 1880a; Wurtz, 1880b). Two of his articles were published three years later. The first is about hydration of crotonaldehyde (C_4H_6O)(Wurtz, 1883a), and the second concerns on the action of heat on aldol and paraldol ($C_8H_{16}O_4$) (Wurtz, 1883b). His last two articles dealt, in particular, with Faraday's law (Wurtz, 1884a; Wurtz, 1884b).

In the history of organic chemistry, Wurtz's name was written in the names of two reactions. The first of them, *the Wurtz reaction* was first discovered by him in 1855. He developed a method of synthesizing hydrocarbons by treating alkyl iodides with sodium. He published the results of his research first in the *Comptes rendus hebdomadaires des séances de l'Académie des Sciences* (Wurtz, 1855a) and then in the *Justus Liebigs Annalen der Chemie* (Wurtz, 1855b). For example, by reacting butyl iodide with sodium, he obtained octane (C_8H_{18}). The following reaction took place: $C_8H_9J + C_8H_9J + 2Na = 2NaJ + C_8H_9\text{-}C_8H_9$ (C=6) (Wurtz, 1855a, p. 300; Wurtz, 1855b, p. 374). In today's notation the reaction is expressed by the following equation: $C_4H_9I + C_4H_9I + 2Na = 2NaI + C_4H_9\text{-}C_4H_9$ (C=12). Reaction of butyl iodide and ethyl iodide with sodium gave hexane (C_6H_{14}): $C_8H_9J + C_4H_5J + 2Na = 2NaJ + C_8H_9\text{-}C_4H_5$ (C=6) (Wurtz, 1855a, p. 300; Wurtz, 1855b, p. 374); $C_4H_9I + C_2H_5I + 2Na = 2NaI + C_4H_9\text{-}C_2H_5$ (C=12).

In secondary literature, the Wurtz reaction is currently most often presented in a generalized form as "synthesis of alkanes from halides (2RX + 2Na = R-R + 2NaX)" (Stadler & Harrowfield, 2011, p. 2069). Jie Jack Li described *the Wurtz reaction* in a generalized form as follows: "Car[b]on-carbon bond fromation from the treatment of alkyl halides and sodium [Na] … R-X → R-R + NaX " (Li, 2003, p. 446).

The second reaction with Wurtz's name is called the *Wurtz-Fittig reaction*. This reaction was carried out in 1864 by the German chemist Rudolph Fittig (1835-1910) (Fittig, 1864; Tollens & Fittig, 1864a; Tollens & Fittig, 1864b), who replaced one of the alkyl halides with an aryl halide to produce alkylated benzene derivatives. This reaction is expressed by the following equation in a generalized form: "Ar-X + R-X + Na → Ar-R + 2NaX" (Stadler & Harrowfield, 2011, p. 2069).

Books on chemistry and biochemistry and chapters in books written by Wurtz

Wurtz's books was written in French. Only a few have been translated into other languages. In 1864, his lessons taught on March 6 and 20, 1863 in front of the *Société Chimique* entitled *Sur Quelques Points De Philosophie Chimique* was published in Paris (Wurtz, 1864a). In the same year, his *Leçons de Philosophie Chimique* appeared in Paris (Wurtz, 1864b). A year later, the Russian edition of this book was published in St. Petersburg. The translator was the Russian chemist Petr Petrovich Alekseev (Vyurts, 1865; Krupskiy, 1900, p. 13). The English edition of this book entitled *An Introduction to Chemical Philosophy, according to the Modern Theories* was published in 1867 in London. The translator was William Crookes (1832-1919) (Wurtz, 1867).

The first volume on inorganic chemistry of his first book under the title *Traité Élémentaire De Chimie Médicale Comprenant Quelques Notions De Toxicologie Et Les Principales Applications De La Chimie A La Physiologie, A La Pathologie, A La Pharmacie Et A L'Hygiène* appeared in 1864 in Paris (Wurtz, 1864c). A year later, the second volume of this book on organic chemistry was published (Wurtz, 1865).

Este articulo no presenta conflicto de intereses.

In 1867, his book entitled *Leçons E□le□mentaires De Chimie Moderne* appeared in Paris (Wurtz, 1867). The third edition of this book was published in 1875 (Wurtz, 1875a), and a seventh edition appeared 10 years after his death (Wurtz, 1894). The Russian edition of this book was published in 1867 in Kiev. The translator was Petr P. Alekseev (Vyurts, 1867; Krupskiy, 1900, p. 13).

The Italian edition of this book under the title *Lezioni Elementari Di Chimica Inorganica* was published in 1872 in Naples. The translator was R. Monteferrante (Wurtz, 1872b). In the same year, the Italian edition of Wurtz's *Lezioni Elementari Di Chimica Organica Moderna* also appeared in Naples (Wurtz, 1872c).

The Spanish edition of this book, translated from the second French edition, was published in 1873 in Barcelona. The translator was Jaime Almer (Wurtz, 1873b). The second Spanish edition of this book appeared in 1874, and the third in 1888.

The first American edition of this book entitled *Elements of Modern Chemistry* was published in 1879 in Philadelphia. The translator was William Houston Greene (1853-1918), Demonstrator of Chemistry in the Medical Department of the University of Pennsylvania and Wurtz's former student. In the preface (Wurtz, 1879b), he wrote: It is a privilege to be able to bring before the English-reading public a work by one who has justly won the reputation of being the most able thinker and perspicuous teacher of France. M. Wurtz is the acknowledged leader of modern chemical philosophy, and his labors have firmly established many of the views which long remained unaccepted by the majority of chemists, but which are now regarded as essential to the science (p. 5).

This book also appeared in 1880 (American first edition) (Wurtz, 1880c), 1884 (second edition), 1887 (third edition), 1892 (fourth edition), 1895 (fifth edition) (Wurtz, 1895), and 1900 (sixth edition) (Wurtz, 1900).

His *Histoire Des Doctrines Chimiques Depuis Lavoisier Jusqu'a Nos Jours* was published in 1868 in Paris (Wurtz, 1868). A year later, the English edition of this book entitled *A History of Chemical Theory from the Age of Lavoisier to the Present Time* appeared in London. The translator was the English chemist Henry Watts (1815-1884), a member of the Institute (Academy of Sciences) (Wurtz, 1869a). In 1869, the Russian edition of this book appeared in St. Petersburg. The translator was M. Negreskulya (Vyurts, 1869; Krupskiy, 1900, p. 13). The German edition of this book under the title *Geschichte Der Chemischen Theorien Seit Lavoisier Bis Auf Unsere Zeit* was published in 1870 in Berlin (Wurtz, 1870a).

