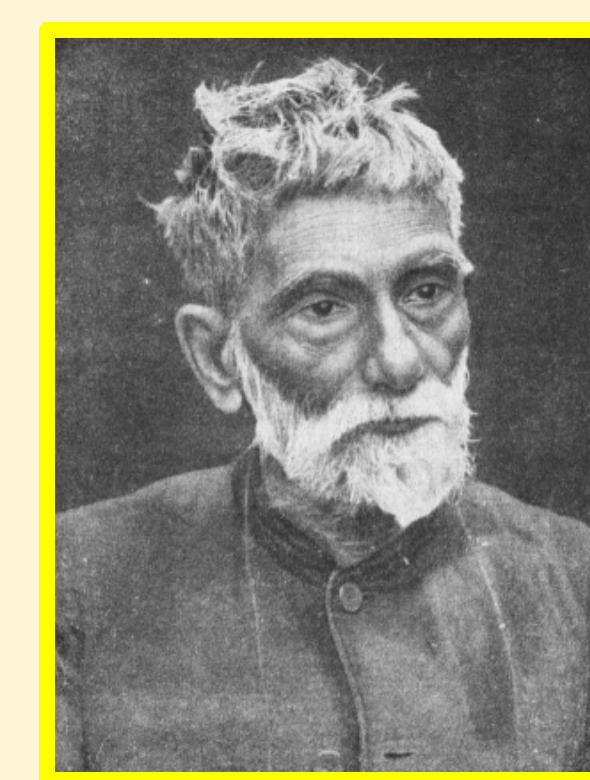




Alchemy

e-Issue, August-2020 – A Tribute to Acharya Prafulla Chandra Ray

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ACHARYA PRAFULLA CHANDRARAY: A LIFE DEDICATED TO THE DEVELOPMENT OF SCIENCE (Mrinal Roy, SEM-V, Dept. of Chemistry)

The nineteenth century was the golden age of Bengal. Many great personalities in various fields in this country used spirituality, education, science and literature to liberate the society from the darkness of illiteracy and superstition. Acharya Prafulla Chandra Ray was one of them. Prafulla Chandra Ray, dedicated his life to uplifting the nation in various fields, especially in education and science. On one hand, P. C. Ray was a social activist, inspirer of industry and a person with aesthetic taste and on the other, he was a successful educationist and a true propagator of science among the mass to remove the darkness of blind beliefs for the sake of national prosperity.

A) FAMILY BACKGROUND: Prafulla Chandra Ray was born in a small village called Raruli by the side of Kapataksha River on 2nd August, 1861. This village is now in Bangladesh. Prafulla Chandra belonged to a famous Ray family. His father was Harish Chandra Ray and his mother was Bhuvan Mohini Devi. Fanu, Ray's nickname became very popular in childhood. Ray was one of seven siblings, having four brothers – Jnanendra Chandra, Nalini Kanta, Purna Chandra and Buddha Dev – and two sisters, Indumati and Belamati, all except Buddha Dev and Belamati survived to adulthood.

B) EDUCATION: In 1866, Ray began attending a village school run by his father, where he studied till the age of nine. In 1870, when he was about 10 years old, his family moved to Calcutta, where Harishchandra rented a house at 132, Amherst Street. The following year, Ray was admitted to Hare School. While Ray was in the fourth standard, he suffered a severe attack of dysentery as a result; he was forced to suspend his studies and return to his ancestral home. After recovering from his illness, he returned to Calcutta in 1876 and was admitted to the Albert School founded by the Brahmo reformer Keshub Chandra Sen. His for knowledge was already visible. After the school education, in 1878, he took admission in Metropolitan Institution (now Vidyasagar College) for F. A. Degree which was established by Pandit Ishwarachandra Vidyasagar. In college, Prafulla Chandra came in close contact with eminent professors like Surendra Nath Bandopadhyaya, Prasanna Kumar Lahiri who motivated him to read English literature, which fascinated him at that time. Although Ray initially focused on history and literature till this date, Chemistry was then a compulsory subject in the F. A. degree. Since the Metropolitan Institution did not offer any facilities for science courses at the time, Ray attended lectures in Physics and Chemistry, as an external student, at Presidency College. He was particularly attracted to the Chemistry curriculum by Alexander Pedler, an inspirational lecturer and experimenter, who was one of the earliest research chemists in India. Soon fascinated by experimental science, Ray decided to make his career in Chemistry, as he recognized that the future of his country depended on the progress of science. He left for the United Kingdom in August 1882. There in Edinburgh, Chemistry was his favourite subject and he drew the attention of Professor Cram Brown. In the year 1885, Ray obtained his B. Sc. degree and in 1887, he was awarded the D. Sc. degree from the Edinburgh University in recognition of his work on "Conjugated (gepaarte) Sulphates of the Copper-magnesium Group". He was awarded the Hope Prize scholarship and was also elected Vice President of the Chemical Society of the Edinburgh University. Ray returned to India in 1888.

