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### Below Ground Mines I

Below ground (buried) mines can be as small as of a cigarette packet

Usually these types of mines are difficult, if not impossible to see as they are buried

**Weight:** 600 g  
**Diameter:** 112 mm  
**Height:** 56 mm  
**Body:** Bakelite  
**Main Charge:** TNT  
**Main Charge Weight:** 240 g  
**Charge:** Tetryl  
**Lethal Range:** up to 2 meters

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### Below Ground Mines II

Below ground mines are designed to detonate when someone applies pressure to the top

The blast action severs the leg, inflicts damage to the lower body sections and drives foreign particles deep into the upper body

Capable of blowing off half a leg

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### More Facts about Landmines

More than 100 million landmines are deployed in 88 countries

25 000 are every year killed or injured by landmines

80% of the victims are civil and of these are 50% children

The cost to deploy a landmine is approximately 2 \$

To cost to remove a landmine is approximately 850 \$

Treatment of a victim for a landmine is approximately 3000 \$

80% of all landmines contain 2,4,6-trinitrotoluene (TNT)

Source: Danish Red Cross

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### Present Tools for Detection of Landmines

There is a desperate need for alternative technologies!!!

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### Can a Chemosensor be used to Detect Explosives from Landmines?

TNT: Cc1cc(C(=O)N)cc1[N+](=O)[O-]  
 2,6-DNT: Cc1cc(C(=O)N)cc1[N+](=O)[O-]  
 2,4-DNT: Cc1cc(C(=O)N)cc1[N+](=O)[O-]  
 1,3,5-TNB: Cc1cc(C(=O)N)cc1[N+](=O)[O-]

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### Synthesis of a Potential Chemosensor for Explosives... ...in the Shape of a Tetra-TTF-Calix[4]pyrrole

### X-Ray Crystal Structure of a 1:2 Complex between... ...Tetra-TTF-Calix[4]pyrrole and Acetone

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### Detection of 1,3,5-Trinitrobenzene (1,3,5-TNB)... ...by the Tetra-TTF-Calix[4]pyrrole

Yellow solution → Green solution

Black crystals were isolated of the 1:2 complex between tetraTTF-calix[4]pyrrole and 1,3,5-trinitrobenzene

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### Anion Dependent Complexation and Decomplexation between... ...the Tetra-TTF-Calix[4]pyrrole and 1,3,5-Trinitrobenzene

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### Anion Dependent Complexation and Decomplexation between... ...the Tetra-TTF Calix[4]pyrrole and 1,3,5-Trinitrobenzene

K. A. Nielsen and J. O. Jeppesen et al. *J. Am. Chem. Soc.* 2004, 126, 16296–16297

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### Detection of 2,4,6-Trinitrotoluene (TNT)... ...by the TetraTTF-Calix[4]pyrrole

Black crystals were isolated of the 1:2 complex between tetraTTF-calix[4]pyrrole and 2,4,6-trinitrotoluene

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### What Have We Got...

- A chemosensor capable of detecting the explosives (i.e., TNT) used in 80% of all landmines
- It works through a simple color change from YELLOW to GREEN
- Improving the design of the sensor, so it also will be able to detect the explosives in the presence of anions
- Transfer it from solution onto a solid-state support in order to obtain a real sensor

### ...and Where are We Going

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