Mumio: natural pharmaceutical material

Quynh Hoa Tran

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Praktická část Vlastní příprava Mumia ve formě gelu a hydrogelu. Popis jeho vlastností a účinků. Práce bude ukončena věděckým závěrem, který zhodnotí vytvořený Mumio gel a hydrogel.

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3) ZANDRAA Oyunchimeg et.al. Viscoelastic Properties and Morphology of Mumio-based Medicated Hydrogels. Novel Trends in Rheology IV. AIP Conf. Proc. 1375, 261-271 (2011).
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doc. Ing. Roman Čermák, Ph.D.
děkan

UNIVERZITA TOMÁŠE BATI VE ZLÍNĚ
Fakulta technologická
L.S.

Ing. Lubomír Beníček, Ph.D.
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ABSTRAKT

Přírodní farmaceutické materiály jsou jakýmsi vracejícím se trendem v době vývoje nejrůznějších a stále novějších produktů vyvinuté nejmodernějšími technologiemi. I dnešní vyspělá medicína se často vrací zpět k přírodě. Takovým přírodním objevem, i když už velmi starým, je právě mumio.

Tato práce představuje souhrn dosavadních informací o mumiu, jako o přírodním farmaceutickém materiálu. Cílem je přestavit význam mumia jako farmaceutický materiál a jeho vlastnosti, výhody a nevýhody.

Práce je rozdělena do dvou částí. První část je především teoretická a zaměřuje se na původ, složení a vlastnosti mumia. Druhá část je věnována diskuzi o použití mumia ve formě "Mumio gelu" a "Mumio na bázi hydrogelu".

Práce bude ukončena závěrem a hodnocením o hodnotě mumia a jeho použití v medicíně, stejně jako přírodní farmaceutická složka z věcného hlediska.

Klíčová slova: Mumio (Mumijo, Shilajit), přírodní farmaceutický materiál, gel, hydrogel

ABSTRACT

Natural pharmaceutical materials are a kind of recurring trend in the development of various and ever newer products developed with the latest technologies. Even today's advanced medicine often goes back to nature. One such discovery, although it is very old, is the mumio.

The work represents a summary of information about mumio as a natural pharmaceutical material. The aim of this work is to introduce about the importance of mumio as a pharmaceutical material and its characteristics, advantages and disadvantages.

The work has been divided into two parts. The first part is mainly theoretical and focuses about the origin, composition and characteristics of mumio. In the second part, discussed about the application of mumio in the form of “mumio gel” and “mumio based hydrogel”. Finally, the work will be ended by conclusion with assessments about the value of mumio in medical application as well as a natural pharmaceutical component/material point of view.

Keywords: Mumio (Mumijo, Shilajit), natural pharmaceutical material, gel, hydrogel

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I hereby declare that the print version of my Bachelor's thesis and the electronic version of my thesis deposited in the IS/STAG system are identical.

In Zlin 28. 5. 2014 …….

Quynh Hoa Tran

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INTRODUCTION

Mumio is a widely used traditional medicine, especially in Russia, Mongolia, Iran, Kasachstan and Kirgistan. Mumio preparations have been successfully used for the prevention and treatment of infectious diseases. They display immune-stimulating and antiallergic activity as well.

The properties of mumio have been investigated by various researchers about antitoxic properties of standard dry mumijo extract reported Frolova et al. (1997) [1], at the same time, Kiseleva et al. (1997) [2] mentioned about the amino acid fraction of dry mumio extract. The object of the study of Sharma et. al in 2003 was the effect of a mumio in the blood (an antioxidant and cardio-protective properties). After some time of examination, it was found that mumio has no effect on blood pressure, heart rate and body weight. There were no significant changes in hemoglobin, blood sugar, urea, creatinine, uric acid, protein, albumin and enzymes (aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase. However, there was a significant reduction of triglycerides, LDL and VLDL cholesterol while raising HDL cholesterol. Was also significantly increased the level of vitamin E and C [3].