C) RESEARCH AND DISCOVERIES: Prafulla Chandra began his work in 1895. In 1896, he observed the formation of a solid of a yellow crystal with a reaction of mercury and dil. nitric acid. In the same year he published an article stating a new stable chemical compound - Mercurous nitrite. This result was first published in the Journal of Asiatic Society of Bengal. Synthesis of pure ammonium nitrite through double displacement between ammonium chloride and silver nitrite is a significant contribution of P. C. Ray. He then worked on mercury alkyl- and mercury aryl-ammonium nitrite. Prafulla Chandra retired from the Presidency College in 1916, and joined the Calcutta University College of Science (also known as Rajabazar Science College) as its first "Palit Professor of Chemistry", a chair named after Tarakanth Palit. In 1936, at the age of 75, he retired from active service and became Professor Emeritus. Long before that, on the completion of his 60th year in 1921, he made a free gift of his entire salary to the Calcutta University for the development of the Department of Chemistry in the University College of Science. For the upliftment of the poor, rural and unemployed, he applied the benefits of science to social life. Hence, Meghnad Saha honoured him with the title, "The father of scientific research in India". He had written 107 papers in all branches of Chemistry by 1920. Some of his notable students were Satyendra Nath Bose, Meghnad Saha, Jnanendra Nath Mukherjee, Jnan Chandra Ghosh.

D) SOCIAL WORKS: Prafulla Chandra Ray was not only a successful professor but also he was a great socialist. The floods of North Bengal in 1933 left millions homeless and hungry. Prafulla Chandra organized the Bengal Relief Committee, which collected about two and a half million rupees in cash and distributed it to the affected areas in an integrated manner. He regularly donated money for the welfare of the Sadharan Brahmo Samaj, Brahmo Girls School and Indian Chemical Society. In 1922, he donated money to establish the Nagarjuna Prize for Outstanding Work in Chemistry.

E) NATIONALISM: Acharya Prafulla Chandra Ray had innate immense liking for his mother tongue. He himself translated his own autobiography as "Atmacharit" and published it in 1937. Among his many notable books the most important one is "The History of Hindu Chemistry". He also protested strongly against the atrocities of the British government. Acharya P. C. Ray himself said that freedom is more important than scientific development. His advocacy was not bound within the four walls of academic buildings like college, university, classroom or laboratory but was manifested in the field of practicality, to create scope for unemployed youth. He established "Bengal Chemical". The factory opened up a new vista inspiring the young generation to pursue science.

ACADEMIC FELLOWSHIPS, MEMBERSHIPS AND HONORARY DOCTORATES

- Fellow of the Royal Asiatic Society of Bengal (FRASB)
- Fellow of the Chemical Society (FCS; 1902)
- Honorary Member of the Deutsche Akademie, Munich (1919)
- Foundation Fellow of the National Institute of Sciences of India (FNI; 1935)
- Fellow of the Indian Association for the Cultivation of Science (FIAS; 1943)
- Honorary Doctor of Philosophy degree from the University of Calcutta (1908).
- Honorary D.Sc. degree from Durham University (1912)
- Honorary D.Sc. degree from Banaras Hindu University (1920)
- Honorary D.Sc. degree from the University of Dhaka (1920 and 28 July 1936)

After a busy life this great teacher, scientist gradually came under the shadow of old age. The health of Acharya Prafulla Chandra Ray slowly deteriorated. At the age of eighty four, the great scientist breathed his last on 16th June, 1944. This was a great loss to the country. Even after his death, the light of his works still shines in different fields of the society.

