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Review on urea (Uses, advantage, disadvantage) in biochemical fields

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Abstract
Natural urea and artificial urea that seep into nature are quickly decomposed by bacteria into ammonia, nitrite ions, and nitrates, and these are substances in the nitrogen cycle. Both uric acid and urea are substances excreted by birds and bats. Urea is found as a natural substance in areas with a dry climate. It was found naturally in 1973 in "Tropin Hill" near Lake Rason in Western Australia, and it was fraught with ammonium phthalate and ammonia phosphate. Urea was the first organic compound produced synthetically from inorganic starting materials, and this undermined the principle of vitalism or vis vitalis in Latin. Urea was discovered as a substance in its own right in 1773 by Hilaire Rouelle. The first to manufacture it was Friedrich Wöhler in 1828 through a chemical reaction process between potassium cyanate and ammonium sulfate; in this way, she paved the way for the branch of organic chemistry, after proving that organic substances can be produced from non-living things and materials.

Keywords: urea, carbamide, reactions of urea, disease of urea

Introduction

In chemistry and biochemistry, carbamide, or urea, is an organic compound with the chemical formula $CO(NH_2)_2$. The name Carbamide is recommended in international non-proprietary names and used in Europe. For example: the compound hydrogen peroxide - urea (the old approved name in England) is now used in medical circles as carbamide peroxide and is used in teeth whitening. Other names include carbamide resin, isourea, carbonyl diamide, and carbonyldiamine. This substance is produced in many animals, as a final component of the process of metabolizing nitrogenous compounds (such as amino acids) in the carbamide cycle that occurs in the liver, and is expelled from the body through urine and sweat.

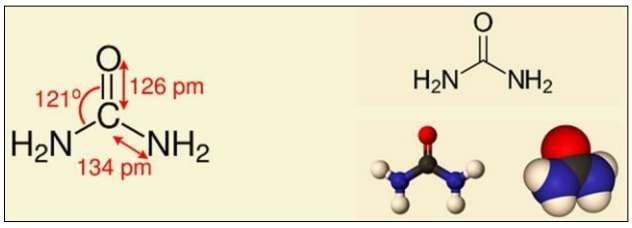

Fig 1: Structure of Urea

Pure carbamide (Urea) is a white crystalline substance that smells close to that of ammonia, is non-toxic and even cleanly is not harmful. Pure urea is white in color in the form of crystals, odorless, non-toxic, and considered pure, easily soluble in water. Global production of it is 200 million tons per year, and it is one of the most frequently produced chemicals. Urea is used in the manufacture of industrial fertilizers containing nitrogen (nitrogen), and urea is a raw material for the chemical industries, as it is used in the manufacture of resin, adhesives, and electrical insulators. It is a substance used in the manufacture of melamine, caffeine, hydrazine, varnish, bleaching materials and other chemicals.

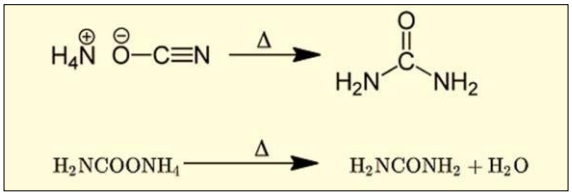

Fig 2: Preparation of Urea

Urea is formed in the liver, and the method of its formation is uncertain, but the theory of the ornithine circuit has found some acceptance, and in the process; Alginine is transformed by the action of the enzyme arginase into ornitine, and ornitine urea condenses with ammonia and carbon dioxide to form citrulline, which then takes another molecule of ammonia to form arginine. Urea is solid, colorless crystals. It dissolves in water and alcohol and does not dissolve in ether. It is found in blood and tissue fluids in all vertebrates and some invertebrates. It is the main nitrogenous component in human and mammalian urine in general, and is the final product of protein metabolism.

