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PRESENTATION ON

# *HISTORY AND DEVELOPMENT OF PICRIC ACID (SYNTHESIS, PROPERTIES)*

CUFS 2416 EXPLOSIVE AND POST BLAST INVESTIGATION

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

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# INTRODUCTION

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**Picric acid** is an organic compound with the formula  $(\text{O}_2\text{N})_3\text{C}_6\text{H}_2\text{OH}$ . Its IUPAC name is **2,4,6-trinitrophenol (TNP)**.

The name "picric" comes from Greek word (*pikros*), meaning "bitter", due to its bitter taste. It is one of the most acidic phenols. Like other strongly nitrate organic compounds, picric acid is an explosive which is its primary use. It has also been used as medicine (antiseptic burn treatments) and as a dye.



# HISTORY

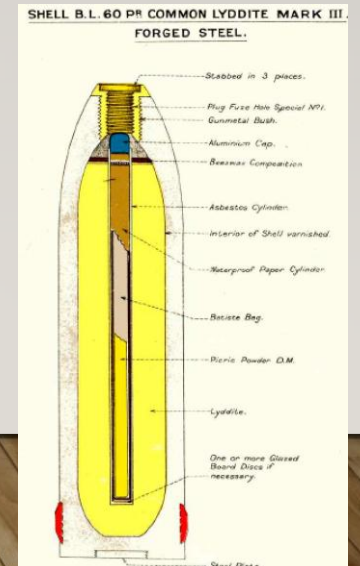
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- In 1799, French chemist **Jean-Joseph Welter** (1763–1852) produced picric acid by treating silk with nitric acid; he found that potassium picrate could explode.
- Picric acid was the first strongly explosive nitrated organic compound widely considered suitable to withstand the shock of firing in conventional artillery after 1830 and was hence used for military purpose.
- In 1885, based on research of **Hermann Sprengel**, French chemist Eugène Turpin patented the use of pressed and cast picric acid in blasting charges and artillery shells.
- In 1887 the French government adopted a mixture of picric acid and guncotton with the name **Melinite**.
- By 1894 Russia was manufacturing artillery shells filled with picric acid.
- The sensitivity of picric acid was demonstrated by the Halifax Explosion.



# DEVELOPMENT

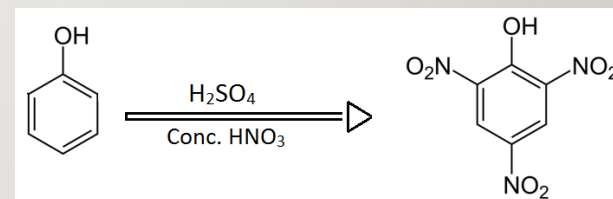
- In 19<sup>th</sup> century picric acid was widely used as a fast dye for silk and wool.
- its was not until that the possibility of using picric acid as explosive was explored by Welter(1830)
- Picric acid was found to be suitable replacement for black powder by Turpin in (1885)
- **Designolle** and **Brugere** suggested that picrate salt could be used as a propellant while in (1871)
- Sprengel showed that picric acid could be detonate to an explosion and replaced black powder with picric acid for the filling of munition shells (1873).
- Black powder replaced by picric acid in British munition under the name **Lyddite** (1888)
- In Russia prepared picric acid (1894).
- Picric acid was accepted all over the world as the basic explosive for military uses.
- Now day in laboratories picric acid has primarily been used for explosives and fireworks.
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# SYNTHESIS

Required :

- Material : beaker, glass rod , spatula, flask
- Chemical : phenol , conc Sulfuric acid ,conc nitric acid
- Instrument : weighing machines ,hot plate .



Take 2ml Phenol into conical flask, add 3.5ml conc H<sub>2</sub>SO<sub>4</sub> (solution turn dark )

Add concentrated HNO<sub>3</sub> dropwise while constantly stirring it. heat it in boiling water bath (100°C ) for 2 hours

To collect the crude product, purifying the solution recrystallize from ethanol, warm the solution completely dissolving ethanol, leave it undisturbed so that the crystal precipitate out.

- Place on a hot plate at 80°C for about 30 minutes to form a para-product and then place in an ice bath to cool at 0°-5°C for 30 minutes.

Cool the solution in an ice bath followed by addition of cold distilled water about 30 ml and then filtering through filter paper.

# HANDLING

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- Do not use metal spatulas to remove picric acid. Do not place in metal containers or containers with metal lids.
- Handling the moistened solid or a solution, clean the bottleneck, cap, and threads with a wet cloth before resealing. Collect the used cloth in a plastic or glass container and label as hazardous waste for disposal

# PHYSICAL PROPERTIES

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- Appearance – colorless to yellow solid
- Molar mass – 229.10g/mol
- Density - 1.763g/cm<sup>3</sup> , solid
- Boiling point - > 300<sup>0</sup>C  
(detonates)
- Melting point – 121 to 123<sup>0</sup>C
- Friction sensitivity – very high
- Solubility – 12.7 g/l (in water )
- Chemical formula – C<sub>6</sub>H<sub>3</sub>N<sub>3</sub>O<sub>7</sub>
- Oxygen balance – 45.4%
- Nitrogen content – 18.34%
- Deflagration point – 300<sup>0</sup>C



# CHEMICAL PROPERTIES

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- Picric acid is an odorless, yellow, crystalline organic solid
- The aqueous phase becomes yellow with 1-2% dissolved picric acid
- Also known as picronic acid, trinitrophenol, nitroxanthic acid, carbazotic acid or phenoltrinitrate,  $C_6H_2(NO_2)_3OH$  is yellow crystals that are soluble in water, alcohol, chloroform, benzene,
- heating phenol with concentrated sulfuric acid, and is used for explosives, matches,
- electric batteries, and etching copper.

# REFERENCES

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- <https://www.uthsc.edu/research/safety/documents/sop-picric-acid.pdf>
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- <https://pubchem.ncbi.nlm.nih.gov/compound/Picric-acid>
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**THANK YOU.**

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