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## **BIOGENIC ROLE OF SULPHUR**

*Ahmed younus, group 1. Scientific adviser: Tishakova Tetyana*

Sulphur also known as Brimstone is seventh most abundant mineral in human body [1]. It is a macro-element. Its abundance level is 0.20% to 0.25% in human body [2]. Sulphur helps to retain cellular structure. Sulphur is used to manufacture tetraoxosulphate (VI) acid [3]. Sulphur bonds known as disulphide bonds helps in determining quaternary structure of proteins. Sulphur-di-oxide is also used as antioxidant in pharmaceutical procedures. Sulphur makes up vital amino acids which are used to create proteins for cells and tissues. Amino acids like methionine, cysteine and taurine contains Sulphur which plays an important role in human body [4]. Sulphur helps to maintain blood glucose levels and serve as antimicrobial agent in human body [7, 1]. Sulphur deficiency in body cause obesity, heart diseases, Alzheimer's, and chronic fatigue [5]. The excess amount or increase of Sulphur in human body causes skin irritations, allergy and kidney damage [5]. Many ointment's such as benzyl peroxide, sebutone, resorcinol, Sulphur soaps, lotions and dusting powder containing Sulphur are being used to cure skin rashes [6]. Natural Sulphur baths may help to relief pain associated with arthritis [6]. The best sources of Sulphur includes Onions, eggs, garlic, cabbage, mushrooms, broccoli, cheese, cocoa, dried apricots fish and meat etc [8]. Methylsulfonylmethane, MSM, can also be used as a good source of organic Sulphur in our diet as it allows removal of metabolic wastes from cells [10].

### List of reference

1. [&https://medical-dictionary.thefreedictionary.com/Brimstone+\(sulfur\) &](https://medical-dictionary.thefreedictionary.com/Brimstone+(sulfur))
2. <https://thoughtco.com>
3. <http://freechemistryonline.com/sulphur-properties.html>
4. <http://www.toxipedia.org/download/attachments/17044484/Report>
5. <http://www.askanaturopath.com/faqs/sulphur/p/373>
6. <http://www.umm.edu/health/medical/altmed/supplement/sulfur>
7. [https://en.wikipedia.org/wiki/Blood\\_sugar\\_regulation](https://en.wikipedia.org/wiki/Blood_sugar_regulation)
8. <https://www.livestrong.com/article/289250-list-of-foods-high-in-sulfur/>
9. <https://draxe.com/msm-supplement/>
10. <http://theshawnstevensonmodel.com/7-benefits-of-msm-the-miracle-supplement/>

## BIOGENIC ROLE OF COBALT

*Aishath Hana, group 1. Scientific advisor: Tishakova Tatyana*

Cobalt is microelement that builds up in liver, plasma, kidneys, spleen and pancreatic gland. It is a vital element in the construction of vitamin B12 [1,2]. Cobalt stimulates the formation of RBCs, glycogen, hormone production and enzyme activities. It is required for daily growth and maintenance of body cells, nervous system to repair myelin sheath, absorption of vitamin C and iron, normal functioning of pancreas, appetite, metabolism, curing cancer, anemia, infectious diseases, reduction of blood cholesterol level, development of RNA and DNA and increasing the activity of white blood cells [3,4].

Daily requirement of cobalt is of less than 1mg, out of which 0.36mg is in adipose (fat layer), 0.3mg in hair, 0.28 in the bones, 0.2 in the muscles and 0.11 in muscles[3]. Cobalt deficiency is connected to vitamin B12 deficiency so it is a cause of pernicious anemia, diseases in gastrointestinal tract and presence of helminths. Prolonged deficiency of cobalt results in neurological disorder, memory loss, mood changes, psychosis and maybe death. Excess of cobalt in the body results in kidney damage, nerve damage, over production of RBCs leading to thickening of blood, goiter, increase activity in bone marrow and cardiomyopathy[5,6].

Cobalt is available as tablets and injection. It treats pernicious anemia in the form of vitamin B12. Food products that can be consumed to supplement cobalt in the human body are present in all most all herbs and vegetables such as beets, cabbage, potato, onions, lettuce, ginger, cucumber and many more. Legumes, grains, fruits and berries such as apricot, black currant, wheat and strawberries contain cobalt in them. Animal products such as rabbit meat, beef and veal and dairy products such as milk, sour cream and yoghurt contain cobalt in them. Likewise, seafood such as lobster, squid, canned fish also contain cobalt in them[7,8].

### Reference

1. Fundamentals of medical chemistry: self-work book/ A.O Syrovaya, E.R. Grabovetskaya, L.G. Shapoval:2015-23p
2. <http://www.stayhealthytil70.com/tag/importance-of-cobalt-in-human-body/>
3. <https://blissreturned.wordpress.com/2012/02/24/cobalt-it-is-an-essential-element-required-for-the-normal-functioning-of-the-pancreas/>
4. <https://euromd.com/21-healthy-living/138-beauty-and-fitness/4-vitamins-and-supplements/post-4244-cobalt-in-the-human-body/>

5. <http://www.mineraldeficiency.net/cobalt-deficiency>
6. [http://nutrients.mineravita.com/eng/cobalt\\_disorders.php](http://nutrients.mineravita.com/eng/cobalt_disorders.php)
7. <https://www.herbwisdom.com/herb-cobalt.html>
8. <https://www.independent.ie/business/farming/cobalt-keeps-your-lambs-on-target-26460419.html>

## **BIOGENIC ROLE OF IODINE**

*Mariyam Zuha Abdul Sattar, group 1. Scientific advisor: Tishakova Tatyana*

Iodine is a trace element. Iodine assists in the production of thyroid hormones; Thyroxine (T4) and triiodothyronine (T3) which are required for metabolic regulation of the body [1]. We require about 0.1 milligrams of iodide per day. In our bodies, we have up to 20 milligrams, mostly in thyroid glands [2].