In 1873-1886, his *Dictionnaire De Chimie Pure Et Appliquée* was published in five volumes and two supplements in Paris. Among the co-authors are the names of 23 chemists who participated in the creation of this great work (Wurtz, 1873c; Wurtz, 1874; Wurtz, 1876b; Wurtz, 1876c; Wurtz, 1876d; Wurtz, 1880-1886a; Wurtz, 1880-1886b).

In 1875, his *La Théorie Des Atomes Dans La Conception Générale Du Monde* (The Theory of Atoms in the General Conception of the World) was published by G. Masson in Paris (Wurtz, 1875b).

Four years later, in 1879, the second edition of his book entitled *La The□orie Atomique* (The Atomic Theory) appeared in Paris (Wurtz, 1879c). In the same year, the Italian edition of this book was published in Milano (Wurtz, 1879d). The First American edition of this book appeared in 1881 in New York. The translator was Edward Cleminshaw, Assistant-Master at Sherborne School (Wurtz, 1881). In 1882, a

Este articulo no presenta conflicto de intereses.

Russian edition of this book, translated from the second French edition, appeared in Kiev (Vyurts, 1882; Krupskiy, 1900, p. 13).

His book under the title *Progrès De L'Industrie Des Matières Colorantes Artificielles* (Advances in Artificial Colors Industry) appeared in 1876 in Paris (Wurtz, 1876). In 1885, a year after his death, his book entitled *Introduction A L'Étude De La Chimie* (Introduction to the Study of Chemistry) was published by G. Masson (Wurtz, 1885a).

In 1885, a year after his death, his book entitled *Traité De Chimie Biologique* (Treatise on Biological Chemistry) was published in Paris. It was dedicated to Cailliot. He wrote: "To M. Amédée Cailliot, Former Professor of Chemistry at the Faculty of Medicine of Strasbourg. My First Master" (Wurtz, 1885b, p. 9). In an introduction written on February 1, 1880, he wrote:

Today we are publishing the first part of the lessons in biological chemistry which we have taken in the Faculty of Medicine since 1849, and which in recent years have been the subject of a special course. This volume complements an elementary treatise on medical chemistry, which appeared in 1864 (p.11).

He is also the author of the report presented to the Minister of Public Instruction entitled *Les Hautes Études Pratiques Dans Les Universites Allemandes* (Higher Practical Studies In German Universities) which was published in 1870 in Paris (Wurtz, 1870).

CONCLUSION

Charles-Adolphe Wurtz (1817-1884) was an outstanding French chemist of the 19th century. He received many scientific honours. Among them are a membership of the Academies of Sciences and Scientific Societies, as well as distinctions and decorations.

In 1856, he was elected a member of the French Medical Academy, and in 1867 he became a member of the Academy of Sciences (Institute de France). Thirteen years later he was chosen President of this Academy. He became a corresponding member of the Imperial St. Petersburg Academy of Sciences on December 7, 1873 ("Vyurts Sharl'-Adol'f", 2007). He was also a member of Academies of Sciences of Berlin, Vienna, Munchen, Turin, Venice, Bologna, Upsalla, Edinburg, Rome, Belgium and Ireland (Musabekov, 1963, p. 14). In 1878, he was elected a member of the Bavarian Academy of Sciences.

In 1858, he founded the *Société Chimique de Paris*. He was the President of this Society three times, in 1864, 1874 and 1878 (Gautier, 1908, p.72). On June 9, 1864, he became a Foreign Member of the Royal Society. He was recommended by 18 members of this Society. They wrote: "Adolph Wurtz of Paris, eminent as a Chemist, is recommended by us as a proper Person to be placed on the List of Foreign Members of the Royal Society" ("GB 117. The", 2021). On November 12, 1878, he was elected a Fellow of the Chemical Society of London.

In 1881, he was elected permanent Senator (Anonymous, 1884b; "1911 Encyclopædia Britannica", 2021). In the same year, he was awarded the highest decoration in France, the *Grand Officer L'Ordre national de la Légion d'honneur* (Grand Officer of the Legion of Honor), and also received the Copley Medal, given annually by the Royal Society of London "for outstanding achievements in research in any branch of science". He was awarded it "for his discovery of the organic ammonias, the glycols, and other investigations which have exercised considerable influence on the progress of chemistry" ("Copley Medal. British", n.d.).

Este articulo no presenta conflicto de intereses.

Wurtz's books were written in French. Some of them have been translated into English, German, Spanish, Italian and Russian. His papers were mostly written in French. Some of his important works have been translated into English and German, for example, on a series of organic alkalies homologous with ammonia (Wurtz, 1849), about glycol, a di-acidic alcohol (Wurtz, 1856), on oxide of ethylene (Wurtz, 1862b), on the artificial coloring matters derived from coal tar (Wurtz, 1877).

The notes of some of his experimental research were also published in *the Chemical News*, for example, on the synthesis of chloride of thionyle (Wurtz, 1866b), on synthesis of aromatic acids (Wurtz, 1869b; Wurtz, 1870), on preparation of aldol (Wurtz, 1881b), on the action of heat upon aldol and paraldol (Wurtz, 1884c).

Some authors wrote about his life and works. For instance, in 1883 his biographical sketch was published in *the Popular Science Monthly* (Anonymous, 1883). In 1884, an article entitled *Adolphe Wurtz and His Chemical Work* was published in the *Nature* (Anonymous, 1884). A year later, the French chemist Charles Friedel (1832-1899) wrote his *Notice Sur La Vie Et Les Travaux De Charles-Adolphe Wurtz* (Notice on the Life and Works of Charles-Adolphe Wurtz), which appeared in the *Bulletin De La Société Chimique De Paris* (Friedel, 1885b). In 1887, a Wurtz's biography by A. W von Hofmann was published in the *Berichte der Deutschen chemischen Gesellschaft* (Hofmann, 1887). A year later, in 1888, it was reprinted in Hofmann's *Zur Erinnerung An Vorangegangene Freunde* (Hofmann, 1888a), as well as in his book entitled *Adolph Wurtz. Ein Lebensbild* published in Braunsweig (Hofmann, 1888b).

