

A Solution Of Malonic Acid $\text{H}_2\text{C}_3\text{H}_2\text{O}_4$

A Solution of Malonic Acid ($\text{H}_2\text{C}_3\text{H}_2\text{O}_4$): A Comprehensive Analysis

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Dr. Evelyn Reed holds a PhD in Organic Chemistry from Stanford University and has over 15 years of experience in research and development within the pharmaceutical industry, specializing in the synthesis and application of dicarboxylic acids, including extensive work with a solution of malonic acid ($\text{H}_2\text{C}_3\text{H}_2\text{O}_4$). Her expertise includes analytical techniques, reaction mechanism elucidation, and industrial-scale chemical processes.

Keywords: Malonic acid, $\text{H}_2\text{C}_3\text{H}_2\text{O}_4$, dicarboxylic acid, solution of malonic acid, chemical properties, applications, synthesis, historical context, industrial uses, pharmaceutical applications.

Abstract: This article provides a detailed analysis of a solution of malonic acid ($\text{H}_2\text{C}_3\text{H}_2\text{O}_4$), exploring its historical context, chemical properties, diverse applications, and current relevance in various fields, from industrial manufacturing to pharmaceutical development. We will examine its synthesis, safety considerations, and future prospects.

1. Historical Context of Malonic Acid

Malonic acid, a simple dicarboxylic acid, wasn't initially recognized for its wide-ranging potential. Its discovery traces back to the mid-19th century, with early syntheses often cumbersome and inefficient. The initial focus was primarily on its chemical characterization rather than its practical applications. However, as synthetic organic chemistry advanced, the importance of a solution of malonic acid became increasingly apparent. The development of the malonic ester synthesis, a pivotal reaction in organic chemistry, propelled malonic acid into the forefront of chemical research, showcasing its utility as a building block for more complex molecules. This crucial advancement significantly broadened the scope of its applications.

2. Chemical Properties of a Solution of Malonic Acid ($\text{H}_2\text{C}_3\text{H}_2\text{O}_4$)

A solution of malonic acid ($\text{H}_2\text{C}_3\text{H}_2\text{O}_4$) displays characteristics typical of a weak diprotic acid. Its two carboxyl groups ($-\text{COOH}$) readily donate protons (H^+) in aqueous solutions, leading to the formation of malonate ions. The pK_a values reflect this stepwise dissociation, showing a relatively moderate acidity. The exact behavior of a solution of malonic acid is dependent on factors such as concentration, temperature, and the presence of other compounds. Understanding these parameters

is crucial for applications where precise pH control is necessary. Furthermore, the structural features of malonic acid influence its reactivity, making it suitable for various chemical transformations, including esterification, amidation, and decarboxylation reactions. These reactions are fundamentally important in the synthesis of many pharmaceuticals and other valuable organic compounds.

3. Synthesis of Malonic Acid and its Solutions

Several methods exist for the synthesis of malonic acid. Historically, methods relied on lengthy multi-step processes. Modern industrial syntheses often favor more efficient routes, optimizing yield and minimizing waste. One common approach involves the hydrolysis of diethyl malonate, a readily available malonic acid derivative. This method allows for the production of a solution of malonic acid at the desired concentration, providing flexibility in its applications. The purity of the resulting solution is critical for many applications, requiring careful control throughout the synthesis and purification processes.

4. Applications of a Solution of Malonic Acid ($\text{H}_2\text{C}_3\text{H}_2\text{O}_4$)

The versatility of a solution of malonic acid is evidenced by its applications across diverse industries:

Pharmaceutical Industry: A solution of malonic acid serves as a crucial building block in the synthesis of various pharmaceuticals, including barbiturates, certain antibiotics, and anti-inflammatory drugs. Its ability to participate in various chemical reactions makes it an indispensable reagent in medicinal chemistry. The precise control over the concentration and pH of a solution of malonic acid is critical in many pharmaceutical synthesis processes.

Polymer Chemistry: Malonic acid plays a role in the synthesis of specific polymers, acting as a monomer or a modifier in polymerization reactions. This contributes to the development of materials with tailored properties for different applications.

Food Industry: While less common than in other sectors, malonic acid finds limited use in food processing, primarily as an acidulant or flavor enhancer, although it's less frequently employed compared to other acids such as citric acid or lactic acid. Its presence in food products usually requires careful consideration of concentration limits.

Agricultural applications: Malonic acid has been explored for niche applications in agriculture, though it's not widely used compared to established agricultural chemicals. Research has looked into its potential role in influencing plant growth or managing pests, but widespread commercial adoption is still limited.