Lack of iodine means there aren't enough thyroid hormones. Hence iodine deficiency can cause goiter, hypothyroidism and mental retardation in infants and children [3].

Excess of iodine in our body is usually a result of iodine supplement consumption as a treatment for a prolonged iodine deficiency. Excess iodine can develop hyperthyroidism, hypothyroidism and goiter. Iodine excess also cause metallic taste in mouth, increased production of saliva and irritates the digestive tract [4].

Iodine can be used in medical field both as an antiseptic and disinfectant to clean wounds and to sterilize skin before surgical or invasive procedure. Iodine containing tablet is given to maintain thyroid hormones [5].

Food rich in iodine include; vegetables grown on soil which has sufficient iodine, Onions, chokeberry, bread, dairy products, saltwater fish, sea food and sea weed. Sodium or potassium iodide is added to salt in various countries [6].

List of references:

1. <https://blissreturned.wordpress.com/2012/02/10/iodine-the-essential-trace-element-that-is-essential-for-the-normal-growth-and-development/>
2. <http://www.rsc.org/periodic-table/element/53/iodine>
3. <https://www.thyroid.org/iodine-deficiency/>
4. <http://www.msmanuals.com/home/disorders-of-nutrition/minerals/iodine>
5. <http://www.ivyroses.com/Chemistry/Elements/Iodine-Uses.php>
6. [http://www.mineravita.com/eng/iodine\\_sources.php](http://www.mineravita.com/eng/iodine_sources.php)

## FLUORINE

*Mohamad Kerdali, group 1. Scientific adviser: Tishakova Tatyana*

Fluorine is a chemical substance of the 17<sup>th</sup> group (halogen group) of the periodic table, it carries the symbol F and has the atomic number of 9 . Fluorine usually exists as a yellow, light, toxic gas and it has a very high ability to react with other substances [1] . Fluorine is considered as a microelement since it is needed in the human body in very small quantities because excess of fluorine in the human body can cause many problems such as skeletal fluorosis and never forget that an overdose of fluorine can be lethal. For example : 5-10 mg of sodium fluoride can be lethal to an adult. Even though excess of fluorine can damage the human body , we can't ignore the fact that fluorine is an elementary element for the human body. Fluorine is present in all of the human body's tissues but mostly in teeth and bones and around approximately 92% of fluoride in the body is stored in bones and teeth. Fluorine is essential for mineralization of bones and formation of dental enamel and it has a strong connection with calcium [2] . Fluorine does not only participate in formation of dental enamel but it helps in preventing dental caries but at the same time excess of fluoride in the teeth can cause dental fluorosis . deficiency of fluorine in the human body can cause decay of teeth, curvature of the spine and eyesight problems. There are many medicinal products containing fluorine such as : anti-anxiety drugs, appetite suppressants, steroids and antibiotics such as Advair Diskus, , Celebrex, Flonase, Lipitor, Paroxetine, Prozac and Redux (according to an online essay referencing to an announcement by the FDA) [3] [4] . lastly, some sources that are rich in fluorine which that can be added to a food diet can be cucumbers, dates, carrots, cabbage, nuts, tomatoes, spinach, asparagus, avocados and sunflower seeds [2] .

List of references :

1. <https://en.wikipedia.org/wiki/Fluorine>
2. Bliss Returned company, (2012), Fluorine: Daily Requirement, Function, Benefits And Food Source That Everyone Should Know, retrieved from : <https://blissreturned.wordpress.com/2012/02/20/fluorine-daily-requirement-function-benefits-and-food-source-that-everyone-should-know/>
3. Becky Plotner, (2016) , Prescription Drugs That Contain Fluoride , retrieved from : <http://www.nourishingplot.com/2016/06/20/prescription-drugs-that-contain-fluoride/>
4. Iwao Ojima , (2009) , Fluorine in Medicinal Chemistry and Chemical Biology

, New York : Blackwell Publishing Ltd.

## **BIOGENIC ROLE OF CHLORINE**

*Faziha Mohamed Zubair, group 1. Scientific advisor: Tishakova Tatyana*

Chlorine (Cl) is a macro element and is present in the body as the chloride ion. However, it is present in extracellular fluid as sodium chloride (NaCl), and is found within the cells as potassium chloride (KCl). Chloride ions are also known to be present in the erythrocytes.

The chloride ions are mobile and move across the cell to maintain its acid-base equilibrium and the cellular osmotic pressure. They also help with balancing the pH and water content in the cells. They aid with activation of salivary amylase and also provides an acidic medium required for activation of gastric enzymes in the stomach. This in turn aids with digestion. It also helps with electrical impulse conduction when dissolved in the bodily water [1].

Chlorine is used in pharmaceutical industry for treatment of hypercholesterolemia, cancer, diabetes, asthma, depression, stomach ulcers, epilepsy, inflammation and anemia. In drugs, it might be used in the form of a chloride or HCl. It might also be bonded in a certain way that directly effects on the therapeutic activity [2].

The main source of chlorine intake is the common table salt or sodium chloride we use in cooking. It is a component in bodily secretions that result from anabolic and catabolic processes. A limited amount of chlorine is stored in the skin, skeleton and subcutaneous tissues. Two thirds of the anions in the blood are comprised of chlorides. It is also present in the stomach as gastric acid HCl. Chlorine is absorbed into the body by digestion and is excreted by kidney or by sweating or through intestine.