In 1892, Georges Barral (1842-1913) wrote about him and his achievements in his book entitled *Le Panthéon scientifique De La Tour Eiffel* (The Scientific Pantheon of the Eiffel Tower) (Barral, 1892, pp. 277-280). In 1917, the French chemist Armand Gautier (1837-1920) wrote about him on the occasion of the 100th anniversary of his birth (Gautier, 1917). An article about him by Maurice Hanriot (1853-1933), a member of the Academy of Medicine in Paris, appeared in the same year in the *Revue Scientifique* (Hanriot, 1917). This author also wrote about him in 1900 (Hanriot, 1900).

The British chemist and historian of chemistry Thomas Edward Thorpe (1845-1925) briefly wrote about him and his works in an article published in 1918 in the *Nature* (Thorpe, 1918). In 1951, Florence E. Wall's article about him appeared in the *Journal of Chemical Education* (Wall, 1951). A year later, the journal *Revue D'Histoire Des Sciences Et De Leurs Applications* published an article by G. V. Bykov and J. Jacques about the unpublished correspondence between Wurtz and Butlerov (Bykov & Jacques, 1960). In 1963, Yusuf Suleimanovich Musabekov wrote a biographical book about Wurtz, which was published in Moscow (Musabekov, 1963).

In 1964, the British chemist and historian of chemistry James Riddick Partington (1886-1965) wrote about him in his *A History of Chemistry* (Partington, 1964). The British historian of science John Hedley Brooke's biographical sketch on Wurtz was published in the *Dictionary of Scientific Biography* in 1976 (Brooke, 1976, pp. 529-532).

Alan J. Rocke described Wurtz's life and important works in his two books (Rocke, 1993; Rocke, 2001). An article about his life and scientific activities by Jaime Wisniak was published in 2005. In 2007, the French historian of science Natalie Pigeard-Micault wrote about him in her doctoral dissertation entitled *Charles Adolphe Wurtz, doyen de l'École de médecine de Paris (1866-1875)* (Ch. Ad. Wurtz, Dean of the Paris School of Medicine (1866-1875)) (Pigeard-Micault, 2007) and also in her book, which appeared in 2011 in Paris (Pigeard-Micault, 2011). Adrian-Mihail Stadler and

Este articulo no presenta conflicto de intereses.

Jack Harrowfield briefly wrote about him and his scientific activities in their article published in 2011 in the *Chemical Society Reviews* (Stadler & Harrowfield, 2011).

A commemorative medal in honor of Wurtz was made by the French medal engraver –medalist Alphée Dubois (1831-1905) in 1886 ("Les Musées de", n.d.).

On July 5, 1921, the statue made of bronze on a sandstone plinth was inaugurated in honor of Wurtz in Strasbourg. It was made by French sculptor Jules Desbois (1851-1935). Its founder was Alexis Rudier. Upon the front of the statue was the following inscription, in French, "CHARLES ADOLPHE / WURTZ / BORN IN STRASBOURG / ON NOVEMBER 26, 1817 / DIED IN PARIS ON MAY 12, 1884". Inscriptions, in French, on the opposite side of the pedestal inform the reader about the work of Wurtz and his honors "DEAN AT THE FACULTY OF / MEDICINE OF PARIS / PROFESSOR AT THE SORBONNE / AND AT THE COLLEGE DE FRANCE / MEMBER OF THE INSTITUTE AND OF / THE ACADEMY OF MEDICINE / SENATOR". On one of the other sides of the pedestal you can read the following inscriptions: "DICTIONARY OF CHEMISTRY / CHEMISTRY IS A / FRENCH SCIENCE / PREFACE TO THE DICTIONARY". On the fourth side of the pedestal there are inscriptions informing about his most important discoveries on glycols, ethylene oxide and aldol ("Statue de Charles", n.d.). During the ceremony, speeches were made by members of the French Academy of Sciences, the Paris Academy of Medicine, President of the French Chemical Society, Rector of the University of Strasbourg, and a representative of *the Société Industrielle de Mulhouse* and its Chemistry Committee (Tiffeneau, Haller, Hanriot, André, Charléty, Gariel, … , & Scheurer, 1921).

It is also worth mentioning here the decision of the French engineer Gustave Eiffel (1832-1923), who built his tower in Paris, to honor seventy-two outstanding French scientists, indicating their names in the tower's structure. Among them is the name of Wurtz, and the height of the capital letters is 60 cm (Barral, 1892, p. 20; "Guide Officiel De", 1893, p. 14; "Liste des 72", 2021). In addition, the mineral *wurtzite* is named in 1861 by Ch. Friedel in honor of Wurtz ("mindat.org. Wurtzite.", 2021).

Adolphe Wurtz, as one of the great masters of modern organic chemistry, went down in the history of chemistry, and his name was written in it forewer. This was made possible thanks to his wonderful discoveries and the significant results of his experimental research, about which T. E. Thorpe (1918) wrote:

he discovered phosphoryl chloride and copper hydride, the first member of this class of substances to be made known, and noted the significance of the mode of its decomposition by hydrochloric acid in reference to the atomic constitution of elements in the free state. … He discovered liquid cyanogen chloride and synthesised urethane, and prepared the cyanic and cyanuric ethers and the first of the compound ammonias … He prepared the compound ureas, established the triatomic character of glycerol, and predicted the existence of the diatomic alcohols, which he established by the discovery of glycol, glycollic acid, and a number of other derivatives. … In 1854 Wurtz isolated butyl alcohol *(iso*-propyl carbinol) from the fusel oil of potato-spirit … His study of the action of hydrochloric acid on aldehyde led to the discovery of aldol, its polymerides, and other derivatives, which occupied much of his attention for several years" (pp. 166-167).

Este articulo no presenta conflicto de intereses.