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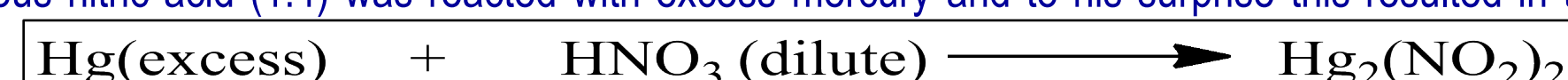
MAGNIFICENT RESEARCH CONTRIBUTIONS OF ACHARYA PRAFULLA CHANDRA RAY- THE FATHER OF INDIAN CHEMISTRY (Sayani Bidyabhusan, SEM-V, Dept. of Chemistry)

Acharya Prafulla Chandra Ray was mainly an eminent Chemist, specifically, in the area of inorganic compounds. The interest of Sir Prafulla Chandra Ray in chemistry was aroused by Sir Alexander Pedler's fascinating lectures and demonstration when he was in Presidency College during his FA course. At the age of 21(1885), he was awarded B.Sc degree from Edinburgh University. Thereafter, he realized the fact that he has born for chemistry and he became a worshiper of chemistry, in his word "almost by mistake"

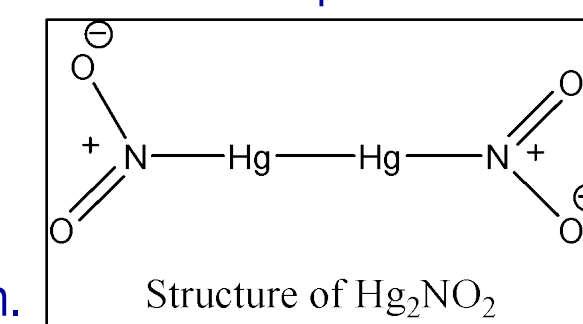
Research Contributions:

Mercury compounds

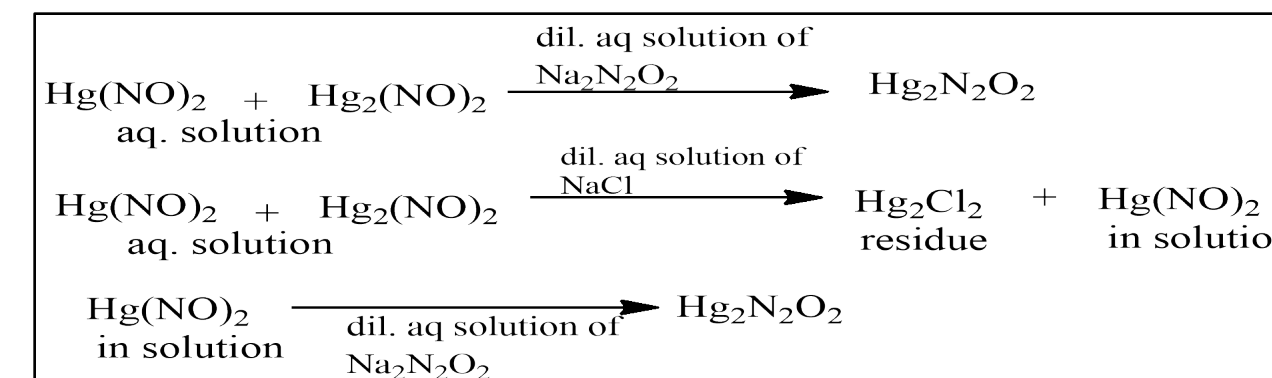
In 1895, Acharya Prafulla Chandra Ray reported the first synthesis of the hitherto unknown mercurous nitrite, Hg₂(NO₂)₂. This event was described by him in his autobiography as "the discovery of mercurous nitrite opened a new chapter in my life". The preparation of Hg₂(NO₂)₂ was an accidental discovery. He wanted to prepare water soluble mercurous nitrate as an intermediate for the synthesis of calomel, Hg₂Cl₂. Accordingly, dilute aqueous nitric acid (1:4) was reacted with excess mercury and to his surprise this resulted in the formation of yellow crystalline Hg₂(NO₂)₂.