Other works about mumio as traditional medicine in a form of fossil deposits of snow petrel (*Pagodroma nivea*) from Antarctica was reported by Aiello et al. (2008) [4], mumio and its beneficial effects on metabolic processes, the human immune system and its antiseptic activity studied Garedew et al. (2004); Aiello et al. (2008) and at the same year Garedew did a study about mumio as a mixture of effective pharmacological substances that has a bacteriostatic effect against Gram-positive bacteria (*Bacillus breva and Bacillus subtilis*), in vitro antibacterial effects of Mumio preparation from Mongolia which was more effective against Gram-positive than Gram-negative bacteria was studied by Galgóczy et al. (2011) [5] and mumio-based medicated hydrogel and its viscoelastic properties and morphology was reported by Saha, Zandraa et al in 2011 [6].

The subject of the present work (2014) is about Mumio as a natural pharmaceutical material (in a form of gel and hydrogel). Could it be a pharmaceutical material or it is just another herbal medicine?

I. THEORY

1 GENERAL INFORMATIONS ABOUT PHARMACEUTICAL MATERIALS

1.1 Pharmaceutical materials

Pharmaceutical materials are those which are suitable for the production and use as pharmaceutical as well as in medicine. These are materials that are used as necessary equipment in medicine and in the pharmaceutical industry for the manufacture of composite materials or pharmaceuticals. It does not only equipment in laboratories, operating equipment made from various types of plastics or metals, but also agents for the production of pharmaceuticals, creams and ointments.

These materials are divided into natural and synthetic. Natural pharmaceutical materials are found in nature. Those we called natural biopolymers (polymers[1] - they are from more than only one substance). Artificial materials are born in manufactures. They are under very strict requirements but due to today's advanced and constantly evolving technology manufacturing requested specific products is not so difficult. This concerns the appearance, shape, size, and material composition and important properties like biocompatibility, biodegradability and sterility. Compared to natural materials they have the advantage of wider application, flexibility and their properties can be adjusted.[7]

1.2 Natural materials

They exist in a pure composition or can comprise many different substances. Substances produced by living organisms (e.g., collagen, starch, chitin) or partially synthetically modified natural biopolymers (gelatin, chitosan).[8]

Nature provides compounds that are active and for human body is often the best cure. Medicinally active substance means a single or a mixture thereof or medicinal products which are intended for administration. The active substances include substances of natu-

[1] „Polymer is a macromolecular substance consisting of a large number of atoms bonded by chemical bonding into long chains. They contain mostly hydrogen, carbon, oxygen, nitrogen and other elements. These chains form periodic components which are called structural units (monomer units or mers).”[9]

ral as well as chemical origin, which induce the response of a living organism. Medicines are products derived from technological processing of medicinal substances, excipients and plants into a dosage form. To be a medicinal product must comply with very strict conditions, namely must be accurately known:

• Composition. For pure chemical compounds it is very simple, but for products derived from fungi, etc. it's not that easy.

• The scope of action must be dependent on the dose.

• Dosage

• Possible side effects and adverse reactions in the body and which arise when co-administered certain other drugs or foods.

• Designed disease, respectively areas of diseases.

For natural remedies are very often encounter the term medicinal drug. It is dried or otherwise preserved plant or part thereof, intended for direct therapeutic use or as a feedstock for the production of phytotherapeutic (means natural remedies). Phytotherapeutics remedies are prepared wholly or partly from medicinal plants (roots, rhizomes, leaves, etc.) or several products (pollen, resins, oils, etc.).[10] Preparation of natural origin is frequently used as detoxicating drugs. It was established that most effective natural detoxicants are flavonoid-containing preparations processing antioxidant, hepatoprotective and cholagogic properties.[11]

Among phytotherapeutics therefore we cannot classify drugs, which by their nature are chemically uniform, because these drugs are conventionally between pure chemical drugs, although has been obtained from plant material. Production of phytotherapeutic faces to the same strict conditions as in the case of chemical drugs, if not even more stringent. Medicinal drugs are checked for identity, whether it is actually a declared resource (microscopically and chemically). For medicinal plants for the preparation of tea substances and extracts is often performed to determine the content of active ingredients. Reason for using phytotherapeutic inter alia, that the total extract of medicinal plants is often more convenient for the patient than the net effects of the main insulated material. Favorability effect consists in the interplay of certain substances in the extract. When biological testing determines that a substance in which the concentration of the

beneficial effects involved, then it is optimal to isolate these substances, mixed in suitable proportions and these produce one kind of "artificial phytotherapeutic" [12].

One of the oldest phytotherapeutic is mumio.

