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PRESENTATION ON

# *HISTORY AND DEVELOPMENT OF EXPLOSIVE-TETRYL (SYNTHESIS AND PROPERTIES)*

CUFS 2416 EXPLOSIVE AND POST BLAST INVESTIGATION

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B.SC. FORENSIC SCIENCE (SEM 6)  
SCHOOL OF FORENSIC SCIENCES  
BHUBANESHWAR CAMPUS

# CONTENT

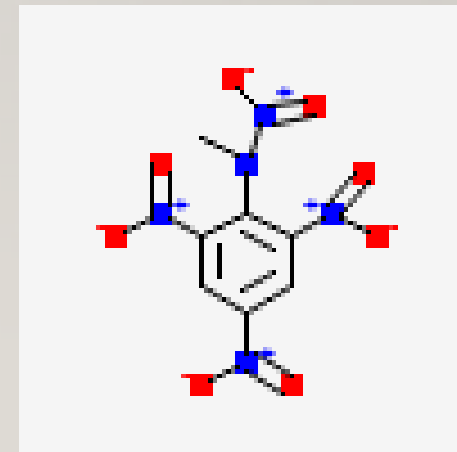
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- Introduction
- History
- Development
- Synthesis
- Physical properties
- Handling

# INTRODUCTION

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- Tetryl is a pale yellow crystalline explosive  $C_7H_5N_5O_8$  used especially as a detonator.
- Tetryl is a nitramine booster explosive, thus its use has been largely superseded by RDX.
- Tetryl is a sensitive secondary high explosive used as a booster, a small charge placed next to the detonator in order to propagate detonation into the main explosive charge.
- Tetryl is also known as 2,4,6-Trinitrophenylmethylnitramine.
- Tetryl is sensitive to friction, shock or sparks.



# HISTORY

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Tetryl is an aromatic nitramine known since 1877 and we must remember it for its historical significance as it was used as a booster explosive for a long time.

Tetryl was first prepared in 1877 by Mertens and its structure established by Romburgh in 1883.

Its use as a booster was eventually foreshadowed by PETN and RDX. It was also the standard bursting charge for small-caliber projectiles.

The Americans have discontinued the use of tetryl on the argument that it is relatively unstable after storage at elevated temperatures. Various NATO nations have, however, not discontinued its use in booster and lead charges.

# DEVELOPMENT

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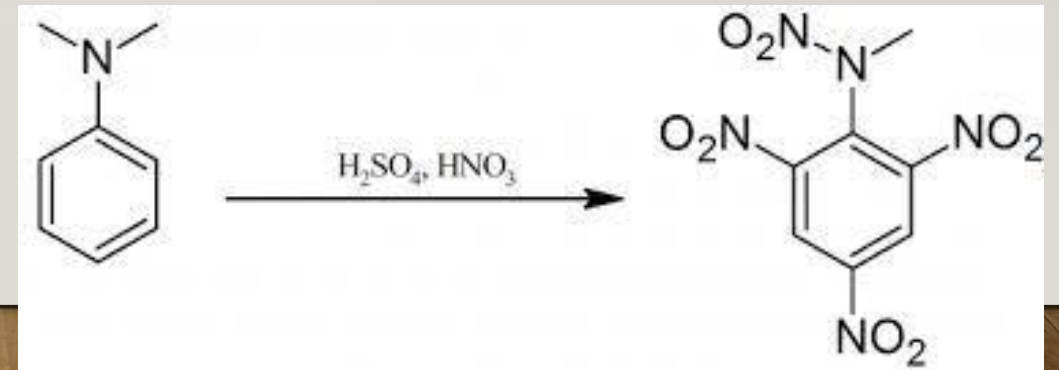
- Tetryl was produced by U.S. Army ammunition plants until 1973 after its discovery. It was widely used as a military explosive during World War I and World War II.
- Tetryl is not produced commercially now. Prior production was limited to Army ammunition plants such as Joliet Army Ammunition Plant (Illinois), which produced tetryl until 1973.
- Tetryl was used to make extremely fatal explosives, mostly during World Wars I and II and is no longer manufactured or used as it has now been replaced by RDX and PETN. Stocks of tetryl are found in storage at military installations and are being destroyed by the Department of Defense (DOD) in USA.



# SYNTHESIS

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- Tetryl has been produced in a batch process by dissolving dimethylaniline in an excess of concentrated sulfuric acid at 20-30 °C to give dimethylaniline sulfate (Kirk-Othmer 1980). The solution was nitrated with a mixture of nitric and sulfuric acids to produce 2,4-dinitrodimehtylaniline and eventually crude tetryl. The crude product was filtered, washed with water, and dissolved in acetone. The acetone was evaporated and the product filtered to yield purified tetryl. In a second production process 2,4- or 2,6-dinitrochlorobenzene was reacted with methylamine to form dinitrophenyl methylamine, which was nitrated to form tetryl



# PHYSICAL PROPERTIES

|                     |  |
|---------------------|--|
| Chemical formula    | $C_7H_5N_5O_8$   |
| Molar mass          | 287.14 g/mol   |
| Appearance          | Yellow crystalline solid   |
| Odour               | Odourless  |
| Density             | 1.73 g/cm <sup>3</sup>   |
| Melting point       | 129.5 °C (265.1 °F; 402.6 K)   |
| Boiling point       | 187 °C (369 °F; 460 K)   |
| Solubility in water | 0.0051 g/100 ml (0.5 °C)<br>0.168 g/100 ml (98.6 °C)   |
| Solubility          | Soluble in glacial acetic acid, acetone, ethyl acetate, ethylene glycol diacetate, pyridine<br>Slightly soluble in benzene, carbon disulfide, carbon tetrachloride, chloroform, diethyl ether, ethanol |

# HANDLING

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## Safety:

- Tetryl is toxic and explosive. Should be handled with care and proper protection.
- Tetryl is highly irritating to the skin and mucous membranes and may cause severe upper respiratory tract irritation with coughing
- Tetryl stains the skin yellow and causes skin sensitization. Severe, prolonged exposures may cause liver injury. Repeated or prolonged inhalation exposure may cause asthma

## Storage:

- Should be stored for short periods of time, in spark-free containers.
- It is also very sensitive to fire and has potential explosion risk (Class A explosive) and hence avoided

## Disposal:

- Can be destroyed via controlled incineration.
- A safer method involves the slow and controlled addition in Fenton's reagent (solution of hydrogen peroxide and the ferrous sulphate).



# REFERENCE

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- <https://www.sciencemadness.org/smwiki/index.php/Tetryl>
- <https://pubs.acs.org/doi/10.1021/je60016a042>
- <https://pubchem.ncbi.nlm.nih.gov/compound/Tetryl>
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**THANK YOU.**

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