Chlorine deficiency (hypochloremia) is a condition where the amount of chlorine is not sufficient and it isn't utilized completely. The amount of chlorine in the body increases dramatically in warmer weather as sweating decreases the fluid content of the body. There is also significant chloride loss during severe diarrhea or vomiting or severe alkalosis. Chlorine deficiency's treatment mainly depends on its underlying cause. Chloride can be consumed in many ways including meat, eggs and milk. However, its main source is the normal salt we use in cooking. It is recommended to consume 7.5 to 9 grams of chlorine per day. The average person loses up to 5.3 grams of chlorine per day [3].

List of references:



[1] <http://www.preservearticles.com/201105317358/what-is-the-importance-of-chlorine-in-human-body.html>

[2] <https://chlorine.americanchemistry.com/Chlorine/Pharmaceuticals/>

[3] <https://traceminerals.com/chloride-the-forgotten-essential-mineral/>

## **BIOLOGICAL ROLE OF SILICON**

*Toluwani Balogun, group 2. Scientific adviser: Syrovaya Anna*

Silicon is a chemical element of 1 group of the D.I Mendeleev periodic table and an alkali metal

Silicon, number 14 on the Periodic table, is the eighth most abundant element on Earth. The element cannot be found in pure form due to its high reactivity. It's vital for both Plants and Animal. Silicon is responsible for a dangerous lung disease called silicosis that can affect professionals who breathe silicon dust [1].

Silicon is fundamental, for improved functions of cartilage, connective tissue and organs such as: the walls of aorta, trachea, tendons, and ligaments.

It's vital purpose is due to its ability to crosslink with the collagen; protein that gives strength and elasticity of the tissues and bones.

Furthermore, Silicon improves the functioning of systems such as the circulatory system, since it's properties is of great importance for the creation, elasticity and porosity of arteries.

### Other Biological role of Silicon

- Prevents Osteoporosis
- Involved with the formation of antibodies
- Stimulates cells and cell metabolism
- Protects the body from harmful effects of aluminium
- Antiaging
- Growth of hair and nails
- Improved functioning of the eyes

And most importantly, reduction of fats and cholesterol in the body [2].

### References:

1. <http://nautilus.fis.uc.pt/st2.5/scenes-e/elem/e01440.html>

2. [http://www.mineravita.com/eng/silicon\\_role.php](http://www.mineravita.com/eng/silicon_role.php)

## THE BIOLOGICAL ROLE OF MERCURY

*Ikpe Deborah Samuel, group 2. Scientific adviser: Syrovaya Anna*

Mercury is a transition metal. Mercury is neither a macro nor a micro element, rather it is referred to as a toxic element. Mercury exists in deposits around the world as cinnabar. Mercury exists in many forms, the toxicity of mercury depends on its chemical form [1].

Mercury occurs naturally as a man made contaminant. Human beings come in contact with mercury in their body system through the release of processed mercury which goes into the atmospheric soil-water distribution cycles where it can remain in circulation for a long time. The major way of human exposure to mercury is mostly through eating contaminated fish, seafood and other wildlife [2].

Mercury exposure can cause a lot of medical problems at the cellular and organ system levels. At the cellular level, exposure to mercury can cause alterations in membrane permeability, it can also change the macro-molecular structure and cause some sort of DNA damage. It can also be shown to induce oxidative stress and mitochondrial dysfunction. Accumulation of mercury in the heart is said to bring about cardio-myopathy. Mercury absorbed in the body has so many effects, for example, it can cause digestive disturbances because it can prevent the production of digestive enzymes. In the gastrointestinal system, it causes abdominal pain, indigestion, ulcers. It can cause kidney damage. It can damage the immune systems function, it can be linked to a few immune or autoimmune conditions including, allergic diseases, eczema, epilepsy, schizophrenia, multiple sclerosis. In the nervous system, it hinders the production of energy, which thereby causes depression, paranoia, hallucinations, memory loss, lack of concentration, tremors in different body parts, headaches, fatigue, etc. Mercury has also shown effects on other special sensory systems which include; blindness, hearing loss, reduced sense of smell, abnormal sense of touch, optic neuropathy. It can also affect the endocrine system by alteration of the pituitary, thyroid, adrenal glands and the pancreas. Problems with the pituitary glands are linked with depression. Mercury is also said to cause some reproductive problems like miscarriage, stillbirth, etc [3-4].

Reference:

1. <https://www.ndhealth.gov/wm/Mercury/MercuryContainingDevicesProducts.htm>
2. <https://www.greenfacts.org/en/mercury/1-3/mercury-2.htm#1p0>

3. [https://en.wikipedia.org/wiki/Mercury\\_\(element\)](https://en.wikipedia.org/wiki/Mercury_(element))
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3988285/>

## **COPPER**

***Khanyisa Rakobela Monyamane, group 5. Scientific adviser: Lukianova Larisa***

Copper a chemical element symbolised “Cu”, has the atomic number 29 and it is an element of group 11, which remains solid at 20 degrees Celsius. Copper is a goldish-red element that can be used in wires because Copper is soft and malleable.

Copper is a micronutrient, meaning it is only required in small quantities by an organism.

Copper is an important element to life. Organic copper (copper in food) is digested by the liver. It can be taken into the body by water, copper supplements and food high in copper like cashews, walnuts, sesame seeds and sunflower seeds.

Copper is a key mineral in many different body systems. It is needed for maintaining blood volume, building strong tissue, and producing energy in your cells. Yet, for all its critical importance, we don't have much copper in our bodies, not really more than the amount found in a single coin.

An average adult requires 1.2 milligrams of copper a day, this insures enzymes transfer energy in cells regularly. More copper than needed is dangerous. This could lead to kidney and liver failures, anemia and in other cases cancer.