In this context, it is very significant to mention that, for mercury(I), the electronic configuration should be 5d¹⁰6s¹ with a spin free electron which would make the mercurous compound paramagnetic. However, mercurous compounds are diamagnetic which indicates the absence of any spin free electron [loss of two s electrons not one, to a configuration of d¹⁰ noble gas]. This is due to the instability of Hg⁺ complexes and disproportionation of Hg⁺ to Hg²⁺. Moreover, the nitrite ion is not very stable and can undergo facile decomposition. Hg⁺ being a soft cation it reacts with soft nitrogen centre of nitrite anion in a chain fashion.



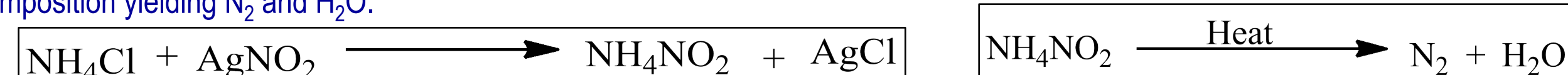
Incidentally, he became interested in the chemistry of Hyponitrites anion. The hyponitrites were prepared by reacting the corresponding nitrite with aqueous solution of sodium hyponitrite, Na₂N₂O₂. The reaction of mercury with nitric acid was used to prepare a solution containing a mixture of mercurous nitrite [Hg₂(NO₂)₂] and mercuric nitrite (Hg(NO₂)₂). From this mixture, he isolated the corresponding hyponitrites in the pure form.



Beside, numerous complexes of amines were also isolated. For example ethylenediamine (en), NH₂(CH₂)₂NH₂, afforded [Hg(en)(NO₂)₂].

Ammonium Nitrite and Alkylammonium Nitrites

One of the most notable contribution of Acharya Prafulla Chandra Ray in the field of nitrite chemistry was the synthesis of ammonium nitrite in pure form via double displacement reaction between ammonium chloride and silver nitrite; which was sublimed at 32-33°C under reduced pressure to afford crystalline colourless needles. It had all along been believed that ammonium nitrite undergoes fast thermal decomposition yielding N₂ and H₂O.