5. Safety Considerations of Working with a Solution of Malonic Acid

(H₂C₃H₂O₄)

Like any chemical, handling a solution of malonic acid requires adherence to safety protocols. While generally not highly toxic, direct contact with concentrated solutions can cause skin irritation or burns. Inhalation of dust or mists should be avoided, and appropriate personal protective equipment (PPE), including gloves and eye protection, should always be utilized. Proper ventilation is essential to mitigate potential hazards. Disposal of malonic acid solutions must follow established environmental regulations to avoid environmental contamination.

6. Future Prospects of Malonic Acid and its Solutions

Ongoing research continues to explore novel applications for a solution of malonic acid (H₂C₃H₂O₄). The focus is on developing more sustainable and environmentally friendly synthetic routes, enhancing its utility in green chemistry initiatives. Further exploration of its potential in materials science and the development of new pharmaceuticals holds significant promise. The continued investigation into its biological activities could lead to unexpected discoveries and applications in various fields.

Conclusion:

A solution of malonic acid (H₂C₃H₂O₄) holds a significant place in chemistry, spanning a rich history and possessing considerable contemporary relevance. Its versatility as a building block in organic synthesis, coupled with its diverse applications across numerous industries, underscores its importance. Understanding its chemical properties, safe handling, and potential for future applications are crucial for researchers and practitioners alike. The ongoing exploration of its properties and applications will continue to shape its role in various scientific and industrial domains.

FAQs:

1. What is the molar mass of malonic acid? The molar mass of malonic acid (H₂C₃H₂O₄) is approximately 104.06 g/mol.
2. Is malonic acid soluble in water? Yes, malonic acid is soluble in water.
3. What are the typical pH values of a malonic acid solution? The pH of a malonic acid solution depends on its concentration; generally, it will be acidic, with a pH lower than 7.
4. What are the main safety hazards associated with malonic acid? Skin and eye irritation, as well as potential respiratory irritation from dust or mists.
5. How is malonic acid stored? Malonic acid should be stored in a cool, dry place, away from

incompatible materials.

6. What is the malonic ester synthesis? A classic organic chemistry reaction utilizing diethyl malonate to synthesize substituted acetic acids.

7. What are some alternative names for malonic acid? Propanedioic acid is a more systematic IUPAC name.

8. What is the melting point of malonic acid? The melting point of malonic acid is approximately 135-137°C.

9. Where can I purchase malonic acid? Malonic acid is available from various chemical suppliers.

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Editor: Dr. Arthur Davies, PhD, Analytical Chemistry

Dr. Davies has extensive editorial experience in chemical journals and possesses a strong background in analytical chemistry, ensuring the article's technical accuracy and clarity. His experience guarantees the article meets high editorial standards.

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Malonic acid 104 103 60 Fumaric acid 116 115 80 Levulinic acid 116 115 80 Maleic acid 116 115 80 Succinic acid 118 117 80 Pyroglutamic acid 129 128 60 ... Chromatogram of organic acid ...

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PRODUCT: Starch-Malonic Acid-Manganous sulphate solution CODE: J780.50 SECTION 11: TOXICOLOGICAL INFORMATION INGREDIENTS LC50 LD50 Starch - Potato or Corn Not ...

[LINN CIENTIFIC NC - flinnsci.com](#)

Malonic Acid and Potassium Bromide Solution Malonic acid Potassium bromide Water SECTION 2 — HAZARDS IDENTIFICATION Get medical advice or attention (P313). If inhaled: Call a ...

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

6 Sulfuric acid and malonic acid are both dibasic acids. One mole of a dibasic acid can form two moles of hydrogen ions. $\text{H}_2\text{SO}_4 \rightarrow 2\text{H}^+ + \text{SO}_4^{2-}$ 2CE Dibasic acids can form salts of the type ...

A computational study of the malonic acid - OSTI.GOV

acid, malonic acid (MA, Figure 1). In solution, malonic acid undergoes keto-enol tautomerization with an equilibrium constant that is estimated to be less than 10^{-4} , favoring the keto form.⁵ ...

Name: Period: Seat# - My Chemistry Class

2) If it takes 50 mL of 0.5 M KOH solution to completely neutralize 125 mL of sulfuric acid solution (H_2SO_4), what is the concentration of the acid solution? Assume we are only removing one ...

Experiment 5 Titration of Acids and Bases - atilim.edu.tr

the malonic acid solution, what is the molarity of the malonic acid solution? 3. Sodium carbonate is a reagent that may be used to standardize acids in the same way. In such standardization it ...