Genetic diseases, such as Wilson’s disease (disorder in which copper builds up in the body) and Menkes’ disease (affects copper levels in the body, thus causing deficiency of copper), affect the use of copper in the body as they disrupt the balance of copper in the body.

Copper also plays a role in the formation of melanin, which is what gives our hair and skin its colour.

Reference:

1. [www.rcs.org](http://www.rcs.org)
2. [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)
3. [www.whfoods.com](http://www.whfoods.com)

## **BIOGENIC ROLE OF RADON**

***Aishath Mihna Mohamed, 6 Group. Scientific adviser: Levashova Olga***

In 1990, Friedrich Ernst Dorn discovered the element Radon (Rn) by the emission from the radium during radioactive decay [1]. It is a natural radioactive gas which is chemically inert and is an odorless, colorless gas at room temperature and

pressure. Below its freezing point (-71.15 °C), it has a brilliant yellow phosphorescence or glows yellow. Radon is the densest gas because it is formed by the decay of denser radioactive elements like thorium, radium and uranium [2-3]. Radon disintegrates through short lived decay product before forming of lighter elements like lead and bismuth. The short lived decay products of radon are responsible for most of the hazard by inhalation. Radon and its decay product, radon progeny emit highly ionizing alpha-radiation.

The effect of Radon depends on the amount of exposure to the element. The main hazard of exposure to Radon is cancer.

**Lung Cancer:** The Studies of uranium miners showed that, the workers who were exposed to the high levels of radon have an increased occurrence of chromosomal aberrations in blood lymphocytes [4].

**Stomach Cancer:** Mineral Ions in well water contains Radon. Drinking of contaminated water has a high risk of Stomach cancer. According to EPA estimates, almost 168 deaths per year are due to Cancer and the 11% due to Stomach cancer [5].

Radon was used in treatment of tumors and was useful in cancer therapy. The radiation given kills off cancer cells as well as healthy cells. There-by Radon is not widely used in cancer therapy. Safer and efficient isotopes are used instead [2-3].

Radon can be detected by Etched tract detectors, Electron chambers and Charcoal detectors. Etched tract detector is an alpha detector placed for the period of 12 months.

In electron chamber with different sensitivities, which measures over a few days or over a month. Charcoal detection is used for measurement of radon level for few days [6].

Radon levels in the surrounding environment and homes can be reduced by sealing cracks in floors and walls to change the flow of air into the building. The amount of radon entering into a house can be reduced by improving ventilation of the house and installing radon sump system [6].

Reference:

Reference 1: <http://www.rsc.org/periodic-table/element/86/radon>

Reference 2: <https://www.lenntech.com/periodic/elements/rn.htm#Radon>

Reference 3: <http://www.chemistryexplained.com/elements/P-T/Radon.html>

Reference 4: Popp W, Plappert U, Muller WU, Rehn B, Schneider J, Braun A. Biomarkers of genetic damage and inflammation in blood and bronchoalveolar lavage fluid among former German uranium miners: a pilot study. *Radiat Environ Biophys*.

Reference 5: <https://www.livestrong.com/article/125327-radon-test-kits/>

Reference 6: [http://www.who.int/ionizing\\_radiation/env/Radon\\_](http://www.who.int/ionizing_radiation/env/Radon_)

## STIBIUM

***Katrina Nanguwo Ithete, group 7. Scientific adviser: Kozub Svetlana***

Stibium is also known as Antimony. On the periodic table, it is given the Symbol: Sb, Atomic number: 51, Atomic Mass: 121.76 and it is found in Group 15 and Period 5. Swedish chemist Jons Jakob Berzelius gave antimony its symbol. It is a micro-biogenic element and It is classified as Semi-metallic (Metalloid) which exist in two forms (metallic and nonmetallic). Metallic is bright, silvery, hard and brittle whilst the Non-metallic is grey powder form. Stibium is poor conductor of both heat and electricity. It is stable in dry air and does not react to dilute acids and alkalis. It expands on cooling and it is Found in nature or obtained from ores stibnite or valentinite. Nicolas Lemery, a French chemist 1707 was first to study it [1].

Stibium is not an essential nutrient for plants and Animals but it can be incorporated into lipids. Its Absorption rate is relatively low (even in soluble forms). Distribution and excretion of this microelement in the body depend on its valence state (i.e. Trivalent has longer elimination half-life than pentavalent compounds). Majority of Stibium is excreted in urine and others in faeces or milk. Stibium Accumulates in liver, thyroid and heart. It has no significant biological role but in small doses, it stimulates metabolisms [2].

Stibium medicinal products such as Pentavalent antimonials (Sbv), have been the mainstay of all forms of leishmaniasis for seven decades and remains the most important anti-leishmanial compound in the world for all forms of leishmaniasis. However, toxicity profile of Stibium warrants search for safer drugs to replace it as first line drug in other parts of the world. Serious and fatal antimony toxicity not infrequent even with standard products complication caused by Stibium includes Cardiotoxicity and Pancreatitis especially in HIV co-infected. Antimonials are also used as emetics and Antiprotozoal. The two Stibium isotopes are used in the production of medical radioisotopes. Stibium gains entrance into the body via Foods stored in enamel vessels and cans, Cereal and Cereal products. e.g. Rice, Meat, poultry, eggs and their products, Vegetables and Dairy Products [3].

## References:

1. Butterman, W.C., & Carlin, J.F.J. (2014). Antimony. Mineral commodity profiles. Washington, D.C: U.S department of the interior
2. Haynes W.M., Ed, (2015). CRC Handbook of Chemistry and physics. NY: University Press
3. Syrovaya O.A., Shapoval L.G, Petiunina V.N., Et Al (2014). Individual Tasks for Students' Self-control of Knowledge in Medical Chemistry. Kharkiv: KhNMU.

