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Astrolite and anhydrous hydrazine



Astrolite (hydrazine nitrate) is a two-component, liquid, blasting explosive. It was created as a by-product of research on rocket fuel in the 1960s. Its basic composition is hydrazine, a very dangerous substance. Astrolite has had many versions. The two most famous are G and A-1-5 for their high detonation velocities and explosive power.

Features:

- colorless liquid
- toxic, corrosive, poisonous
- not very sensitive to impacts and electrostatics,
- flammable
- detonation speeds above 8000m/s,
- detonation force greater than that of TNT
- density about 1.4g/cm³

Receiving

Reagents:

- **anhydrous**hydrazine (N₂H₄)
- ammonium nitrate (NH₄YEAH₃)
- aluminum dust (Al)

Equipment:

- mask, gloves and a protective google
- stirrer
- glass containers (no flasks, preferably plain, large jars)

Astrolite G production

This is a rather uncomplicated procedure. Mix two parts of ammonium nitrate with one part of anhydrous hydrazine. The reaction does not occur violently, but it should be carried out outdoors due to the ammonia released. The 2:1 ratio is not theoretically ideal, but in practice there is justification for its use.

In theory, the proportions result from the reaction equations



NH₄YEAH₃, MW= 80.04 g/mol

N₂H₄, MW= 32.04 g/mol

20g NH₄YEAH₃ x (1mol NH₄YEAH₃ / 80.04g NH₄YEAH₃)

x (1mol N₂H₄ / 1mol NH₄YEAH₃)

x (32.04g N₂H₄ / 1mol N₂H₄) = 8.00g anhydrous hydrazine (100%)

The theoretical proportions are therefore **2.5:1, not 2:1**. However, they would be too beautiful if such a reaction actually took place, without any by-products. Hydrazine with mononitrate (N₂H₄·HNO₃) and two (N₂H₄·2HNO₃) hydrazine nitrate. Additionally, hydrazine is very hygroscopic (it absorbs water from the air).

bubbles and ammonia is released. Technically, we do not have pure, anhydrous hydrazine because hydrazine hydrates coexist with it (N₂H₄·H₂O) and hydroxy hy (N dihydrate 2H₄·2H₂OABOUT). Therefore, the proportions include a small excess of hydrazine.

Astrolite A-1-5 production

It is the most powerful non-nuclear explosive device. It is twice as powerful as TNT, but its production is only slightly more difficult than the G version. We add one aluminum dust to five parts of nitrate. Then mix with hydrazine in the same proportions as in the case of version G.

Attention

- all Astrolites are prepared directly on the training ground, in the open air
- detonations are best carried out about 20 minutes after mixing the ingredients (best effects) required detonator
- with a no.8 primer power

Now a little about what is actually created and what we call it **hydrazine nitrate**

Hydrazine mononitrate:

- formula: N₂H₄·HNO₃
- density: 1.64 g/cm³

- molar mass: 95.06 g/mol
- melting point: 62.1 °C (unstable), 70.7 °C (stable) decomposition
- temperature: 229 °C
- critical pressure: 7.4 Nm (2kg hammer dropped from 37cm... for nitroglycerin 4cm)
- detonation velocity: 8690 m/s at a density of 1.60 g/cm³
- gas volume: 1001 l/kg



During decomposition, 4.25 moles of gas/mol of HN are produced in the explosion; converting to kg (1000/95 = 10.52)

4.25 (22.4) = 95.2

(95.2) 10.52 = 1001 liters of gas per kilogram of HN

Hydrazine dinitrate:

- formula: $\text{N}_2\text{H}_4 \cdot 2\text{HNO}_3$
- molar mass: 158.08 g/mol
- melting point: 80 °C gas
- volume: 920 l/kg
- dinitrate is corrosive: $\text{N}_2\text{H}_4 \cdot 2\text{HNO}_3 \rightarrow \text{N}_2\text{H}_4 \cdot \text{HNO}_3 + \text{HNO}_3$

It is also possible to produce similar 'astrolito' products based on Astrolite itself

Standard mixtures:

Ammonium nitrate	Hydrazine nitrate	Hydrazine	Detonation velocity	Density
91%	7%	2%	8600m/s	1.42cm ³
88%	7%	5%	8500m/s	1.39cm ³
84%	7%	9%	8300m/s	1.35cm ³
79%	7%	14%	8100m/s	1.31cm ³

ULX

ULX, that is **Underwater Liquid Explosives**, are more refined compounds in which Astrolite is the oxidant, so they can be detonated underwater.