The importance of urea to living organisms

Many vertebrates, such as elasmobranchs, such as sharks, rays, amphibians, and mammals, produce urea as a final product of the metabolism that takes place on nitrogen compounds such as amino acids. When an amino acid is decomposed, amoya is produced first, which is a toxic substance when it is in a high concentration, as it negatively affects the cells. Urea is formed in the liver through the reaction of two molecules of ammonia with one molecule of carbon dioxide in the urea cycle. Urea travels from the liver to the kidneys and is excreted from the body with urine. Almost half of the solids found in urine are urea. Imbalances in the urea cycle have genetic causes and it is a metabolic disease, a disease related to an imbalance in the reactions of ammonia. It leads to a rise in the amount of ammonia in the blood, which is harmful to nerve cells. Small amounts of urea are also excreted from the human body with sweat and intestinal secretions. The human body produces between 20 - 39 grams of urea per day. Some animals take advantage of urea to protect them from hardening due to the cold. Sharks and rays do not excrete all urea, but use it to control the osmotic pressure that helps the transport of various substances between cells. Eating food rich in proteins leads to a relative increase in the percentage of urea, even if the kidneys are healthy, and this shows a low activity for the work of the kidneys. If the kidneys are exposed to disease, or if the efficiency of the kidneys is modest due to diabetes, this leads to an increase in the level of urea in the blood (usual level: 10–50 mg/dL) in the blood. Urea is found in milk and milk, and the amount of urea in milligrams per liter of milk is an important measure in the feeding of cows. The percentage of urea in milk is determined by feeding the cow an appropriate amount of proteins per day and the amount of carbohydrates fermented by the cow's stomach, and it is used as a measure of the animal's efficiency in making use of the proteins it eats. If the proportion of proteins in excess or less than the appropriate limit in the animal's nutrition, it will have dire consequences for the animal's health.

The importance of urea in the chemical industries

One of the uses of urea in industry is the manufacture of melanin, which is used in the manufacture of various types of resin, and some of this resin is used in the manufacture of plywood. It is also used in the preparation of urea-formaldehyde resin. In addition, urea is often used in the manufacture of nitrogenous fertilizers, and is also used as a reducing agent. And the uses of urea are increasing annually, its production has doubled between 1960 and 1970 four times. Between 1990 and 2010, its production and demand increased at a rate of 3% annually. However, the technical efficiencies in its manufacture exceed the demand by between 10% to 20%. And may increase the demand for it could be the desire of legislators to reduce nitrogen oxides from traffic cars, buses and vans - as well as the desire to expand production of biofuels

Manufacture of Urea

Urea is prepared in the laboratory by reaction of ammonia with phosgene or with carbonic acid ester or by hydrolysis of cyanamide. As for the industrial preparation of urea, it is carried out in large quantities. In 2012, global production of urea reached 184 million tons. According to the estimates of the International Fertilizer Industry Association (IFA), production is expected to increase during the years 2013-2018 by about 41 million tons, including 5 million tons in the United States alone. To increase production of urea in the United States will require an increase in gas extraction from slate stones. For the production of urea in large factories, natural gas, air and water are used according to the Haber-Bosch method, which produces first ammonia and then urea last. To produce hydrogen, carbon dioxide is first separated, two-thirds of which is used to produce urea. The method of producing synthetic urea by high pressure goes back to "Karl Bosch" and "Wilhelm Meiser". BASF Chemical Factory built its factory in 1922, where it built a high pressure reactor as an initial step with a capacity of 150 atmospheres of ammonia and carbon dioxide. The reaction can be reduced by working with a high percentage of ammonia. In its plant, PAFS uses increased ammonia content in the manufacture of ammonia sulfate and ammonia nitrate. At the end of the 1920s the reaction was improved and the excess ammonia was sent back to the production process. In the same way, global reaction cycles have been developed by DuPont, Pechiney and Stamicarbon. The processes differ among themselves in terms of the method of decomposition of ammonia carbamate, the separation and production of carbon dioxide and ammonia, as well as in the treatment and manufacture of urea. The reaction temperature according to the method is between 170 - 220 degrees Celsius, and the reaction pressure is between 125 and 250 atm. All modern methods have one thing in common, which is to return the excess gases to the reactor, where the stripping process takes place. It takes 0.58 tons of ammonia and 0.7 tons of carbon dioxide to produce 1 ton of urea. According to the process method, between 85-160 kilowatt-hours of electricity and 0.9-2.3 tons of steam are used in its production. During production, it is intended to reduce the production of biuret, which consists of urea at high temperatures, and this substance remains in the industrially produced urea as an impurity foreign substance. The producer wishes to reduce the

presence of biuret in urea to less than 1%, as the biuret has a negative impact on seed grains, which has a bad effect on agricultural output.