2 HISTORY OF MUMIO AND ITS COMPOSITION

2.1 Its history

The first mention of the mumio dates back more than three thousand years. Mumio was known in Persia, Babylon, Egypt, but also in Greece, Rome, and of course in Asia. The meaning of this word is “body stores or saving the body”. Mumio is mentioned in works of such great men as Aristotle, who researched effects on people and recorded various applications, and in works of his student Alexander the Great and others (Shirasi, Tabib). It was written about in Indian sacred books – Vedas. Mumio was used as a medicine by Sumerians. It is often present in medical writings as Susruta-Samhita, Ccaraka-samita, Chinese book of difficult issues. Knowledge about mumio and its applications were kept secret, and were handed over in families of high ranked doctors only by word of mouth from father to son. The Church also knew (and knows) mumio very well. As well as the most famous medieval representatives of medical science as Avicenna, Paracelsus, Agricola, Quiricus, Servet. The substance occurs in several varieties with different physical appearance: "golden mumio" is red, "silver mumio" is white, "copper mumio" is blue, and "dark mumio" brown to black [13].

This traditional drug has different name in different coutries. For Tibetans it is “king of pharmaceuticals” - they call it Barak Shun [Brogshaun (mountain oil)], in Arabia it was given a name Chafiz-al-Adžsod or Arakubal džibal (mountain sweat). In Russia - Mumie or Mumiyo, India - Silajit, Birma - Kao-tun (blood of the mountain), Altai Mountains [Barachgschin (oil of the mountain)], Mongolia [Brogschaun (mountain juice)] and Iran, Kasachstan, Usbekistan as well as in Kirgistan [Arakul dshibal (mountain sweat)]. The Asian mumio is found at high altitudes as deposits in cave walls and caves where they are embedded into rocks. Some are considered to be up to 3000 years old. A series of medical applications has been described including immune-stimulating and antiallergic activity as well as an ameliorating effect against gastric and intestinal ulcers and finally healing of bone fractures. Mumio has a protective effect against radiation and a favorable nonotropic property.[14]

Nowadays is mumio used like a food supplement [15] or cosmetic polymer gel with healing effects made from natural and synthetic substances comprises solution of mumio powder with other sunbstances.[16]

2.2 Its composition

Depends on place of site it has different colour and composition. As expected, the composition of these organic ingredients is dynamic. Mumio as a complex formulation, in addition also an amelioration of a series of afflictions and may act as an antimicrobial, antiviral, antitumor, antiallergic, immunomodulating or anti-inflammatory medicine, similar to the active compounds from mushrooms, or of Propolis, or "Kampo" compounds as well as of Arabic medical herbs. The colour range varies from a yellowish brown to pitch-black, depending on composition. There are many local legends and stories about its origin, use and properties. It should not be confused with ozokerite, also a humic substance similar in appearance but apparently without medicinal qualities, a substance used, for example, in cosmetics. Genuine mumio should melt in the hand and has a distinct smell of bitumen, whereas ozokerite melts at 73-76 °C.

The chemical composition of Asian mumio contains about 20% of minerals, 15% of proteins, 5% of lipids and 5% of steroids, the rest are carbohydrates, alkaloids and amino acids. Collected and analyzed samples from Antarctica show that mumio contains grycerol derivates, yellow material originates from the snow petrels - birds (*Pagodroma nivea*). It is waxy organic material and the composition of this ingredients is dynamic, means that is, as expected, depends on the environmental living conditions of the birds.

It is still unclear whether mumio has a geological or biological origin as it has numerous traces of vitamins and amino acids. There are views of scientists who say that mumio is a unique plant extract with dozens of minerals: six amino-acids, vitamins A, B, C and P (citrins), natural steroids, terpinoids, phospholipids and polyphenol complexes. Mumio contains trace and macro-elements (cobalt, nickel, copper, zinc, manganese, chromium, iron, sodium, potassium, magnesium, and others). And in the other side there are some scientists who claim that mumio has origin from animals.

The existence of 12 essential acids from the 20 importance and other important nonessential acids is proved. Mumio has been subject to scrutiny for alcohol components and were identified 65 organic bonds and 24 still unproven unsaturated fatty acids. But there are few substances that can be certainly named: wax, carbohydrates, lipids, alkaloids, resins and balsams, steroids, polyphenols, essential oils and vitamins B and last but not least humic acid - resulting in coloration of mumio. So in general we can certainly di-

vide its composition into two large group of substances. The first group is minerals and the second group is carbon compounds and elements that are contained in the mumio are in chemical bonds so there is no need to be afraid about those elements that are in their pure form harmful [17].