## **CENTRIFUGATION AS A RESEARCH METHOD OF CHEMICAL ANALYSIS**

*Chigozirim Ejinkeonye, group 12. Scientific adviser: Tishakova Tetyana*

Centrifugation is a technique or method used in chemistry for the separation of substances of different densities in a mixture. It does this through spinning the mixture sample in a centrifuge. Centrifugation is also used to analyze the hydrodynamic properties of macromolecules [1].

The Principle of Centrifugation- Centrifugation works by speeding up the rate of sedimentation of the mixture. In a mixture of substances of different densities, such as a mixture of chalk and water, if the mixture is left to stand, the particles sediment over time. The larger particles (chalk) will settle at the bottom while the smaller particles (water) settle on top of the larger particles.

Sedimentation does not take a very long time when the particles have a large density and size. However, it takes a very long time when the particles have a very small density and size such as in the blood. Therefore, to speed up the separation of this kind of mixture, centrifugation is used [1].

In a centrifuge, the mixture samples are subjected to centrifugal force (hence the name, centrifugation). The centrifuge spins the samples at very high angular velocity upto even 70000 rpm, depending on the type of centrifuge. Due to the centripetal force acting on the sample, the denser particles present in the mixture sample move away from the axis of rotation while the less dense particles move towards the axis of rotation [2].

There are different types of centrifuges with varying capacities and speeds: microcentrifuges, high-speed or superspeed centrifuges and also ultracentrifuges. Microcentrifuge have a capacity of 0,5 – 2,0 mL and have maximum angular speeds of 12,000–13,000 rpm. High-speed centrifuges have a higher capacity and can reach speeds of up to 30,000 rpm. Ultra-centrifuges can reach angular speeds of more than 70,000 rpm and have a larger capacity than the other two [1].

Centrifugation has many applications. It is used in uranium-enrichment to separate the uranium-238 and uranium-235 isotopes of uranium in uranium hexafluoride gas [3]. Centrifugation is applied in DNA stable isotope probing [4]. It is also used in separation of proteins, cellular components and nucleic acids. In medicine, it is used extensively in blood analysis.

#### References

1. <https://en.wikipedia.org/wiki/Centrifugation>
2. JoVE Science Education Database. *General Laboratory Techniques*. An Introduction to the Centrifuge. JoVE, Cambridge, MA, (2017).
3. <http://www.centrifuge.guide/significant-applications-of-centrifuges/>
4. [https://en.wikipedia.org/wiki/Stable-isotope\\_probing](https://en.wikipedia.org/wiki/Stable-isotope_probing)

### THE GEMSTONE JASPER

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Jasper is an opaque form or variety of quartz and/or Chalcedony (which is translucent, grey or white). The mineral is a highly contaminated quartz (up to 40% of the total mass). Even the most uniform jasper mineral consists of extraneous impurities in its tenth part. However, foreign inclusions make jasper and beautiful, and valuable. [1]. The reddish brown color is due to the iron III inclusion. It also has a vitreous or glass luster, which means that it has a reflecting property similar to that of glass. Its chemical formula is  $\text{SiO}_2$  [1]. Jasper can be found worldwide [2].

Jasper is an excellent natural stimulant. It mildly affects the main functions of the body, normalizes the work of dilapidated systems and synchronizes the mechanisms controlled by the central nervous system.

#### IMPORTANCE OF JASPER TO HUMANS AND IN HOLOSTIC MEDICINE (HEALING POWER OF THE STONE)

1. It is believed to protect people from poisonous sting and bites, epilepsy, mental disturbances. Also helps with prostrate issues, hair, skin, pregnancies (to ease childbirth) and the heart [2].
2. Helps with treatment of disorder of bladder, kidney, liver, varicose veins and spleen. E.g. bloodstone jasper [4].
3. It is a highly restorative stone for deteriorating tissues of internal organs [4].
4. Jasper is good for healing of wounds and stops bleeding [3].
5. Wearing Jasper alleviates stress and induce tranquility. It eliminates

negative energy. It is good for soothing the nerves and increasing focus, and is a wonderful stone for stopping nightmares or harmful thoughts.

6. Jasper is an excellent diet stone, a remedy for the treatment of diseases of the stomach, kidneys, urinary bladder and eye diseases.

7. Jasper helps in cutting down or quitting smoking, and assists in reducing over-consumption of alcohol. It removes harmful toxins from the system over time, and helps stop the emotional triggers that perpetuate the behavior.

8. It is highly protective and grounding, and used to promote dream recall.

9. Jasper minerals of red color are able to treat many female diseases and increase fertility. Yellow jasper enhances female sexuality and attractiveness, acts as an aphrodisiac (helps increase sex drive) and a regenerator of sperm [3].

