# Brady’s test for aldehydes and ketones – teacher notes

In this experiment students add various liquid aldehydes and ketones to 2,4- dinitrophenylhydrazine to form solid derivatives. To show that the reaction does not occur with alcohols they also do the test with methanol and ethanol.

## Topic

Aldehydes and ketones

## Timing

15 minutes

## Equipment

### Apparatus

* Eye protection
* Plastic well-plate, 24 wells (eg Sigma ref: M 9655)

For preparation of 2,4-dinitrophenylhydrazine:

* Beaker, 100 cm3

### Chemicals

Solutions should be contained in plastic pipettes – see the accompanying guidance on apparatus and techniques for microscale chemistry (<https://rsc.li/3vT4w71>), which includes instructions for preparing solutions.

* Ethanol
* Propanone
* p-Methoxybenzaldehyde (or other aromatic aldehyde or ketone)
* Methanol
* Ethanal (Acetaldehyde)
* Solution of 2,4-dinitrophenylhydrazine (see preparation notes below) – requires 24 hours to dissolve completely

For preparation of 2,4-dinitrophenylhydrazine:

* Deionised water

## Preparing a solution of dinitrophenylhydrazine

1. Weigh out 0.5 g of 2,4-dinitrophenylhydrazine and dissolve in 10 cm3 of concentrated sulfuric acid in a 100 cm3 beaker. (Leave overnight to allow the compound to dissolve completely.)
2. Add this solution carefully to a solution of 15 cm3 of ethanol and 5 cm3 of deionised water. This gives the yellow-brown stock solution.

The solution can be used for about 10 days but it gradually deteriorates as a precipitate forms.

This procedure is based on that described in L. Harwood and R. Moody, *Experimental organic chemistry – principles and practice*, p 242. Oxford: Blackwell Scientific, 1989.

## Observations

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| Compound  | Observation  |
| Ethanal  | Immediate yellow precipitate  |
| Propanone  | Yellow, crystalline precipitate forms slowly (after 1–2 minutes)  |
| *p* -Methoxybenzaldehyde (or other aromatic aldehyde or ketone)  | Immediate red precipitate  |
| Methanol  | No change  |
| Ethanol  | No change  |

The reaction between propanone and dinitrophenylhydrazine:



## Health, safety and technical notes

* Read our standard health and safety guidance (<https://rsc.li/2RXlD8Q>).
* Wear eye protection throughout (splash-resistant goggles to BS EN166 3).
* 2,4-dinitrophenylhydrazine, (NO2)2C6H3NHNH2(s) – see CLEAPSS Hazcard HC030 and CLEAPSS Recipe Book RB033. 2,4-dinitrophenylhydrazine is FLAMMABLE and HARMFUL if swallowed. It is also dangerous in contact with oxidising agents, and can potentially become explosive if allowed to dry out completely. Avoid skin contact.
* Concentrated sulfuric acid, H2SO4(aq) – see CLEAPSS Hazcard HC098a and CLEAPSS RB098. Concentrated sulfuric acid is CORROSIVE and OXIDISING.
* Propanone – see CLEAPSS Hazcard HC085A and CLEAPSS Recipe Book RB002. Propanone is highly FLAMMABLE and IRRITANT to eyes and the respiratory system.
* p-Methoxybenzaldehyde is of low hazard.
* Methanol – see CLEAPSS Hazcard HC040b. Methanol is highly FLAMMABLE, TOXIC by all routes and causes damage to organs (particularly CNS and optic nerve). Propanol could be used as a safer alternative to methanol. It is FLAMMABLE (see CLEAPPS Hazcard HC084A).
* Ethanal (acetaldehyde) – see CLEAPSS Hazcard HC034. Ethanal is highly FLAMMABLE, a carcinogen and an eye/respiratory IRRITANT. Protect face when opening containers and ensure laboratory is well-ventilated. Avoid contact with sulfuric acid – violent polymerisation occurs.