Urea-formaldehyde is a type of resin or thermosetting hard plastic made by a condensing reaction between urea and formaldehyde (methanol), with subsequent crosslinking on the chains. Urea-formaldehyde resins are used in the adhesive industry and in the preparation of MDF boards; In addition to many important industrial applications.

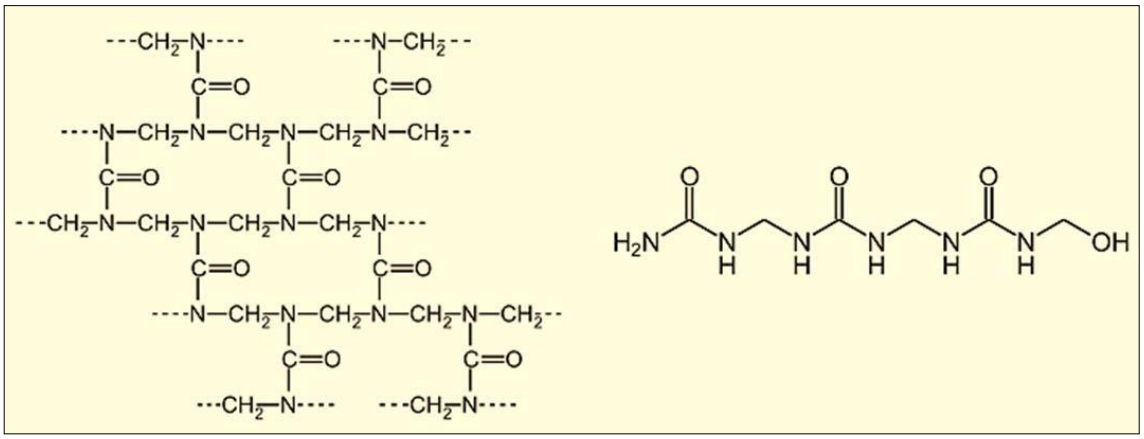

Fig 3: Some Urea Derivatives

The conditions that cause increased blood urea levels fall into three different categories: pre-renal, renal, and post-renal. Pre-renal ketosis can occur due to reduced blood flow through the kidneys (eg hypotension, congestive heart failure, shock, hemorrhage, dehydration) or increased production of urea in the liver by a high-protein diet or increased protein catabolism (Such as in case of fatigue, fever, corticosteroid therapy, gastrointestinal bleeding). Renal causes can be attributed to decreased kidney function, and include acute and chronic renal failure, acute and chronic glomerulonephritis, tubular necrosis, and other kidney diseases.

Post- renal causes can be due to decreased urea excretion; because urine flow is obstructed by stones, bladder or prostate tumors, or a severe infection., If we suppose that a man eats 300 gm of carbohydrates & 100 gm of fat & 100 gm of protein, then this food contains 16.5 gm of nitrogen (in protein) per day and he must excrete excess nitrogen from the body's need (after maintaining tissues and providing growth requirements) and that 95% of the nitrogen excreted In the urine is through the kidneys, and the remaining 5% is excreted with the feces. Therefore, 95% of the excreted with the urine is urea.

Conclusions

Urea is the most commonly used substance in the world in nitrogenous fertilizers, and these fertilizers are calculated based on their nitrogen content. In different regions of the world, such as Asia, the proportion in 1997 was more than 50%. And increased consumption of urea severely in Asian countries. In 2013, India, China and Pakistan were the world's largest consumers of urea. Creams containing urea are used in dermatology as topical skin products used to treat dry skin. 40% urea is used to treat psoriasis, dry skin, eczema, keratosis and others

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