Fantastic Four Color Oscillator - flinnsci.com

bromate-malonic acid reaction. The overall reaction occurring in this demonstration is the cerium-catalyzed oxidation of malonic acid by bromate ions in dilute sulfuric acid. The bromate ions ...

Oscillating Clock Reaction - University of Illinois Urbana ...

This solution is 0.23 M. 2. Solution B. In a 500 mL flask, dissolve 16 grams of malonic acid and 3.5 grams of potassium bromide in 500 mL of distilled water. This solution is 0.31 M malonic ...

An Introductory Laboratory Exercise on Solution Preparation: ...

commonly encountered in solution preparation. Four solutions are necessary for the BR reaction; each provides certain specific opportunities for hands-on practice. Solution 1 contains two ...

Now You See It—Now You Don't - flinnsci.com

Sulfuric acid solution, H_2SO_4 , 1.5 M, 400 mL Plastic weighing dishes, 3 Safety Precautions
Sulfuric acid solution is severely corrosive to eyes, skin, and other tissue. Malonic acid is a ...

MITOCW | Briggs-Rauscher Reaction | MIT Chemistry Behind ...

The second solution is malonic acid and manganese sulfate monohydrate in water. And the third is hydrogen peroxide in water. And when mixed together, things get complicated. The overall ...

Chapter 6 Acids and Bases - WebAssign

[$\text{C}_6\text{H}_5\text{O}_6^{2-}$] in a 0.075-M solution of ascorbic acid. 64. Oxalic acid ($\text{H}_2\text{C}_2\text{O}_4$) is a diprotic acid with two carboxylic acid group that occurs naturally in some plants. Calculate the pH and the ...

LINN CIENTIFIC NC - sfdr-cisd-tx.newlook.safeschoolssds.com

Malonic Acid Solution Malonic acid Water SECTION 2 — HAZARDS IDENTIFICATION Get medical advice or attention (P313). If inhaled: Remove victim to fresh air and keep at rest in a ...

MALONIC ACID - CDH Fine Chemical

MALONIC ACID PRODUCT CODE 029129 SYNONYMS Propanedioic acid C.I. NO. -- CASR NO. (141-82-2) PROPERTIES ATOMIC OR ... Solubility 10% solution in water is clear and almost ...

Belousov-Zhabotinsky reaction - ResearchGate

2 bromate, 0.19 M malonic acid, 0.64 M sulphuric acid and 0.11 M bromide. The residence time in the reactor is 30 min. A stock solution of sodium silicate solution is prepared by mixing 222 mL of

Ionization Constants for Acids and Bases

Acid Name Formula pK_a K_a a thiocyanic acid HSCN -1.8 63 iodic acid HIO_3 0.78 0.17 chlorous acid HClO_2 1.94 1.1×10^{-2} hydrofluoric acid HF 3.20 6.3×10^{-4} nitrous acid HNO_2 3.25 $5.6 \times \dots$

FLINN SCIENTIFIC INC.

Malonic Acid and Potassium Bromide Solution Malonic Acid (141-82-2) 3.2%, Potassium Bromide (7758-02-3) 0.7%, and Water (7732-18-5) 96.1%. Section 3 — Hazards Identification Call a ...

Material Safety Data Sheet - TN

Malonic acid ACC# 13575 Section 1 - Chemical Product and Company Identification MSDS Name: Malonic acid Catalog Numbers: S80069, S80069A, A170-100 Synonyms: ...

Splendor of One Chemical Reaction - MIT OpenCourseWare

Malonic acid is a strong eye, skin and respiratory irritant. Take great . WARNING NOTICE using low heat while stirring and add in 4.3 mL of concentrated sulfuric acid. Dilute the solution ...

Sodium Citrate (Hydrogen Peroxide Stabilizer) - Water Boards

2. Product is the conjugate base of malonic acid, a carboxylic acid. In a water solution, sodium malonate dissociates into sodium ions and malonic acid. 3. MSDS - See attached file 4. ...

LINN CIENTIFIC NC

Malonic Acid Solution Malonic acid Water SECTION 2 — HAZARDS IDENTIFICATION Get medical advice or attention (P313). If inhaled: Remove victim to fresh air and keep at rest in a ...

FLINN SCIENTIFIC INC. - University of Nevada, Reno

Starch-Malonic Acid-Manganese Sulfate Solution Potato Starch (9005-84-9) 0.06%, Malonic Acid (141-82-2) 1.5%, Manganese(II) Sulfate Monohydrate (15244-36-7) 0.3%, and Water (7732-18 ...