#### REFERENCES

1. [http://www.minerals.net/gemstone/jasper\\_gemstone.aspx](http://www.minerals.net/gemstone/jasper_gemstone.aspx)
2. <https://www.gemselect.com/gem-info/jasper/jasper-info.php>
3. <https://www.crystalvaults.com/crystal-encyclopedia/jasper>
4. <https://meanings.crystalsandjewelry.com/jasper/>
5. <https://www.thespruce.com/what-is-the-meaning-of-jasper-stone-1274363>

### CHEMISTRY OF AMETHYST

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Amethyst is a transparent to semi-translucent mineral as well as a gemstone with a hexagonal prism structure [1]. The colour of amethyst is sometimes light or dark purple, with a certain tendency toward blue or red. The colour of amethyst depends on impurities such as iron and manganese, or iron and aluminium. The concentration of colouring pigments influence the colour of the stone. A variant colour of impurities is added to the main colour. This secondary blue or red shade complements the beauty of the stone. The intensity of the colour of the stone is subject to purely geometric proportions and the refraction of light through the prism of the cut. However, Amethyst also owes its violet colour to irradiation and iron impurities [3]. Amethyst has medicinal properties and is able to help in the treatment of physical illnesses, cope with emotional problems, improves cerebral circulation and rejuvenates the body. Amethyst has a positive effect on the mind, calming or stimulating it according to circumstances. Eliminates absent-mindedness, strengthens memory and assists internal comprehension,



facilitates the assimilation of new ideas and leads to an understanding of cause-effect relationships.

This stone facilitates the decision-making process, grants common sense and spiritual insight, and helps to translate decisions into reality. It helps with insomnia caused by the hyperactivity of the mind.

Crystals of amethyst have a weak magnetic field. This means that a human body, also possessing a magnetic field, can exchange energy with an amethyst. If someone is upset, experiencing depression or physical pain, he can completely restore energy and well-being in just a few seconds, being near the amethyst, which therefore gives it many medical benefits. The far-infrared radiation of Amethyst is known to support healthy cell growth and regeneration [4]. The most important consequences of infrared amethyst radiation:

- 1) Enhancement of cell growth. Amethyst promotes wound healing, hair growth.
- 2) A good dream. Infrared radiation calms the body, so that sleep becomes easier and deeper.
- 3) Stimulation of blood circulation. Amethyst enhances capillary circulation, which promotes healing and skin rejuvenation.
- 4) Stimulation of circulation of other body fluids.
- 5) Resistance to oxidation processes, which slows down aging.
- 6) Kills the bacteria.

Due to the emission of negative ions, amethyst helps to remove toxic substances and poisonous aerosols from the body, and facilitates breathing [4].

References:

1. Amethyst Gemstone Information: website / SETT Company, 2006
2. The Mineral amethyst: The purple Quartz Mineral Amethyst: website / Hershel Friedman and Minerals, 1997.
3. The Amazing Amethyst: mythology, chemistry & inspired jewellery design: website / Julian Stephens, 2017.
4. 8 Benefits of Amethyst Gemstone: website / Global Healing Centre, 1998.

## **GEMSTONE AMBER**

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Nature had endowed us with so much substances of great importance, as a result of this, it is a priority for us as medical chemist to study these substances and use the great value to help human life.

Amber (succinite) is a pitch earth occurring in irregular masses with no cleavage and having a conchoidal fracture, it is also called “sea stone” or “sea amber”, it exists in ranges of bright colours [1]. It has a honey transparency shards like a sunlight shine, brittle, lustre, resinous to waxy, negatively electrified by friction [1,2]. Amber is a mixture of hydrocarbons with no definitive chemical formulae but composed majorly of C, H, O and other elements depending on the region where it is found [4]. Amber (succinite) slightly dissolved in polar solvents [1,4].

In ancient times it was noticed that wearing an amber necklace cleans the skin, relieves rashes and pustular diseases. Amber, burned as an incense on the sacrificial altar, took off asthma attacks and pains behind the sternum. The priests, who often inhaled the amber smoke, never suffered from rheumatism.

The compounds of succinic acid are chemically very active. However, unlike many other reagents, their action is beneficial to any living organism. Getting into living tissues, succinic acid and its derivatives activate the mechanisms of gas exchange in cells, which by times accelerates the development of living tissue and increases the potential energy of the entire organism.

Succinic acid has a beneficial effect on the recovery of nervous system, strengthens the activity of the intestine. As an antioxidant eliminates free radicals and has modulating effect on the immune system. In China an “Amber syrup” made from succinic acid and opium was used as a sedative and antispasmodic medicine. It is also strengthens blood vessels, heals violations of the heart rhythm, protects from syncopal state, improves the functioning of the thyroid gland [5]. American endocrinologists prescribe amber beads to their patients. There is a special method of treatment used in medical practice: amber oil is rubbed into the thyroid gland area, which is also a product of amber processing. It may be employ as an anti-tumor agent because it affects the tricarboxylic acid cycle. Recent studies has shown positive effects in the recovery from chronic hepatitis and diabetes [5]. Amber has analgesic properties, it is therefore worn around area on the body with pain to alleviate the teeth pain [3]. Chinese traditional medicine use succinate to stimulate blood circulation and to prevent blood stagnation [5]. Succinic acid is used in the initial stages of ovarian cyst, endometriosis, fibroma, or myoma - benign uterine tumors. With timely treatment succinic acid helps to stop the growth of tumors. After surgical removal of tumors, succinic acid helps to recover the body’s work faster. Improves healing and prevents re-growth of tumors. [5].

Purified and processed amber can be good analgesic which may be very useful in medical practice.

References:

1. A book of precious stone: the identification of gem and gem minerals and their scientific, commercial, artistic, and historical aspects /Julius Wodiska. 1909. – P. 169 – 173.
2. Healing crystals, the A – Z guide to 430, gemstone completely revised and updated version / Micheal Gienger. – 2009. – P. 12.
3. John M. Riddle. Amber in ancient and medieval pharmacy and medicine / John M. Riddle.
4. Texas Gemstone / Elbert A. King, JR. – Austin, 1983. – P. 18.
5. The medicinal, use, preparation and application of Baltic amber / Gail Faith Edwards. – 2015.