From the chemical point of view mumio is a natural mix of organic and inorganic matters. It consist of 26-28 microelements, 10 metallic oxides, 6 amino-acids, steroids, phospholipids, range of vitamins, ethereal oils and other biologically active substances [18]. A part of the natural biological active organic substances contains derivatives of oxycoumarin, acetic acid known as phenylamino, benzoic acid, steroids, phosphatides, albumins, gum resin, resin and resinous substance, glycine, serine, alanine, lysine, arginine, leucine, tyrosine, phenylalanine, glutamic acid, aspartic acid, methionine, valine, tryptophan. From the organic acids are there adipic acids, succinic acid, citric acid, oxalic acid, vitamins P, B1, B6, B12. A second part is inorganic nature consist of micro and macro elements like copper, iron, zinc, cobalt, potassium, calcium, total phosphorus, magnesium, tin, aluminum, cadmium, chromium, bismuth, nickel, titanium, molybdenum, vanadium, silicon, lead, sodium, boron, beryllium and many others.[19]

Due to the analysis mumio powder has those elements [20]:

Table 1. Analyzed composition of the mumio powder

Element	**Value [mg / 100g]**
Kalium	8510
Calcium	4700
Magnesium	1430
Ferro	326
Natrium	56,600
Vit. B12	42,100
Stroncium	13,500
Zinc	4,350
Vit. B6	4,280
Vit. B2	0,728
Glutamin	0,460
Selenium	0,135
Cobalt	0,125
Vit. D3	0,025
Iodine	<0,300

Table 2. Analyzed composition of the mumio powder

Element	**Value [% / 100g]**
Glycine	3,54
Alfa-alanine	1,37
Glutamate acid	0,872
Aspartic acid	0,713
Methyonine	0,555
Isoleucine	0,484
Cystine	0,43
Valine	0,366
Threonine	0,35
Tyrosine	0,347
Phenyl alanine	0,324
Proline	0,321
Serine	0,278
Arginie	0,21
Lysine	0,198
Histidine	0,137
Leucine	0,113

3 ABOUT MUMIO

3.1 Mumio and its properties

Purified from additives mumio is black color, shiny on surface and has consistency similar to asphalt. According to the place of the occurrence and content of the mixture tends to have mumio in a different color. If mumio has the correct pureness, the tablets are always dark color. If tablets are brown that means that they are combinations with other preparations, typically propolis or licorice. With so many ingredients it has an unmistakable bitter taste and a characteristic smell. It dissolves in water easily but not dissolves in alcohol. Softening approximately at 10 °C, so dissolve while holding in the palm of your hand. Above 140 °C starts degrade into undefinable products[2].

It has a plastic behavior, at a temperature lower than 20°C it will solidify and will soften when warmed. It easily dissolves in water without leaving any residue, and it will soften when worked between the fingers. Purified mumio has an unlimited shelf life. Mumio has a wide spectrum of pharmacological activity. But, despite decades of impressive research results, official medicine is familiar with it only as food additive.

Figure 1. Purified mumio

(at: http://www.pokladyprirody.cz/292-mumio-shilajit-25g)

[2] More in Appendix I.

3.2 Forms of mumio

Form of small particles. It is not necessary to encapsulate it into caplets, medical colored glass or plastic bottles. The result of correct purification technology is always a consistent tablet typically in a transparent tablet die.

Form of liquid. No need to stabilize mumio in any way. It lasts at room temperature at least three years without change qualities. [21]

Figure 2. Raw mumio

(at: http://www.kg.all.biz/biologicheski-aktivnoe-veshchestvo-mumie-g3896)

3.3 Types of mumio

People has tendency to simplify, call similar things ia a similar way and use the commonly used terms. But for mumio, there are not similar names for the same things. Mumio is divided and called in different ways. It is according to the place of occurrence or by color. And so we can hear mumio called as IRON MUMIO, also called RED or

GOLD (coloration is caused by increased content of iron additives), COPPER MUMIO, also called BLUE MUMIO (coloration is caused by increased content of copper) or LICHENACEOUS MUMIO and so on. The only criteria for Mumio quality remains its purity (absence additives) and location of gathering. No organic solvent is used to purify real mumio, only pure water (but not tap water). The source of the highest quality mumio in present time is Kyrgyzstan where the production is subject to government quality and purity control [22].