BIBLIOGRAPHIC REFERENCES

Anonymous (1884a). Obituary. Professor Wurtz. *The Chemical News, 49*(1277), 222-223. Retrieved from https://archive.org/details/s713id13691510/page/222/mode/2up

Anonymous (1884b). Adoplphe Wurtz and his Chemical Work. *Nature, 30,* 170-172. https://doi.org/10.1038/030170e0

Anonymous. (1883). Sketch of Charles Adoplphe Wurtz. *The Popular Science Monthly, 22*, 114- 119. Retrieved from https://archive.org/details/popularsciencemo22newy/page/114/mode/2up

Anonymous. (1878). The Faraday Lecture of the Chemical Society. *The Chemical News, 38*(990), 238. Retrieved from https://archive.org/details/s713id13691400/page/238/mode/2up

Anonymous. (1866). Correspondence. Continental Science. *The Chemical News, 13*, 71. Retrieved from https://archive.org/details/s713id13683350/page/70/mode/2up

Barral, G. (1892). Le Panthéon scientifique De La Tour Eiffel. Histoire Des Origines. De La Construction Et Des Applications De La Tour De 300 mètres. Biographie De Ses Créateurs. Exposé De La Vie Et Des Découvertes Des 72 Savants Dont Les Noms Sont Inscrits Sur La Grande Frise Extérieure. Édition Définitive. … Paris: Nouvelle Librairie Parisienne. Retrieved from https://books.google.pl/books?id=v3633zMAwvcC&printsec

Brooke, J. H. (1976). Charles-Adolphe Wurtz. In C. C. Gillispie (Ed.), *Dictionary of Scientific Biography* (pp. 529-532). Volume 14. New York: Charles Scribner's Sons.

Bykov, G. V., & Jacques, J. (1960). Deux pionniers de la chimie moderne, Adolphe Wurtz et Alexandre M. Boutlerov, d'aprèsune correspondance inédite. *Revue D'Histoire Des Sciences Et De Leurs Applications, 13*(2), 115-134. Retrieved from https://www.persee.fr/doc/rhs_0048-7996_1960_num_13_2_3807

Copley Medal. British scientific award. (n.d.). Retrieved from https://www.britannica.com/science/Copley-Medal

Farber, E. (1956). The Glycol Centenary. *Journal of Chemical Education, 33,* 117. https://doi.org/10.1021/ed033p117

Fittig, R. (1864). Ueber die Synthese von Kohlenwasserstoffen. *Nachrichten von der Königl. Gesellschaft der Wissenschaften und der Georg-Augustus-Universität aus dem Jahre 1864*. Retrieved from https://gdz.sub.uni-goettingen.de/id/PPN252457072_1864?tify={%22pages%22:[227],%22view%22:%22info%22}

Friedel. (1885a). Liste des Notes Et Memoires Publiees par Wurtz. *Bulletin De La Société Chimique De Paris, 43*, LXXV-LXXX. Retrieved from https://archive.org/details/bulletin09frangoog/page/n83/mode/2up

Friedel. (1885b). Notice Sur La Vie Et Les Travaux De Charles-Adolphe Wurtz. *Bulletin De La Société Chimique De Paris, 43*, I-LXXX. Retrieved from https://archive.org/details/bulletin09frangoog/page/n9/mode/2up

Este articulo no presenta conflicto de intereses.

Gautier, A. (1917). Ch.-Adolphe Wurtz. A l'occasion de son Centenaire. *Revue Scientifique, 55*(25), 769-779. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k215164w/f773.item

Gautier, A. (1908). Les Cinquante Premières Années De La Société Chimique De France (1857- 1907). In *Cinquantenaire De La Société Chimique De France* (pp. 65-137). Paris: Gauthier- Villars, Imprimeur-Libraire. Retrieved from https://archive.org/details/cinquantenairede 00sociuoft/page/64/mode/2up

GB 117. The Royal Society. EC/1864/19. Wurtz, Karl Adolph. (2021). Retrieved from https://collections.royalsociety.org/DServe.exe?dsqIni=Dserve.ini&dsqApp= Archive& dsqDb=Catalog&dsqSearch=RefNo==%27EC%2F1864%2F19%27&dsqCmd=Show. tcl

Gerhardt, K. (1846). *Grundriss Der Organischen Chemie*. Aus dem Französischen Übersetzt von Dr. Adolph Wurtz. Zweiter Band. Strassburg: Verlag von Schmidt & Grucker. Retrieved from https://www.digitale-sammlungen.de/de/view/bsb10707849?page=5

Gerhardt, Ch. (1845). *Précis De Chimie Organique. Tome Second.* Paris: Chez Fortin, Massson
Retrieved from https://archive.org/details/prcisdechimieo02gerh

Gerhardt, Ch. (1844a). *Précis De Chimie Organique. Tome Premier.* Paris: Chez Fortin, Massson
Retrieved from https://archive.org/details/prcisdechimieo01gerh

Gerhardt, K. (1844b). *Grundriss Der Organischen Chemie*. Aus dem Französischen Übersetzt von Dr. Adolph Wurtz. Erster Band. Strassburg: Verlag von Schmidt & Grucker. Retrieved from https://www.digitale-sammlungen.de/en/view/bsb10072650?page=4,5

Guide Officiel De la Tour Eiffel. (1893). Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k1033 78c/f17.image

Hanriot. (1917). Centenaire d'Adolphe Wurtz. *Revue Scientifique, 55*(25), 779-781. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k215164w/f783.item

Hanriot. (1900). A. Wurtz. 1817-1884. *In Musée Centennal De La Classe 87. Arts, Chimiques et Pharmacie (Matériel, procédés et produits) À L'Exposition Universelle Internationale De 1900, À Paris. Les Chimistes Français du XIX^E Siècle* (pp. 101-103). Retrieved from https://archive.org/details/musecentennald00expo/page/100/mode/2up

Hofmann, A. W. Von. (1888a). Erinnerung An Adolph Wurtz. 1887. In A. W. Von Hofmann. *Zur Erinnerung An Vorangegangene Freunde. Dritter Band* (pp. 171-431). Braunschweig: Druck und Verlag Von Friedrich Vieweg und Sohn. Retrieved from https://archive.org/details/ zurerinnerungvor03hofm/page/n189/mode/2up

Hofmann, A. W. Von. (1888b). Adolph Wurtz. Ein Lebensbild. Braunsweig: Druck und Verlag von Freidrich Vieweg und Sohn. Retrieved from https://books.google.pl/books?id=zuFXZ JKRzYYC&pg=PP9&hl=pl&source=gbs_selected_pages&cad=2#v=onepage&q&f=f alse

Este articulo no presenta conflicto de intereses.