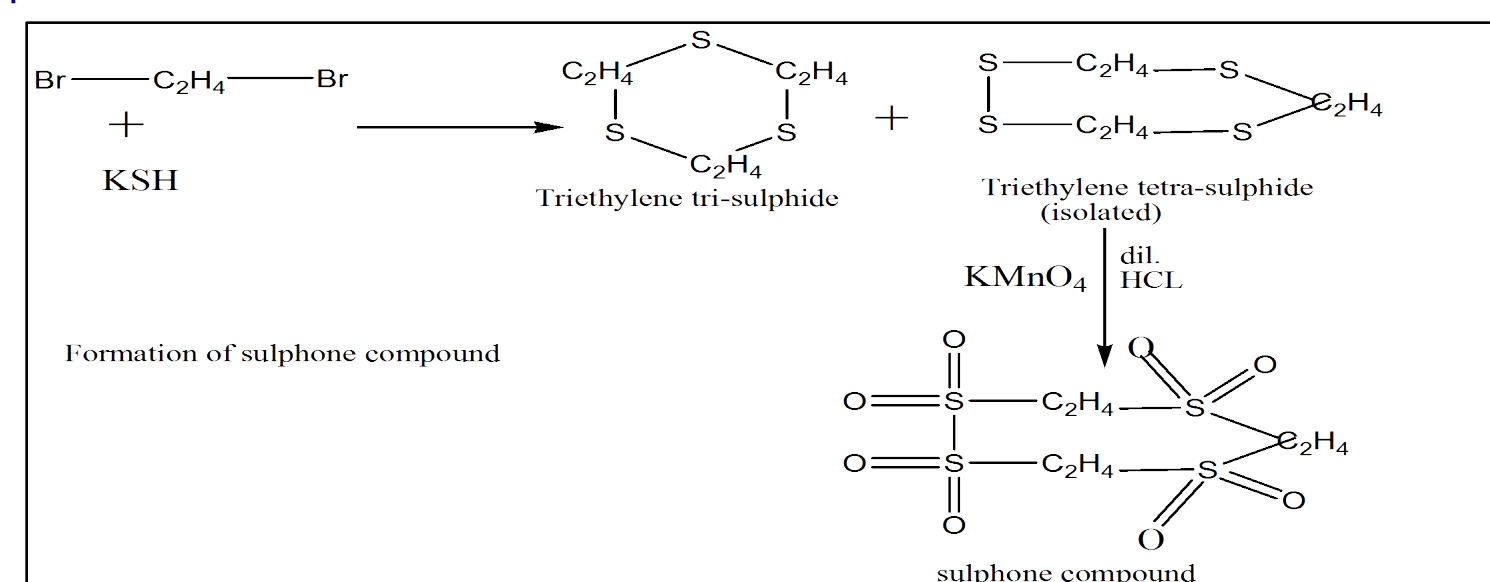


Sir Prafulla Chandra Ray established that this reaction is far less facile than thought. He carried out a series of experiments to show that pure ammonium nitrite is indeed stable and it can be sublimed without decomposition even at 60°C.

Organic Sulphur Compounds

Around 1914, Acharya Prafulla Chandra Ray initiated work on organic thio compounds like thiols, thioethers and related species and their binding to metals. Long-chain sulphur species, sulphur-containing condensed heterocycles and thioketones are some of the moieties that he synthesised. For example, as a by-product of the synthesis of 1,4-dithian starting from dithioethylene glycol and ethylene bromide, he isolated the long chain compound, BrC₂H₄(SC₂H₄)₁₈Br, which was 'the first instance of a crystalline organic sulphur compound of such high molecular weight as 3068.

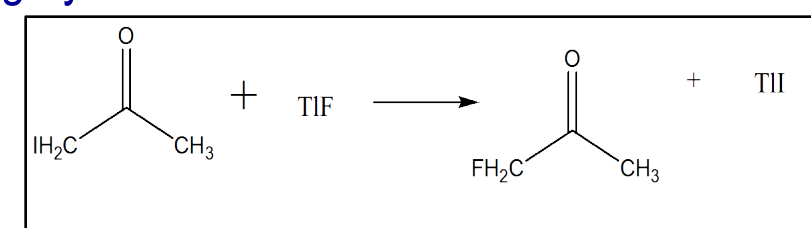
He also worked on the synthesis of condensed heterocyclic systems. Of these, the synthesis of triethylene tri- and tetra-sulphides from simple reactions of ethylenedibromide and alcoholic KSH were noteworthy. Potassium permanganate oxidation of the tetrasulphide to the corresponding sulphone compound was also examined.



A brief report of his work on the synthesis of thiocamphor and other cyclic thioketones was published in Nature in 1934. Thiocamphor was synthesized in a good yield by the simultaneous action of dry H₂S and dry HCl gas on a solution of camphor in absolute alcohol at 0°C. This method was extended later to synthesize cyclic thioketones containing different ring systems.

Other Research Outcomes

Much later in the College of Science, he developed certain methods for facile fluorination of organic compounds using thallos fluoride as the fluorinating agent. For example, one-pot synthesis of monofluoroacetone from the reaction of monoiodoacetone and anhydrous thallos fluoride was successfully achieved in a high yield.



Conclusion

The above discussion revealed the versatility of Acharya Prafulla Chandra Ray's research activities. In his obituary notice, Nature (July 15, 1944) wrote "it was by the enthusiasm for research with which he inspired his students that he will best be remembered"

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AN IMPORTANT CONTRIBUTION TO CHEMICAL AND PHARMACEUTICAL INDUSTRY BY ACHARYA PRAFULLA CHANDRA RAY

(Priyanka Mondal & Sarwar Hassan, SEM-V, Dept. of Chemistry)

INTRODUCTION :

Acharya Prafulla Chandra Ray was born on August 02, 1861 in Raruli-katipara, a village in the district of Khulna now in Bangladesh. His father Harish Chandra Ray- a landlord with liberal views, belonged to a wealthy cultured family. His school and early college education took place in Calcutta. He initiated chemical Research in India. He was the founder of the Indian Chemical Industry. To commemorate the life and achievements of A.P.C. Ray, father of Indian Chemistry.