## **GEMSTONE: CITRINE**

***Mutilitha Karitina.T., group 26. Scientific adviser: Lukianova Larysa***

In today's world gemstones are known to be precious pieces of minerals which are extracted from the ground using different methods, they are further polished and artificially transformed into many useful products such as jewels, mineral medicines and even transformed further into attractive crystals for resorts [1].

Citrine gemstone is one of the mineral crystals that is sold in many places in the world. Citrine with chemical formula  $\text{SiO}_2$  from family of quartz, composition of silicon dioxide macrocrystalline quality, a naturally yellow to gold, yellow brown dark orange and sometimes reddish brown. It is mostly found in mineral environments with Igneous and sedimentary metamorphic rocky type. Mines with natural citrine gemstones today exists in Brazil, Madagascar, Ural mountain of Russia and also Dauphine France just to mention a few [2, 3].

Just like many of the minerals citrine is mostly used for jewel manufacturing. Jewels such as earrings, neckless, rings and bracelets may contain pieces of citrine. Citrine crystals and stones are also kept in resorts for tourist attractions main purpose for money making ventures. In some religion and traditions citrine is known and considered having strong spiritual and healing power, people use it to maintain happiness, boost confidence, promote peace, stimulate mental function and help with developmental of self-awareness [4].

In medicine world citrine is known to play a role in development of

antidepressant drugs, anti-allergy and also medicine which help with development of digestive system and aid the metabolism process. Citrine may also be considered as one of the minerals which aid the healing of tissues, maintain kidney and liver function and help with restore degenerative illnesses. It is also known as a good fighter against diabetes. Citrine helps to maintain the endocrine and thyroid balances [5, 6]

Because citrine doesn't exist as a pure element organic foods which contains silicon such as vegetables green spinach groundnuts seeds sweet potatoes and also fruits oranges and raisins may contain a component of citrine. Animal products which contains citrine are liver and cheese. There is no documented deficiency noted for citrine [6].

In conclusion citrine is one of the popular gemstones that is used worldwide. Artificial processed for commercial purpose. Citrine is a diverse gemstone which may have components found in various food and it can also be used in medicine. Spiritual healings and decorations may consider citrine as a highly valuable gemstone.

#### References

1. [www.gemselect.com-geminfo](http://www.gemselect.com-geminfo)
2. [www.minerals.net/minera citrine](http://www.minerals.net/minera-citrine)
3. [www.rocksandco.com](http://www.rocksandco.com)
4. [www.pinterest.com](http://www.pinterest.com)
5. [www.crystalvaults.com](http://www.crystalvaults.com)
6. [www.house of citrine.com](http://www.houseofcitrine.com)

## PHOSPHATE BUFFER

### *Ekamdeep Kaur, group 32. Scientific adviser: Levashova Olga*

The phosphate buffer system is the main intracellular buffer for counteracting metabolic acids. It is found both in the blood and in the cellular fluid of other tissues, especially the kidneys. In cells, it is represented by the salts  $K_2HPO_4$  and  $KH_2PO_4$ , and in the blood plasma and in the intercellular liquid  $Na_2HPO_4$  and  $NaH_2PO_4$ . It functions mainly in plasma [1].

Phosphate buffer is a solution used in research biological studies.  $NaH_2PO_4^{-2}$  acts as acid and  $Na_2HPO_4$  acts as base. The composition of this system includes hydrophosphate and dihydrogen phosphate. Hydrophosphate has alkaline properties, whereas dihydrogen phosphate exhibits properties of a weak acid. When this system interacts with acidic products, sodium dihydrogen phosphate and sodium chloride form,

and in reaction with alkaline products, monosodium hydrogenphosphate and water are formed:

The highest value of this buffer is for the regulation of the pH of the interstitial fluid and urine (in the blood, hemoglobin and bicarbonate buffers are more important). In urine, hydrophosphate plays a role in saving sodium bicarbonate. So, the interaction of hydrophosphate with carbonic acid occurs, dihydrogen phosphate and hydrocarbonate (sodium, potassium, calcium and other cations) are formed. Hydrocarbonate is completely reabsorbed, and the pH of urine depends on the concentration of dihydrogen phosphate [1-2].

The role of the phosphate buffer in the blood is small, but it plays a significant role in the final regulation of acid-base homeostasis and regulation of the active response of tissues. This operates in internal fluid of all cells and effective buffer in urine as well. In the blood, the effect of this buffer is reduced to the maintenance and reproduction of bicarbonate buffer. Excess acids cause in the system containing carbonate and phosphate buffers, an increase in the concentration of carbonic acid and a decrease in sodium bicarbonate. Further, due to the simultaneous presence of a phosphate buffer and carbonic acid in the solution, an exchange reaction occurs and the excess of carbonic acid is eliminated, and the concentration of sodium hydrogencarbonate increases. Other chemical buffer systems also include intracellular organic phosphates, such as ATP, ADP, as well as hydroxyapatite crystals (in bone and dental tissues) [2].

References:

1. V.A. Kalibabchuk, V.I. Halynska, V.I. Hryshchenko. Medical chemistry. – Kyiv: AUS Medicine Publishing, 2015. – 224 p.
2. Medical Chemistry. Self-study guide for the 1st year students (English medium) / A.O. Syrovaya, E.R. Grabovetskaya, L.G. Shapoval et al. – Kharkiv: KhNMU, 2014. – 70 p.