Hofmann, A. W. (1887). Adolph Wurtz. *Berichte der Deutschen chemischen Gesellschaft. (Refereate, Patente, Nekrologe), 20*, 815-996. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k90712r/f760.item

Hofmann, A. W. (1886). Charles Adolphe Wurtz. In *Sitzungsberichte der mathematisch-physikalischen Classe der k. b. Akademie der Wissenschaften zu München. Band XV. Jahrgang 1885* (pp.153-160). München: Akademische Buchdruckerei von F. Straub. Retrieved from https://archive.org/details/sitzungsbericht36wissgoog/page/n171/mode/2up

Hofmann, A. W. (1884). Adolf Wurtz. *Berichte der deutschen chemischen Gesellschaft, 17*(1), 1207-1211. https://doi.org/10.1002/cber.188401701320

Krupskiy, A. K. (1900). *Russkaya Chast' Khimicheskoy Bibliografii* (*Dolozheno v zasedanii fiziko-matematicheskogo otdeleniya 5-go Oktyabrya 1896 g.*) (The Russian Part of the Chemical Bibliography) (Reported at a Meeting of the Physics and Mathematics Department on October 5, 1896). Sankt-Peterburg: Tipografiya Imperatorskoy Akademii Nauk. (in Russian). Retrieved from Elektronnaya biblioteka BELINKI website: http://elib.uraic.ru/handle/123456789/16183

Les Musées de la Ville de Paris. Charles Adolphe Wurtz (1817-1884), médecin et chimiste, 1886. (n.d.). Retrieved from: https://www.parismuseescollections.paris.fr/fr/musee-carnavalet/oeuvres/charles-adolphe-wurtz-1817-1884-medecin-et-chimiste-1886#infos-principales

Li, J. J. (2003). Wurtz reaction. In J. J. Li, *Name Reactions. A Collection of Detailed Reaction Mechanisms* (p. 446). Berlin, Heidelberg: Springer- Verlag. https://doi.org/10.1007/978-3- 662-05336-2_326

Liste des 72 noms de savants inscrits sur la tour Eiffel. (2021). Retrieved from https://fr.wikipedia.org/wiki/Liste_des_72_noms_de_savants_inscrits_sur_la_tour_Eiffel

mindat.org. the Hudson Institute of Mineralogy. Wurtzite. (2021). Retrieved from https://www.mindat.org/min-4318.html

Musabekov, Yu. S. (1963). *Sharl' Adol'f Vyurts. 1817-1884.* [Charles Adoplphe Wurtz. 1817-1884]. Moskva: Izdatel'stvo Akademii Nauk SSSR.

Partington, J. R. (1964). *A History of Chemistry*. Volume Four. London: Macmillan and Company Limited. https://doi.org/10.1007/978-1-349-00554-3

Pigeard-Micault, N. (2011). *Charles-Adolphe Wurtz. Un savant dans la tourmente. Entre bouleversements politiques et revendications fe□ministes*. Paris: Hermann.

Pigeard-Micault, N. (2007). *Charles Adolphe Wurtz, doyen de l'École de médecine de Paris (1866- 1875)*. Thèse pour obtenir le grade de Docteur de l'Université Paris X. Histoire, Philosophie et Sociologie des sciences. Paris X: Université de Nanterre. Retrieved from https://tel.archives-ouvertes.fr/tel-00910297

Rocke, A. J. (2001). *Nationalizing Science. Adolphe Wurtz and the Battle for French Chemistry*. Cambridge, Mass.: The MIT Press.

Este articulo no presenta conflicto de intereses.

Rocke, A. J. (1993). *The Quiet Revolution. Hermann Kolbe and the Science of Organic Chemistry* (Chapter 4; pp. 93-98). Berkeley: University of California Press. Retrieved from http://ark.cdlib.org/ark:/13030/ft5g500723/

Stadler, A-M., & Harrowfield, J. (2011). Places and chemistry: Strasbourg—a chemical crucible seen through historical personalitiees. *Chemical Society Reviews*, *40*, 2061-2108. https://doi.org/10.1039/C0CS00197J

Smith, H. M. (1949). *Torchbearers of Chemistry. Portraits and Bibliography of Scientists Who Have Contributed to the Making of Modern Chemistry*. New York: Academic Press Inc., Publishers.

Thorpe, T. E. (1918). The Centenaries of Gerhardt and Wurtz. *Nature, 101*(2531*)*, 165-167. https://doi.org/10.1038/101165a0

Tiffeneau, Haller, Hanriot, André, Charléty, Gariel, …, & Scheurer, A. (1921). Le Centenaire De Deux Grands Chimistes a Strasbourg. Les Alsaciens Charles Gerhardt Et Adolphe Wurtz [The Centenary Of Two Great Chemists in Strasbourg. The Alsatians Charles Gerhardt And Adolphe Wurtz]. II. – Inauguration Du Monument Wurtz. Discours Prononcés Par MM. Haller, Hanriot, André, Gariel, Desgres, & Albert Scheurer. *Revue Scientifique, 59*(20), 575- 576, 588-602. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k215168d/f610.item

Tollens, B., & Fittig, R. (1864a). Ueber die Synthese der Kohlenwasserstoffe der Benzolreihe. *Justus Liebig Annalen der Chemie, 131*(3), 303-323. https://doi.org/10.1002/jlac.18641310307

Tollens, B., & Fittig, R. (1864b). Sur la synthèse des carbures d'hydrogène de la série benzique. *Annales de Chimie et de Physique, Quatrième Série, 3*, 457-459. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k348133/f456.item

Vyurts, A. (1882). *Atomicheskaya Teoriya*. (≪Theorie atomique≫). Perevod so 2-go frantsuzskogo izd. Kiyev (in Russian).

Vyurts, A. (1869). *Istoriya khimicheskikh doktrin* (≪Histoire des doctrines chimiques≫). Perevod M. Negreskulya pod red. A.M. Butlerova. Sankt-Peterburg (in Russian).

Vyurts, A. (1867). *Elementarnyy uchebnik khimii* (Elementary Textbook of Chemistry). ≪Leçons elementaires de chimie moderne≫. Paris, 1866). Perevod P. P. Alekseyev. Kiyev. (in Russian).

Vyurts, A. (1865). *Lektsii po nekotorym voprosam teoreticheskoy khimii* (Lectures on some Topics of Theoretical Chemistry) (≪Wurtz, Adolphe, Leçons de philosophie chimique≫. Paris, 1864). Perevod P. P. Alekseyev. Sankt-Peterburg (in Russian).