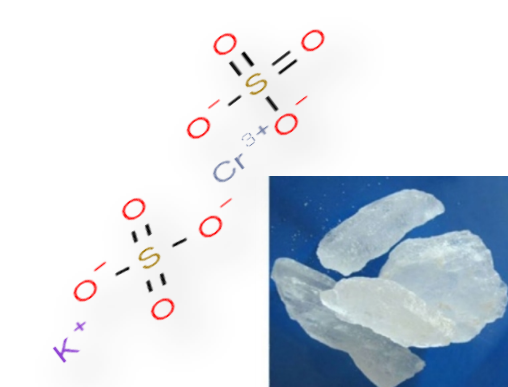
INDUSTRIAL CONTRIBUTION : Bengal chemicals and pharmaceuticals

Bengal Chemicals & Pharmaceuticals Ltd. (BCPL), was established this industry by A.P.C. Ray in 1892. The company was renamed as Bengal Chemicals and Pharmaceutical Limited. A unit under the manufactures industrial chemicals pharmaceutical like antibiotics, tablets, capsules and other household products. Recently, Bengal chemical and pharmaceuticals limited to manufacture hydroxychloroquine to fight against COVID-19 virus infection. The following products which manufacturing Bengal chemicals.

PRODUCTS (Industrial chemicals) :

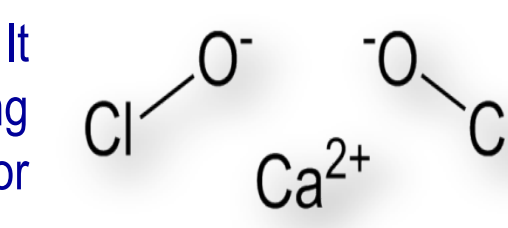
Alum:

An alum is a hydrated double sulphate salt of aluminium with the general formula aluminium with the general formula xAl₂.12H₂O. Where, "x" is a monovalent cation such as potassium (K) or ammonium (Al), by itself "alum" often Refers to potassium alum, with the formula xAl₂.12H₂O



Bleaching powder :

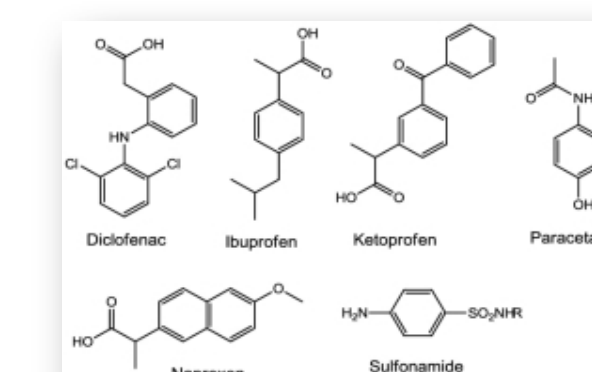
Calcium hypochlorite is an inorganic compound with formula Ca(OCl)₂. It is the main active ingredient of commercial products called bleaching powder or chlorine powder or chlorinated lime which is used for disinfecting drinking water to make water free from micro-organisms.



Pharmaceuticals Product:

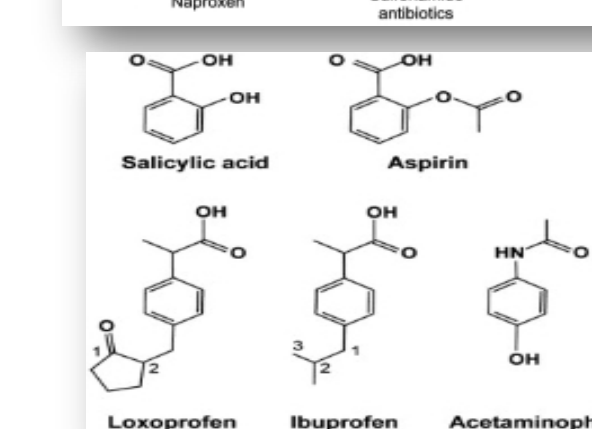
Analgesics drugs:-

Analgesics include Paracetamol, nonsteroidal anti-inflammatory medicine such as the salicylates and opioid medicine such as morphine and Oxycodone. Analgesics medicines are used to relieve pain. They are also known as painkillers or pain relievers.