## **HEMOGLOBIN BUFFER**

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Hemoglobin buffer is one of the most powerful, it includes free, reduced, oxidized hemoglobin, as well as carboxyhemoglobin and potassium salt of hemoglobin. It is believed that this buffer accounts for about 75% of all buffer properties of the blood, and it is based on the ability of the globin part of the molecule to change its conformation and, as a consequence, the acid properties in the transition from one form to another. The involvement of hemoglobin in the regulation of blood pH is associated

with its role in the transport of oxygen and CO<sub>2</sub>. The hemoglobin buffer system plays a significant role in several physiological processes: breathing, transport of oxygen in the tissue, and maintaining the pH constant inside the erythrocytes, and ultimately in the blood. So, the reconstructed hemoglobin in comparison with carbonic acid is a weaker acid, and the oxidized one is the stronger acid. Therefore, when the content of carbonic acid rises in the blood and the pH shifts to the acidic side, the hydrogen ion is attached to the free hemoglobin, thus the reduced hemoglobin is formed [1].

Hemoglobin and oxy hemoglobin buffers are protein buffer system help in providing blood buffer capacity. The ability of protein buffer systems to counteract pH changes is based on the reversibility of hemoglobin oxidation process. It is composed of two hemoglobin forms: reduced hemoglobin (HHb) and oxidized hemoglobin (HHbO<sub>2</sub>). HHb is converted into oxyhemoglobin HHbO<sub>2</sub> by joining oxygen. Hemoglobin and oxy hemoglobin are interconnected and exist as one system. Hemoglobin is a weaker acid than oxy hemoglobin. Therefore Hb<sup>-</sup> ions being anions of a weak acid are capable of more actively bond H<sup>+</sup> ions than HbO<sub>2</sub><sup>-</sup> ions.

So, the acid-base state of blood is an integral component of homeostasis of the organism's internal medium that provides optimal conditions for normal proceeding of metabolic processes [2].

References:

1. V.A. Kalibabchuk, V.I. Halynska, V.I. Hryshchenko. Medical chemistry. – Kyiv: AUS Medicine Publishing, 2015. – 224 p.
2. Weed, Robert I.; Reed, Claude F.; Berg, George (1963). "Is hemoglobin an essential structural component of human erythrocyte membranes?". *J Clin Invest.* 42 (4): 581–88.

## CHLORINE AND IT'S SALTS

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Chlorine is the second lightest element in periodic table. It is an irreplaceable element. It helps in water purification, used as disinfectant, also used in paper production industry to remove ink from paper to recycle it. It is also used in paints, food, antiseptic, plastic, medicine, kills bacteria and microbes from drinking water supply [1].

Chlorine in the form of gas is a poisonous substance. Inhalation of chlorine leads to large respiratory problems such as strong pulmonary edema or even a fatal outcome may occur. It can cause coughing and chest pain. It irritates skin, eye and respiratory

system [2]. Hydrochloric acid (chlorine compound) - is one of the strongest acid, fuming in air, which is in the contact with the skin causes severe burns. Bleach on the basis of chlorine makes any fabric snow-white. But besides that, chlorine is the second important component of table salt, which is important for our body as well as any other macronutrient. Effect of chlorine on human health depends upon the amount and length of chlorine exposure [3, 4].

Chlorine present in all organs and tissues, participates in the metabolism, is part of the biologically active compounds of the body and is an indispensable chemical element. Typically, it is concentrated in the glands of the stomach and the human skeleton, where its content is three times higher than in other organs and tissues. Chlorine is part of the group of macro elements and electrolytes, taking part in regulatory processes: water-salt metabolism, maintenance of osmotic pressure in the blood, lymph, cerebrospinal fluid and other fluids. Along with this, he controls the acid-base balance. Also, this macronutrient is involved in the formation of gastric juice, the formation of blood plasma, the enhancement of enzymes [5, 6].

Chlorine ions have a significant role in maintaining the homeostasis of the internal environment of the human body. Moreover, from its less vivid properties can be highlight in the process of removing waste from the body. Doctors recommend chlorine-containing drugs as a preventative means against hair and teeth loss.

The imbalance of chlorine in the body, in most cases, is accompanied by violations of both the general health status and the appearance of specific complications associated with heart failure or neuromuscular disorders [7].

Symptoms of lack and excess of chlorine:

A lack of chlorine can manifest itself as sluggishness of the whole body, loss of appetite, persistent drowsiness, and a violation of short-term and long-term memory, muscle weakness, dry mouth and loss of taste sensations; with prolonged deficiency, hair and teeth may begin to fall out. A lack of chlorine is often observed in infants when they eat unsalted food. Excess chlorine is manifested as a pain in the eyes and increased lacrimation, dry cough, chest pain, headache, pulmonary edema and fever [8].

#### References

1. Medical chemistry / V.A. Kalibabchuk, V.I. Halynska, V.I. Hryshchenko et al.; Kyiv: AUS Medicine Publishing, 2010. – 224 p.
2. Gorguner, Metin, and Metin Akgun. "Acute Inhalation Injury." *The Eurasian Journal of Medicine* 42.1 (2010): 28–35. PMC. Web. 14 Dec. 2017.

3. Levitin Ye.Ya., Vedernikova I.A. General and Inorganic Chemistry : textbook for students of higher schools Kharkiv: Golden Pages, 2009. – 360 p.
4. Preuss HG, Clouatre DL. Sodium, chloride, and potassium. In: Erdman JWJ, Macdonald IA, Zeisel SH, eds. Present Knowledge in Nutrition. 10<sup>th</sup> ed. John Wiley & Sons; 2012. – 475-492.
5. Neuromuscular disorders: Management treatment” Expert consult. ed. By Tulio Bertorini, 1<sup>st</sup> ed., 2017. – 452 p.
6. Medical Biochemistry/2007/p 31-32)
7. (Biochemistry by Reginald H. Garrett, Charles M. Grisham/2010./p 43-44)
8. <http://chemed.chem.purdue.edu/demos/demosheets/18.2.html>