Different kinds of sites are then reflected in the varying content of minerals in mumio and it can be colored in different shades of color. At the present time are distinguished by these types of mumio:

Resin mumio Archa: mass brownish-black mumio, similar to the resin and its aroma. Because it was proved the iron content and to look at shiny red, is usually referred to as the iron, red or gold mumio. In the Indian site appears blue, in other words copper mumio. As the name suggests it is thanks to the copper content. This kind of mumio we can find in rock crevices in fossilized form.

Bituminous mumio: a dark and waxy matter. Created as a co-product of compressed root juices from juniper. They occur on the walls of caves and crevices.

Mumio from honey wax: brown to black in color. A product of wild bees, but reinforced the natural chemical processes.

Mineral mumio: black color. Were the activities of bacteria and lower algae in the presence quantities of minerals and lavish strong ultraviolet radiation.

3.4 The incidence

The extensive deposits are in the middle of Asia, mostly on the tips of the Himalayas, the Pamir, Altai and Kazakhstan in certain places. The place of occurrence today are the United States, Scandinavia, and North Africa, however, the best quality mumio now occurs in the area of Kyrgyzstan. Mumio is found only at high altitudes. At least

1000m but up to 5000 m above sea level. We'll find him mostly in caves, cavities and niches, hanging from the ceiling, or just on the floor in the form of porous rock.

3.5 The emergence

The emergence of mumio is not completely elucidated. The process of its creation cannot be determined even in spite of the precise botanical and geological analysis of sites, because it can vary according to the type and conditions of the sites. But we can say with certainty that all the sites have in common is that they are exposed to prolonged and intense sunlight, the air is in the vicinity of the occurrence of a very clean and there are certain species of flora and fauna. This confirms one of the many theories about that mumio is a product of the vestiges of the flora and fauna.

Other scientists contend that the mumio is either plant or animal origin. Indian literature states that it is a kind of composting, which again confirms the theory above. D. D. Denchorov in 1995 said his theory based on material analysis as follows: *"Complex on organo-mineral product of the metabolism of aerobic micro-organisms involved in the process of decomposition of plant residues, lichens and resins from the roots of fir, spruce and pine."* [23]

3.6 The extraction

From the above it is clear that the extraction of these raw materials is very strenuous, just in terms of altitudes in which these products of nature occur. Pickers are trained. They collect it by craping or chipping manually. The entire collection is roughly three weeks. Collected mumio then passes to the cleaning process.

3.7 The cleaning process

More kinds of mumio need more cleaning methods. Therefore, is a prerequisite for type clean collection. In practice, each cleaning procedure is adapted to the type of mumio but it also depends on the accessibility and quality of the cleaning apparatus.

The method which is confirmed by many international patents guaranteeing consistently the best quality product used to clean spring water (method according Lavrenuk).

Due to the costs, in India mumio is used raw. It is crushed and stirred with plant powder or it is filled into capsule. The efficacy of therapeutic agents is reduced.

3.8 Dosage and toxicity

Despite several studies were not still observed side effects of mumio.

Daily dosage of mumio is between 50 to 800 mg and depends on the reason for use. For children under 10 years is recommended twice a day 1.5 - 2 mg/kg weight. For children under 14 years are recommended twice daily 100 mg and 14 years of age 200 mg.

When preventive use is recommended that the dosage:
10 days - pause 5 days - 10 days - 5 days pause - 10 days - 20 days pause

In acute situations it is recommended that the dosage method:
30 days - 10 days pause - 30 days - 10 days pause [24]

3.9 Storage

As already mentioned, in the form of tablets mumio softens at 10 ° C and decomposes at 140 ° C. It is necessary to watch the temperature of storage space. Mumio gel or hydrogel can be stored at room temperature but for much longer product life is better keep it in the refrigerator (5-6 ° C).