- hydrazine nitrate: monoethyleneamine: water
proportions 80: 16: 4 with a density of 1.42 g/cm³
- hydrazine nitrate: ethylene diamine: water
proportions 80: 16: 4 with a density of 1.41 g/cm³
- hydrazine nitrate: monoethyleneamine: hydroxyethylhydrazine: water
proportions 75: 6: 4: 15 with a density of 1.40 g/cm³

Finally, there is a special feature of the G version. It can be poured on the ground and detonated even after 4 days, provided it does not rain. After a long time, the effects will wear off for natural reasons and basically only fluid is wasted. An interesting property, although ... not very practical for scientific applications. Now that I've made everyone happy about the nice preparation of an explosive, now the other side of the coin regarding hydrazine itself and its preparation.

Anhydrous Hydrazine

Features:

- toxic
- flammable
- corrosive
- poisonous

You need it for Astrolite **anhydrous** hydrazine! Not any hydrazine, concentrated hydrazine, just anhydrous. And whenever I used the term hydrazine, I meant anhydrous. taking care of receiving each one in turn. The reactions will take an easily predictable direction. First we obtain hydrazine, then concentrated hydrazine and then anhydrous hydrazine.

Obtaining Hydrazine (plain)

Reagents:

- ammonia
- gelatine
- sodium hypochlorite
- distilled water (everywhere)

1.5 l of water and ammonia solution (28%), 0.9 l of water, 0.375 l of water with gelatin (10%) and 1.2 l of water with sodium hypochlorite. Mix everything in a round-bottomed vessel. You can heat it up so quickly when 2/3 of the solution evaporates, cool it in ice water and then filter it twice. Once with a regular towel, the second time with a T-shirt covered with a paper towel. He will obtain hydrazine with a concentration of about 60%.

Obtaining concentrated hydrazine:

Reagents:

- hydrazine (from the previous reaction or commercially available)
- xylene
- nitrogen

Mix 144ml of hydrazine with 230ml of xylene in a round-bottomed vessel. Carry out fractional distillation (retrification) to separate xylene and water (hydrazine is the first to form (in a nitrogen environment - it goes boom in the air). We will get 90-95% hydrazine. If the previous one was not very good (<60%), use a little more xylene.

Preparation of anhydrous hydrazine (N₂H₄)**Reagents:**

- concentrated hydrazine (from the previous reaction or commercially available),
- potassium hydroxide
- caustic soda
- nitrogen

20g of potassium hydroxide for every 100g of hydrazine. Leave it overnight in a regular glass so that some of the water can evaporate. Filter and then add baking soda equal to the weight. Place the solution in a round-bottomed vessel (500ml) and shake for two hours. Carry out distillation in a nitrogen environment.

These three stages are the longest but most reliable method, **I will give three others that lead directly to obtaining anhydrous hydrazine.**

Crystallization method**Reagents:**

- barium oxide
- regular hydrazine

100 g of BaO are placed in an ice-cooled flask equipped with a reflux condenser and 100 g of N are added in 5 g portions. 2H₄·H₂O. The mixture is boiled in a stream of N₂ and leaves. The obtained liquid is poured off and distilled in a vacuum under pressure. 50-80 mm Hg in equipment equipped with joints (because N₂H₄ destroys cork, rubber and other organic substances). 93% N is obtained which is again treated with BaO, boiled and distilled. The distillate from the second distillation is cooled to 0 °C and the liquid above the crystals is poured off. Crystals constitute 99.7%. N₂H₄.

Method with reflux and normal condenser**Reagents:**

- hydrazine
- sodium hydroxide

100 g 2H₄·H₂O and 100 g of NaOH are heated to 112-113 °C in a flask equipped with a reflux condenser in an atmosphere of N₂ until the NaOH dissolves. Then instead of c the reflux condenser is used and N is distilled 2H₄ (in the N atmosphere²), increasing the temperature to 150 °C. 55 g N is obtained 2H₄.

Hydrazine salt method**Reagents:**

- hydrazine salt (N₂H₄·2HCl)
- hydrogen

Salt (N₂H₄·2HCl) first dried in a stream of dry air at 120-150 °C, and then at 190 °C, heated for 2-3 hours in a vacuum created by the pump. N is obtained 2H₄·HCl, which is heated to 160 °C and a stream of dry NH₃ is passed through³. NH₃ is formed 4Cl and N₂H₄, which collects in the condensation vessel. Within 20 approximately 125 ml of N is obtained 2H₄ (with 500 g N₂H₄·2HCl), which is then heated in a reflux flask in stream H₂ up to 100 °C. In this way, excess NH₃ is removed³. AT up 100%. N₂H₄