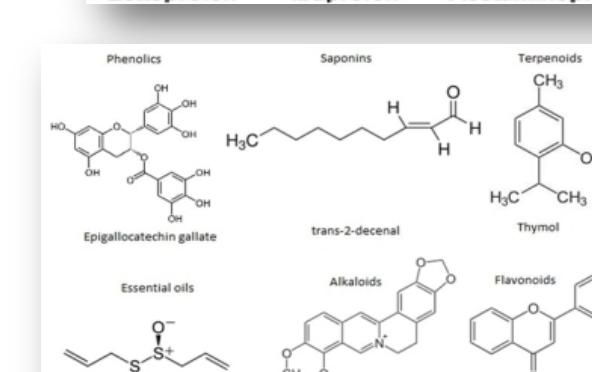
Antipyretics drugs :

The most common antipyretics in the united states are ibuprofen and aspirin which are nonsteroidal anti-inflammatory drugs used primarily as analgesics and also have an antipyretic properties. Antipyretics medicines which used to reduce body temperature and fever.



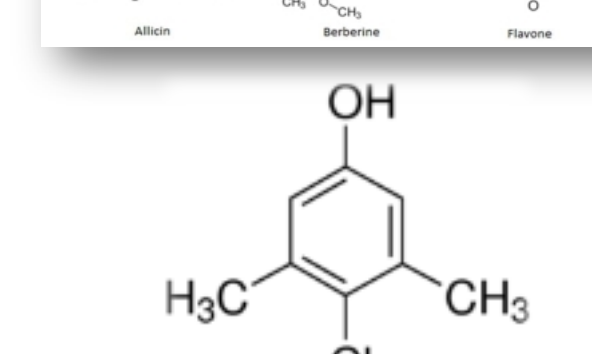
Antimicrobial drug:

A drug used to treat microbial infection. Antimicrobial is a general Term that refers to a group of drugs that includes antibiotics, Antifungals, antiprototals and antivirals.



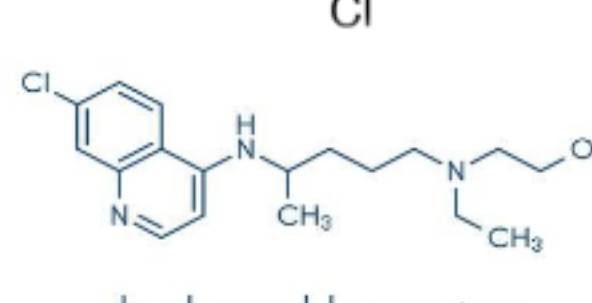
Chloroxylenol:

Chloroxylenol, it is also known as para-chloro-meta xylenol, is an antiseptic and disinfectant Which is used for skin disinfectants and wound cleaners. It is less Effective than some other available agent.



Hydroxychloroquine:

Hydroxychloroquine or HCQ, the malarial drug treated by some as a Potential weapon against COVID-19 has put spotlight on a company Founded by Prafulla Chandra ray.



Conclusion:

The above account reveals the versatility of Prafulla Chandra's industrial contributions activities. Most importantly, Bengal chemicals and pharmaceuticals is the first Indian public sector chemical and pharmaceuticals company of west Bengal.

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EDITORIAL

It is a difficult time for mankind— inarguably the most difficult period human race has seen since the second world war. It is really unbelievable how the shadow of a microscopic virus has engulfed the entire world to a horror and panic stricken condition. All can be seen is horror, sorrow, uncertainty and unrest. But as the poetic verses go—every dark and dreadful night progress slowly towards dawn where a flicker of sunlight comes to remove all darkness. To overcome this atmosphere of dark depression we the members of the Chemistry family of Dum Dum Motijheel College pay homage to the father figure of chemistry education in India, Acharya P. C. Roy, the great Chemist, exceptional teacher, visionary industrialist and motivational philanthropist on his birth anniversary. We are inaugurating the departmental annual wall magazine "Alchemy" in a completely new web-version. Hope this web magazine will enlighten and enrich all of its readers. Heartiest welcome to "Alchemy" in its new format. 02.08.2020