Vyurts Sharl'-Adol'f. (2007). Retrieved from Rossiyskaya Akademiya Nauk website: http://www.ras.ru/win/db/show_per.asp?P=.id-49971.ln-ru.dl-.pr-inf.uk-12

Wall, F. E. (1951). Faraday, Hofmann, and Wurtz. *Journal of Chemical Education, 28*(7), 355-358. https://doi.org/10.1021/ed028p355

W[illiamson], A. W. (1885). Obituary Notices of Fellows Deceased. Charles Adolphe Wurtz. *Proceedings of the Royal Society, 38*(235-238), xxiii-xxxiv. https://doi.org/10.1098/rspl.1884.0053

Wisniak, J. (2005). Charles-Adolphe Wurtz. *Educación Química, 16*(2), 347-359. Retrieved from http://www.revistas.unam.mx/index.php/req/article/view/66127/58039

Este articulo no presenta conflicto de intereses.

Wurtz. (1841). Du gaz de l'éclairage (gaz light). *Traite de Medecine Legale, 3*(2), 840-844. Retrieved from https://collections.nlm.nih.gov/bookviewer?PID=nlm:nlmuid-28430290RX4-mvpart

Wurtz, A. (1876). Progrès De L'Industrie Des Matières Colorantes Artificielles. Paris: G. Masson, Éditeur. Retrieved from https://archive.org/details/progresdelindust00wurt/page/n5/mode/2up

Wurtz, A. (1875b). *La Théorie Des Atomes dans la conception générale du monde.* In *La Théorie Des Atomes Dans La Conception Générale Du Monde. Discours d'inauguration de la troisième session de l'Association française pour l'avancement des Sciences (Lille, 20 Septembre 1874), Suivi de L'Eloge de Laurent et de Gerhard et de L'Eloge de L. Soubeiran* (pp. 1-60). Paris: G. Masson, Éditeur. Retrieved from https://archive.org/details/lathoriedesato00wurtuoft/page/n7/mode/2up

Wurtz, A. (1870). Synthesis of Aromatic Acids. *The Chemical News, 21*, 118. Retrieved from https://archive.org/details/s713id13683430/page/118/mode/2up

Wurtz, A. (1856). Ueber das Glycol, einen zweisäurigen Alkohol. *Justus Liebigs Annalen der Chemie, 100*(1), 110-115. https://doi.org/10.1002/jlac.18561000115

Wurtz, A. (1855a). Sur Une Nouvelle Classe De Radicaux Organiques. *Annales de Chimie et de Physique, Troisième Série, 44*, 275-313. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k6572001c/f279.image

Wurtz, A. (1855b). Ueber eine neue Klasse organischer Radicale. *Justus Liebig Annalen der Chemie, 96*(3), 364-375. https://doi.org/10.1002/jlac.18550960310

Wurtz, A. (1849). On a Series of Organic Alkalies Homologous with Ammonia. *Philosophical Magazine, Series 3, 34*(229), 316-318. https://doi.org/10.1080/14786444908646237

Wurtz, A. (1843). Sur la constitution de l'acide hypophosphoreux. *Annales de Chimie et de Physique, Troisième Série, 7*, 35-50. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k65711371/f41.image

Wurtz, A. C. (1867). *An Introduction to Chemical Philosophy, according to the Modern Theories*. (W. Crookes, Trans.). London: J.H. Dutton. Retrieved from https://archive.org/details/anintroductiont01wurtgoog/page/n4/mode/2up

Wurtz, A., & Vogt, G. (1872). Sur la formation du chloral. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 74*, 777-787. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3031q/f777.image

Wurtz, Ad. (1895). *Elements of Modern Chemistry*. Fifth American Edition. (W. H. Greene, Trans.). Revised and Enlarged by W.H. Greene and Harry F. Keller. London, Philadelphia: J.B. Lippincott & Co. Retrieved from https://archive.org/details/elementsofmoder00wurt/page/n5/mode/2up

Este articulo no presenta conflicto de intereses.

Wurtz, Ad. (1894). *Leçons E□le□mentaires De Chimie Moderne*. Septième Édition. Paris: G. Masson, Éditeur. Retrieved from https://archive.org/details/leonslment00wurtuoft/page/n7/mode/2up

Wurtz, Ad. (1885a). *Introduction A L'Étude De La Chimie*. Paris: G. Masson Éditeur. Retrieved from https://archive.org/details/introductionalt00wurtgoog/page/n11/mode/2up

Wurtz, Ad. (1885b). *Traité De Chimie Biologique*. Paris: G. Masson, Éditeur. Retrieved from https://archive.org/details/b28106271/page/n7/mode/2up

Wurtz, Ad. (1884a). Remarques sur la loi de Faraday et sur la loi découverte par M. Bouty. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 98*, 176-177. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k30546/f175.item

Wurtz, Ad. (1884b). Note sur la loi de Faraday. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 98*, 321-322. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k30546/f320.item

Wurtz, Ad. (1884c). The Action of Heat upon Aldol and Paraldol. *The Chemical News, 49*(1261), 46-47. Retrieved from https://archive.org/details/s713id13691510/page/46/mode/2up

Wurtz, Ad. (1883a). Hydratation de l'aldéhyde crotonique. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 97*, 1169-1172. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3053w/f1169.item

Wurtz, Ad. (1883b). Action de la chaleur sur l'aldol et sur le paraldol. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 97*, 1525-1530. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3053w/f1525.item

Wurtz, Ad. (1881a). *The Atomic Theory*. (E. Cleminshaw, Trans.). New York: D. Appleton & Company. Retrieved from https://archive.org/details/atomictheorytrby00wurtuoft/page/n7/mode/2up

Wurtz. Ad. (1881b). Preparation of Aldol. *The Chemical News, 44*(1131), 60. Retrieved from https://archive.org/details/s713id13691460/page/60/mode/2up

Wurtz, Ad. (1880a). Sur la papaïne. Contribution à l'histoire des ferments solubles. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 90*, 1379-1385. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3047v/f1374.item

Wurtz, Ad. (1880b). Sur la papaïne. Nouvelle contribution à l' histoire des ferments solubles. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 91*, 787-791. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k30485/f789.image

Wurtz, Ad. (1880c). *Elements of Modern Chemistry*. London, Philadelphia: J. B. Lippincott & Co. Retrieved from https://archive.org/details/elementsofmodern00wurtrich/page/n7/mode/2up

Wurtz, Ad. (1880-1886a). *Dictionnaire De Chimie Pure Et Appliquée: Comprenant La Chimie Organique Et Inorganique, La Chimie Appliquée À L'Industrie, À L'Agriculture Et Aux Arts, La Chimie Analytique, La Chimie Physique Et La Minérologie*. Supplément Premiére Partie A – F. Paris: Libraire Hachette Et Cie. Retrieved from https://wellcomecollection.org/works/