4 IMPORTANCE OF MUMIO AS A PHARMACEUTICAL MATERIAL

Mumio is a strong adaptogen with excellent features. In order to classify a substance as an adaptogen is has to fulfill many conditions those are: totally non-toxic and absolutely harmless to the organism. An adaptogen must normalize physical functions regardless existing condition. An adaptogen produces a nonspecific response in the body – an increase resistance against multiple stressors including physical, chemical or biological agents. Although it does not seem so these demands are very tough. As opossed to drugs which have side effects, adaptogens must have beneficial influence on organism without disturbing or damaging it. There are only very few substances with adaptogenic features and only few of them so strong. However, keep on your mind that mumio alone is not a cure for everything. Mumio in long term using does not tigger toxic or any other side effects [25].

Mumio is strong and safe immuno-corrector. It has been widely adopted. It has reconstruction, antiphlogistic, antibacterial and analgesic characteristics. It is health giving and irreplaceable during illnesses. All substances in its composition are in digestible form so long use is safe. Absolutely harmless for people of any age.

Natural components in composition of mumio participate in controlling of interchangeable processes in human body. They facilitate acceleration of reparation, adaptive mechanisms and correction of cellular, humoral units of immunity and factors of nonspecific protection of body (induce the production of endogenous interferons and natural killers). Under the influence of preparation the cholesterol content of various density in plasma, the level of hemoglobin, erythrocytes, leukocytes are standardized as well as the function of hepatic cells is restored after acute viral and poisonous hepatitis. Besides mumio has antioxidant, membranoprotective and antiphlogistic effects, it rises the organism resistance for bacterial infection. Mumio is prescribed in complex therapy for ulcerous illness of stomach and duodenum, erosive illnesses of other sections of gastro-intestinal, inflammatory processes of liver and biliferous tracts (cholecystitis, hepatites of viral and toxic origin), for breathing organs in acute condition, as means to increase total resistibility. In case of immunity weakening and children's blood-forming function reduction for patients after external and internal irradiation, in case of slowly knitting consolidation, sluggish wounds, burns, bedsores, trophic ulcers, for radiculitis,

neuralgia, neuritis of peripheral nerves, chronic celebrovascular insufficiency, discirculatory encephalopathy. As a prophylactic for middle age and old people with lipidosis, for increasing the total resistibility of organism to unfavorable factors of the environment [26].

II. ANALYSIS

5 MUMIO IN THE FORM OF GEL

"The colloidal condition, the gel, is one which it is easier to recognize than to define."

Dorothy Jordan Lloyd, 1926 [27]

Gel is stiff colloidal solution forming a gelatinous mass. System of dispersed particles forms a continuous structure in the continuous dispersion medium. This is explanation from the Dictionary of Medicine [28].

It is a form of substance between a liquid and a solid. Liquid resemble weight and volume, while cohesion resemble solids. It is caused of the cross-liking of polymer chains. In formation of covalent bonds or non-covalent bonds. The solid characteristic of a gel is composed of two dynamic chemical properties: an elastic modulus and a viscous modulus (viscous modulus is smaller than elastic modulus). By the human eye it is observable that gel is smooth and shiny. By the touch is knowable that it is soft, wobbly and resilient.

5.1 Usage of a gel

Gel was first time used for medical applications by Wichterle and Lim in 1980[3]. Today it is involved in manufacturing soft contact lenses, implant materials, antibacterial gels and cosmetic products. One of the most important usages of gel is using it as delivery of drugs. In pharmaceutical applications are used gels consist typically 1% polymer and 99% water. The viscosity is caused of owing the presence of the polymer but it has almost no influence to transport conditions for a small drug molecule. It can be expected to be the same as they are in the water. Polymer networks are not obstacles in the release of drugs so they are likely to diffuse out of the gel rapidly [29].

[3] More about this topic available at: http://www.contactlensesthestory.com/first_fifty_years.pdf

5.2 Mumio gel

Mumio gel is made in two steps. The first step is to mix up mumio solution and the second step (after adding polymers needed) is to create mumio gel.

Polymers needed for creating mumio gel are: mumio in a form of powder (Mumio pwd., Monenzym Co., Ltd. Mongolia), Sodium salicylate (SS, from Petr Lukeš, Czech Republic), Carbomer (from Míča & Harašta), Demineralized (or could be used distilled) water (DW), Seabuckthorn oil (SO, from Biomedica spol. s.r.o.), Cinnamon oil (CO, from Biomedica spol. s.r.o.) and 20% Triethanolamine solution (TEA, from Petr Lukeš, Czech Republic).

