CHEMISTRY

How difficult is it to synthesize Novichok agents? [closed]

Asked 5 years, 10 months ago Modified 4 years, 9 months ago Viewed 1k times

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Closed 5 years ago.

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In the light of the current UK-Russia events, how difficult is to synthesize Novichok agents (with known structures)? Is it something that can be made at any well-equipped university and/or chemical factory, or does it involve some very specialized or possibly secret knowledge?

organic-chemistry chemical-weapons

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edited Apr 13, 2019 at 13:49

Rodrigo de Azevedo

1

asked Mar 22, 2018 at 16:49

studeo

37 5

"Does it involve some very specialized or possibly secret knowledge..." hmm... making Schedule I chemical weapons of mass destruction in violation of the Chemical Weapons Convention is not illegal only in your nation, but also under international law. As for Novichoks, their specific chemical structure is probably unknown but to the Russian Government and some insiders. All we know is that they have a organophosphate group. – JSCoder says Reinstate Monica Mar 22, 2018 at 16:52

Well, Russians deny that they are the source of the chemical. What I want to know is how plausible is that some other random sources exist. At least some of the structures are publicly known - there is an article on Wikipedia. – studeo Mar 22, 2018 at 16:58

Some of the starting materials are controlled substances and are also very toxic. – Waylander Mar 22, 2018 at 17:22

For well equipped university and labs is, chemically speaking, surely possible. This must be as for any other molecule which synthesis has been reported (explicitly or not). Safety and economical consideration let apart. – Alchimista Mar 23, 2018 at 9:49

2 It isn't the ease of synthesis that is the problem with nerve agents: it is the expertise required to not kill yourself and your colleagues while making them. – matt_black Mar 23, 2018 at 11:43

1 Answer

Sorted by: Highest score (default)

3

According to Fragmentation pathways and structural characterization of organophosphorus compounds related to the Chemical Weapons Convention by electron ionization and electrospray ionization tandem mass spectrometry *Rapid Commun. Mass Spectrom.* 2016, 30, 2585–2593:

> N-[Bis(dimethylamino)methylidene]-P-methylphosphonamidic fluoride (**3**) was synthesized by the controlled addition of N,N,N′,N′-tetramethylguanidine to a solution of methylphosphonic difluoride (**1**). N,N,N′,N′-Tetramethylguanidine (0.60 mmol) and triethylamine (0.65 mmol) in dichloromethane (DCM) (500 µL) were added slowly into the solution of methylphosphonic difluoride (0.40 mmol) in DCM (500 µL), while stirring at 0–5 °C. After 30 min, the resulting precipitate was filtered off and the solution was analyzed by GC/MS.
>
> The corresponding O-alkyl N-[bis(dimethylamino)-methylidene]-P-methylphosphonamidates **4** were synthesized by the addition of ROH to a solution of cpd **3**. Sodium hydride powder (NaH, 60% in mineral oil, 0.5 mmol) was washed with dry hexane twice. The hexane was removed and DCM (500 µL) was added and the solution was kept stirring at 0–5 °C. The appropriate alcohol (0.5 mmol) was slowly added into the suspension and the reaction solution was stirred at 0–5 °C for 30 min. Compound 3 in DCM (200 µL) was then added dropwise to the solution, while stirring at 0–5 °C for 2 h. Any precipitate was filtered off and the resulting solutions of the end product were analyzed by GC/MS. It should be noted that, due to the extreme toxicity of these materials, the separation and purification of CWC-related chemical are very difficult and therefore should be carried out only by a trained professional in an efficient fume cupboard equipped with an active charcoal filtration system.

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answered Mar 22, 2018 at 18:22

DavePhD
40.5k 2 83 177

Methyl phosphonic difluoride is not something you can just pick up at the corner store – Waylander Mar 22, 2018 at 18:59

2 @Waylander you can't readily buy it because it is schedule 1 for CWC opcw.org/chemical-weapons-convention/annexes/annex-on-chemicals/… But you can buy the dichloride sigmaaldrich.com/catalog/product/aldrich/… and react with anhydrous HF. – DavePhD Mar 22, 2018 at 20:16

You can, and it is a good test of your handling skills as it is seriously toxic in its own right – Waylander Mar 23, 2018 at 9:21