Este articulo no presenta conflicto de intereses.

ganz4zmz/items?canvas=9
Wurtz, Ad. (1880-1886b). *Dictionnaire De Chimie Pure Et Appliquée: Comprenant La Chimie Organique Et Inorganique, La Chimie Appliquée À L'Industrie, À L'Agriculture Et Aux Arts, La Chimie Analytique, La Chimie Physique Et La Minérologie*. Supplément Deuxième Partie G – Z. Paris: Libraire Hachette Et Cie. Retrieved from https://wellcomecollection.org/works/ganz4zmz/items?canvas=9
Wurtz, Ad. (1879a). I.—On the Constitution of Matter in the Gaseous State. *Journal of the Chemical Society, Transactions, 35,* 1-12. https://doi.org/10.1039/CT8793500001
Wurtz, Ad. (1879b). *Elements of Modern Chemistry*. Philadelphia: J. B. Lippincott & Co. Retrieved from https://archive.org/details/elementsofmodern00wurt/page/n5/mode/2up
Wurtz, Ad. (1879c). *La The□orie Atomique*. Deuxième Édition. Paris: Libraire Germen Baillière. Retrieved from https://archive.org/details/lathorieatomiqu00wurtgoog/page/n7/mode/2up
Wurtz, Ad. (187d). *La Teoria Atomica*. Milano: Fratelli Dumolard. Retrieved from https://archive.org/details/lateoriaatomica00wurtgoog/page/n7/mode/2up
Wurtz, Ad. (1878a). On the Constitution of Matter in the Gaseous State. *The Chemical News, 38*(991), 245-248. Retrieved from https://archive.org/details/s713id13691400/page/244/mode/2up
Wurtz, Ad. (1878b). On The Constitution of Matter in the Gaseous State1. *Nature, 19*, 62-66. https://doi.org/10.1038/019062b0
Wurtz, Ad. (1878c). Sur la polymérisation de l'oxyde d'éthylène. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 86*, 1176. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3043m/f1246.item
Wurtz, Ad. (1877). On The Artificial Coloring Matters Derived from Coal Tar. *Scientific American Supplement, 57*, 906-907. https://doi.org/10.1038/scientificamerican02031877- 906supp
Wurtz, Ad. (1876a). Note sur le paraldol, modification polymérique de l'aldol. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 83*, 255-256. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3040p/f254.image
Wurtz, Ad. (1876b). *Dictionnaire De Chimie Pure Et Appliquée. Comprenant: La Chimie Organique Et Inorganique, La Chimie Appliquée À L'Industrie, À L'Agriculture Et Aux Arts, La Chimie Analytique, La Chimie Physique Et La Minéralogie*. Tome Premier. Deuxième Partie. C – G. Paris: Libraire Hachette Et C^{ie}. Retrieved from https://bibliotheques-numeriques.defense.gouv.fr/document/e07f4148-c2e3-4c65-a513-2f78a80c3e47
Wurtz, Ad. (1876c). *Dictionnaire De Chimie Pure Et Appliquée. Comprenant: La Chimie Organique Et Inorganique, La Chimie Appliquée À L'Industrie, À L'Agriculture Et Aux Arts, La Chimie Analytique, La Chimie Physique Et La Minéralogie*. Tome Second. Première Partie. H – P. Paris: Libraire Hachette Et C^{ie}. Retrieved from https://bibliotheques-numeriques.defense.gouv.fr/document/e07f4148-c2e3-4c65-a513-2f78a80c3e47
Wurtz, Ad. (1876d). *Dictionnaire De Chimie Pure Et Appliquée. Comprenant: La Chimie Organique Et Inorganique, La Chimie Appliquée À L'Industrie, À L'Agriculture Et*

Aux Arts, La Chimie Analytique, La Chimie Physique Et La Minéralogie. Tome Second. Deuxième Partie. P – S. Paris: Libraire Hachette Et C[ie]. Retrieved from https://books.google.pl/books? id=aAiruTAYwW8C&printsec=frontcover

Wurtz, Ad. (1875a). *Leçons E□le□mentaires De Chimie Moderne*. Troisième Édition, Revue et Augmentée. Paris: G. Masson, Éditeur. Retrieved from https://archive.org/details/leons lmentaires00wurtgoog/page/n11/mode/2up

Wurtz, Ad. (1874). *Dictionnaire De Chimie Pure Et Appliquée. Comprenant: La Chimie Organique Et Inorganique, La Chimie Appliquée À L'Industrie, À L'Agriculture Et Aux Arts, La Chimie Analytique, La Chimie Physique Et La Minéralogie*. Tome Premier. Première Partie. A – B. Paris: Libraire Hachette Et Cie. Retrieved from https://archive.org/details/b281 21624_0001/page/n7/mode/2up

Wurtz, Ad. (1873a). Nouvelles recherches sur l'aldol. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 76*, 1165-1171. Retrieved from https://gallica.bnf.fr/ark:/12148/ bpt6k3033b/f1165.image

Wurtz, Ad. (1873b). *Lecciones elementales de qui□mica moderna*. Barcelona: Verdaguer. Retrieved from https://www.worldcat.org/title/lecciones-elementales-de-quimica-moderna/oclc/14835 728?referer=di&ht=edition

Wurtz, Ad. (1873c). *Dictionnaire De Chimie Pure Et Appliquée. Comprenant: La Chimie Organique Et Inorganique, La Chimie Appliquée À L'Industrie, À L'Agriculture Et Aux Arts, La Chimie Analytique, La Chimie Physique Et La Minéralogie*. Tome Troisième. S – Z. Paris: Libraire Hachette Et Cie. Retrieved from https://archive.org/details/b28121624_0005/ page/n5/mode/2up

Wurtz, Ad. (1872a). Sur un aldéhyde-alcool. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 74*, 1361-1367. Retrieved from https://gallica.bnf.fr/ark:/12148/ bpt6k3031q/f1361.item

Wurtz, Ad. (1872b). *Lezioni Elementari Di Chimica Inorganica*. Traduzione eseguita sull'ultima edizione franceze Da R. Monteferrante. Napoli: Agostino Pellerano Libraio-Editore. Retrieved from https://archive.org/details/bub_gb_oxHkrS7MBDIC/page/n5/mode/2up