FICHES DE DONNEES DE SECURITE - fishersci.fr

Malonic acid 141-82-2 (<=100) DNEL = 4.2mg/m3 Concentration prévisible sans effet (PNEC) Voir les valeurs ci-dessous. Component Eau douceDes sédiments d'eau douce Eau ...

SAFETY DATA SHEET Revision Date 08/06/2024 Version 6

Synonyms : Propanedioic acid Formula : C 3 H 4 O 4 Molecular weight : 104.06 g/mol CAS-No. : 141-82-2 EC-No. : 205-503-0 Component Classification Concentration Malonic acid Eye Dam. ...

Lab 11a; Effects of Malonic Acid on Kreb's Cycle

However, in test tubes B and C the Malonic Acid solution effectively bound to the enzyme as a competitive inhibitor, slowing or stopping the reaction. A picture of where this interruption ...

LINN CIENTIFIC NC - flinnsci.com

Starch-Malonic Acid-Manganese Sulfate Solution Potato starch Malonic acid Manganese(II) sulfate monohydrate Water SECTION 2 — HAZARDS IDENTIFICATION Get medical advice ...

Kinetic study of the oxidation of malonic acid by the ...

As for the oxidation of malonic acid by the Mn(III) ions in the solution of sulfuric acid, only the stoichiometry and elementary kinetic data have been given [8] up to now. Since malonic acid ...

ACIDS STRONG WEAK

MALONIC $\text{H}_2\text{C}_3\text{H}_2\text{O}_4$ $K_1 = 1.5 \times 10^{-3}$ $K_2 = 3.0 \times 10^{-6}$... The acid dissolved is by far the greatest contribution ... -an indicator solution which changes colour several times over several pH ...

Temperature-Adaptative Self-Oscillating gels: Toward ...

Apr 30, 2024 · The fabricated base gels were immersed in a solution containing super dehydrated DMSO (1.00 ml) and TEA (6.96 μL) for 24 hr at 23 °C. Then the gels were placed in a Ru(bpy) ...

Titration of a Diprotic Acid - Atlanta Public Schools

pH Sensor in the diprotic acid solution and adjust its position toward the outside of the beaker so it will not be struck by the stirring bar. Turn on the magnetic stirrer, and adjust it to a medium ...

The Effects of Coupling Photocatalysis and Sonolysis on ...

malonic acid solution in an Ar atmosphere at 25°C. Reac-tant: 10 mM malonic acid solution; Light source: 500 W-Hg lamp; Photocatalyst: TiO₂ (Rutile) 0.5 g; Ultrasound: 200 kHz, 6 W cm⁻². ...

SAFETY DATA SHEET - Fisher Sci

Product Name Maleic acid Cat No. : AC125230000; AC125230010; AC125230050; AC125230051; AC125230250; AC125231000 CAS No 110-16-7 Synonyms cis-Butenedioic ...

The condensation of aldehydes with malonic acid - Indian ...

the use of anhydrous pyridine in dry ethereal solution: Florence (1927) also recommended the same method for the synthesis of α-unsaturated aliphatic ... when piperonal, malonic acid and ...

Cinnamic acid derivatives: An ERA - thepharmajournal.com

Malonic acid undergoes Knoevenagel condensation with almost every type of aldehyde and very reactive ketones. Methylene malonic acids are ... products can be obtained in aqueous solution ...

43541 Malonic Acid pure, 99% - srlchem.com

Malonic Acid pure, 99% 43541 Part B CAS : 141-82-2 Molecular Formula : C₃H₄O₄ Molecular Weight : 104.06 Specifications Appearance (Colour) White Appearance (Form) Crystalline ...

exam 2 - euonym.us

6. A solution of the weak diprotic acid malonic acid (H₂C₃H₂O₄) of volume 25.00 mL reacts completely with 37.43 mL of 0.1074 M potassium hydroxide. a) Write a balanced chemical ...

Chapter 6 Acids and Bases - WebAssign

[C₆H₅O₆²⁻] in a 0.075-M solution of ascorbic acid. 64. Oxalic acid (H₂C₂O₄) is a diprotic acid with two carboxylic acid group that occurs naturally in some plants. Calculate the pH and the ...

Fantastic Four-Color Oscillator - Flinn Sci

3. Adjust the stirrer to produce a vortex in the solution. The solution may become amber, and will turn colorless after about one minute. 4. Once the solution is colorless, add all of Solution C ...