The neurotoxin Soman

History

Soman was discovered in 1944 by Richard Kuhn and Konrad Henkel (company IG Farben, Leverkusen) as well as tabun (1936), sarin (1938) and cyclosarin. But non of these chemical weapons were systematically used during the Second World War. After the war, the stocks of warfare agents were seized by the Allies. They continued to be produced and tested during the Cold War.

Sarin for example was used in the war of Iraq against Iran (1980-88), as well as from Iraq against Kurdish minorities. In addition, there were terrorist attacks with Sarin in Japan (1994/95). The most recent example of the use of Sarin and chemical weapons in general is the Syrian civil war, in which the prevailing dictator Assad is accused of having used Sarin against the “rebels”.

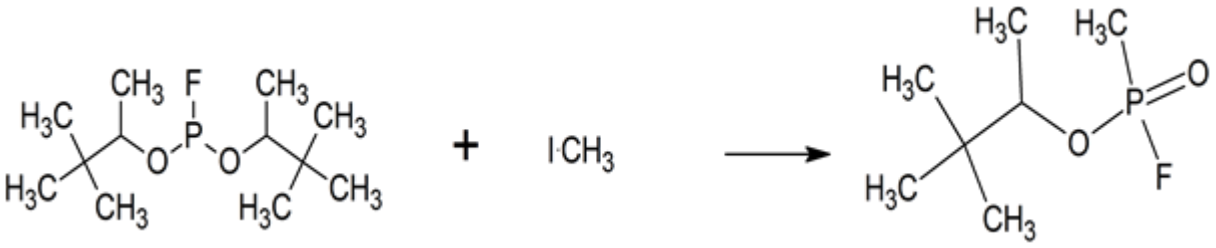
In general chemical weapons were used barely in the last century. The largest amounts of chemical weapons were used in the World War l, e.g. chlorine gas, phosgene or mustard gas.

Militarily considered all chemical weapons entain problems in handling them: other-directed influence, e.g. wind direction, create major risks.

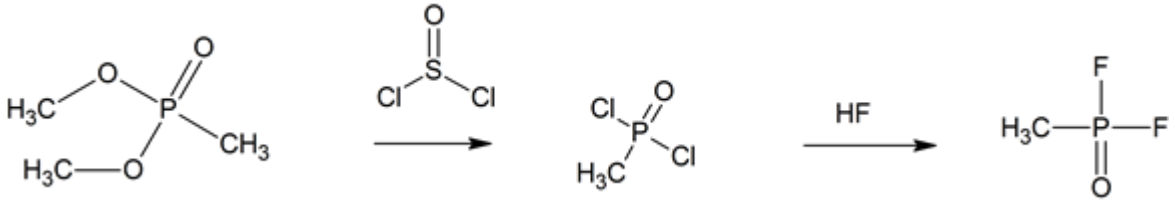
In 1925 they were prohibited in the Geneva Protocol. The great European
powers and Japan accepted this prohibition, the United States additionally in 1975. Exceptions of the Geneva Protocol: action against non Contracting-States and counterattacks.

Synthesis

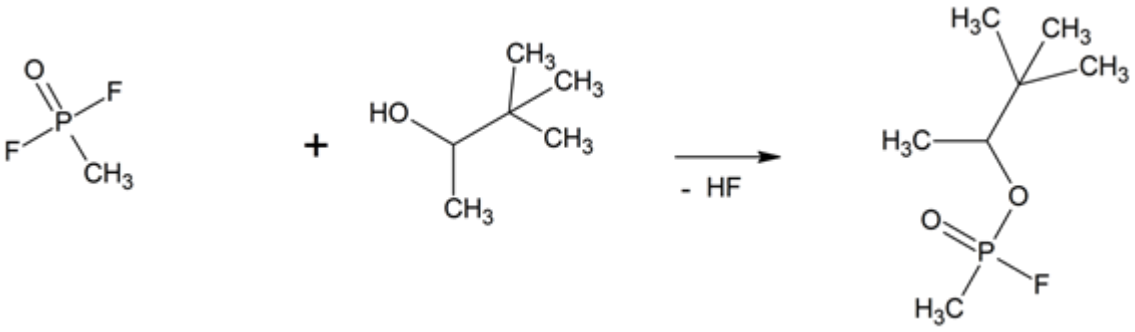
The synthesis of Soman is analoguos to the synthesis of Sarin. Either it is made in a Michaelis-Arbuzov-phosphonatesynthesis wherebis(1,2,2-trimethyl-propyl)-fluorphosphit reacts with methyl iodide:



Another possibility is the reaction of methylphosphonyldiflouride with3,3-dimethyl-2-butanol, in which the methylphosphonylflouride is synthesizedin the following manner:



In the last step Soman is created:



This last step may also take place in a binary chemical weapon bullet, so that Soman only arises at launch.

Porpuse

To improve the effectiveness of Soman and to simplify the storage of it, Soman is thickened by organic polymers.

Furthermore the reactants of Soman can be filled in a binary chemical weapon bullet, which consists of two separated chambers. After launching, the reactants were mixed with each other, where Soma arises and will finally be released.

Absorption

Soman can be absorbed through the intact skin, the respiratory system and the eyes. The only way to prevent the absorption is wearing a body suit.

Pathophysiologie

After absorption of Soman the acetylcholine-esterase will be blocked with the result of preventing the degradation of acetylcholine. The result is a continuous excitation.

Acetylcholine acts as a transmitter substance in the postganglionic fibers of the parasympathetic nervous system, nerves of the sweat glands of the sympathetic nervous system, at the motor endplate of muscles and at all synapses of the autonomic nervous system.

Normally acetylcholine is dismantled by acetylcholine-esterase, which is not
fast enough possible in presence of Soman.

Symptoms

- slight poisoning: Headache, shortness of breath, heavy sweating, miosis, blurred vision with strong eye pain and significant strengthening of the secretion of the nasal secretion, the tear fluid and saliva

- moderate poisoning: severe headache, nausea, vomiting, diarrhea, eye pain/ vision problems and impaired consciousness with cramps

- severe poisoning: Strong tremors, spasms of skeletal muscles through to generalized seizure, vomiting, involuntary loss of urine and stool, severe shortness of breath, impaired consciousness, confusion and anxiety

The death occurs by respiratory paralysis
(threshold dose : 0.0004 mg / l)

-antidote : Atropine, also preclinical applicable
Atropine occupies the receptors in the receiving neuron, so that acetylcholine could not pass the signal in such a high intensity. So the continuous excitation can be prevented.

LD_{50}	LCT_{50}	ICT_{50}
Through the skin: 15 mg/kg body weight	Through the lungs: 0.04 to 0.07 mg*min/l	Through the lungs: 0.025 mg*min/l
Through the stomach: 0.14 mg/kg body weight	Through the skin: 10 mg*min/l	

Conclusion

Chemical weapons are generally ethically questionable. Fortunately the usage of Soman did not take place. In addition to other neurotoxins, e.g. Sarin, Tabun and Cyclosarin, it is the most effective. Furthermore chemical weapons enable to destroy whole countries without destroying the infrastructure. But because of problems in handing it and store it, it is to use it.

Because of the all these features the usage of Soman is only allowed for scientific purposes.

Sources

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