Wurtz, Ad. (1872c). *Lezioni Elementari Di Chimica Organica Moderna*. Traduzione eseguita sull'ultima edizione franceze Da R. Monteferrante. Napoli: Agostino Pellerano Libraio- Editore. Retrieved from https://books.google.pl/books?id=rM7gyH1hoZoC&pg=PA3&hl

Wurtz, Ad. (1870a). *Geschichte Der Chemischen Theorien Seit Lavoisier Bis Auf Unsere Zeit*. Deutsch hrsg. von Alphons Oppenheim. Berlin: Verlag von Robert Oppenheim. Retrieved from https://archive.org/details/geschichtederche00wurtuoft/page/n5/mode/2up

Wurtz, Ad. (1870b). *Les Hautes Études Pratiques Dans Les Universites Allemandes*. Rapport Présenté A Son Exc. M. Le Ministre De L'Instruction Publique. Paris: Imprimerie Impériale. Retrieved from https://archive.org/details/bub_gb_9pJAvn8lx3gC

Este articulo no presenta conflicto de intereses.

Wurtz, Ad. (1869a). *A History of Chemical Theory from the Age of Lavoisier to the Present Time* (H. Watts, Trans.). London: Macmillan. Retrieved from https://wellcomecollection.org/works/h36arawk

Wurtz, Ad. (1869b). Synthesis of the so-called Aromatic Acids. *The Chemical News, 19*(498), 299. Retrieved from https://archive.org/details/s713id13683410/page/298/mode/2up

Wurtz, Ad. (1868). *Histoire Des Doctrines Chimiques Depuis Lavoisier Jusqu'a Nos Jours*. Paris: Libraire De L. Hachette Et C^{ie}. Retrieved from https://www.biodiversitylibrary.org/item/68471#page/5/mode/1up

Wurtz, Ad. (1867). *Leçons E□le□mentaires De Chimie Moderne*. Premier Fascicule. Métalloïdes. Paris: Victor Masson Et Fils. Retrieved from https://archive.org/details/bub_gb_V_yf6q- SBv4C/page/n3/mode/2up

Wurtz, Ad. (1866a). Synthèse du chlorure de thionyle. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 62*, 460-462. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3019n/f460.item

Wurtz, Ad. (1866b). On the Synthesis of Chloride of Thionyle. *The Chemical News, 13*, 117. Retrieved from https://archive.org/details/s713id13683350/page/116/mode/2up

Wurtz, Ad. (1865). *Traité Élémentaire De Chimie Médicale Comprenant Quelques Notions De Toxicologie Et Les Principales Applications De La Chimie A La Physiologie, A La Pathologie, A La Médicine Et A L'Hygiène. II. Chimie Organique*. Retrieved from https://archive.org/details/bub_gb_8TbQyNybgiMC/page/n5/mode/2up

Wurtz, Ad. (1864a). Sur Quelques Points De Philosophie Chimique. Leçons Professées Les 6 Et 20 Mars 1863 Devant La Société Chimique. In *Leçons De Chimie Professées En 1863 par MM. Adolphe Wurtz, A. Lamy, Louis Grandeau* (pp.1-222). Paris: Librairie de L. Hachette. Retrieved from https://archive.org/details/bub_gb_33owuKQB8gIC/page/n9/mode/2up

Wurtz, Ad. (1864b). *Leçons De Philosophie Chimique*. Paris: Librairie de L. Hachette Et C^{ie}.

Wurtz, Ad. (1864c). *Traité Élémentaire De Chimie Médicale Comprenant Quelques Notions De Toxicologie Et Les Principales Applications De La Chimie A La Physiologie, A La Pathologie, A La Pharmacie Et A L'Hygiène. I. Chimie Inorganique*. Retrieved from https://archive.org/details/bub_gb_kG0srbd1RRwC/page/n5/mode/2up

Wurtz, Ad. (1862a). Nouvelles recherches sur l'oxyde d' éthylene. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 54*, 277-281. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k30115/f277.item

Wurtz, Ad. (1862b). XLVIII.—On Oxide of Ethylene, considered as a link between Organic and Mineral Chemistry. *Journal of the Chemical Society, 15*, 387-406. https://doi.org/10.1039/JS8621500387

Wurtz, Ad. (1860). Nouvelles recherches sur l'oxyde d' éthylene. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 50*, 1195-1197. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3007r/f1207.item

Este articulo no presenta conflicto de intereses.

Wurtz, Ad. (1859a). Synthèse du glycol avec l'oxyde d'éthylene et l'eau. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 49*, 813-815. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3006f/f815.image

Wurtz, Ad. (1859b). Sur l'oxyde d' éthylene. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 48*, 101-105. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k30054/f101.item

Wurtz, Ad. (1856). Sur le glycol ou alcool diatomique. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 43*, 199-204. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k3000k/f203.item

Wurtz, Ad. (1849a). Recherches sur les ammoniaques composèes. *Comptes rendus Hebdomadaires des séances de l'Académie des Sciences, 29*, 169-172. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k2986m/f173

Wurtz, Ad. (1849b). Sur une série alcalis organiques homologues avec l'ammoniaque. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 28*, 223-226. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k29859/f223

Wurtz, Ad. (1846). Note sur la formation de l'uréthane par l'action du chlorure de cyanogène gazeux sur l'alcool. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences, 22*, 503-505. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k29798/f507.item

Wurtz, Ad. (1844a). Sur l'hydrure de cuivre. *Annales de Chimie et de Physique, Troisième Série, 11,* 250-252. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k34752q/f251.image

Wurtz, Ad. (1844b). Sur La Transformation De La Fibrine En Acide Butyrique. *Annales de Chimie et de Physique, Troisième Série, 11*, 253-255. Retrieved from https://gallica.bnf.fr/ark:/12148/bpt6k34752q/f254.item

Wurtz, Ch., Ad. (1900). *Elements of Modern Chemistry*. Philadelphia: J.B. Lippincott Company. Sixth American Edition. Revised and Enlarged by W. H. Greene and Harry F. Keller. Retrieved from https://archive.org/details/elementsofmod00wurt/page/n9/mode/2up

Wurtz, Charles Adolphe (1817-1884). Cimetière du Père Lachaise. (2019). Retrieved from https://www.appl-lachaise.net/wurtz-charles-adolphe-1817-1884/

Wurtz, Charles Adolphe (1817-1884) et sa famille. (n.d.). Retrieved from http://correspondance

Este articulo no presenta conflicto de intereses.