5.2.1 Materials needed

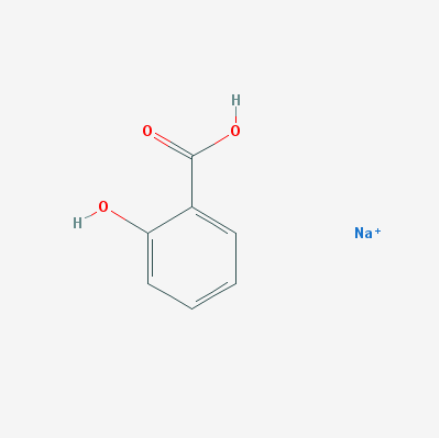
Mumio powder

Figure 3. Mumio powder

(at: http://www.biorenesance.cz/biorenesance/eshop/425-1-Mumio-Shilajit/0/5/2659-Shilajit-Mumio-prasek-25g-Salvia-Paradise)

Sodium salicylate

Known as Salicylate, sodium, Sodium salicylic acid, o-hydroxybenzoic, sodium salt, sodium 2-hydroxybenzoic acid



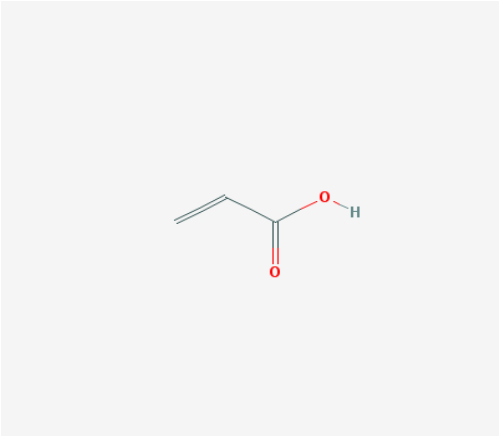
Molecular formula: $C_7H_6NaO_3^+$

Sodium salicylate is a white crystal substance which easily dissolves in water.

SS is anti-inflammatory agents non-steroidal in nature. Except anti-inflammatory actions, they have analgesic, antipyretic, and platelet-inhibitory actions. It is involved in manufacturing gels or medicaments for relieving pain or reducing fever but it is less effective than equal doses of Aspirin (acetylsalicylic acid) in comparison. SS is better tolerated by populous who are hypersensitive to Aspirin, resp. its composition [30].

Carbomer

Known as 2-Propenoic acid, Acroleic acid, Propenoic acid, Vinylformic acid, prop-2-enoic acid, Acryl acid, Propene acid [31]



Molecular formula: $C_3H_4O_2$

Is a white fluffy homopolymer of acrylic acid and polyalkenyl polyethers [32]. The compound is used as a thickener, emulsion stabilizer and like gelling component. Carbomer is best known for its use in the cosmetic industry (toothpaste, shampoo, creams, lotions etc.), it also has practical applications in medicine (gels) and hygiene. Involving this substance to the product producing solutions and gels rich to the touch and it keeps oils or creams suspended in water and prevent separation. The way how polymer chains are bonded let the Carbomer serve as net-like structures in water, allowing them to support fine, insoluble particles and react at lower concentrations. Carbomer is hypo-allergenic and it does not support bacterial growth. It is fast sticky in the air and slimy when contact with water [33]. It has ability to absorb and retain water and it can swell to many times their original volume [34]. In general Carbomer is considered to be safe but strength contact with eyes, skin may cause some irritation [35].

Seabuckthorn oil

Latin: Hippophae rhamnoides

Figure 4. Seabuckthorn oil

(at: http://www.onlyfoods.net/sea-buckthorn-oil.html)

Sea buckthorn oil comes from, as the name suggests, the sea buckthorn plant. It is a woody shrub that grows in mountainous areas (usually at a height of 3300-4500 m). It grows to a height of two to six meters, has long thin leaves and distinctive orange berries. Usually grows in April but ready to be collected up in August or September. It occurs mainly in Central Asia and in Europe (from the Black Sea to the Alps and in the northwest of Europe), also occurs in Canada and the United States. Sea buckthorn oil is antimicrobial agent, antioxidant and haemostatic. It has anti-inflammatory properties and is used to prevent radiation exposure, cancer, liver problems, cardiovascular danger factors. It well acts on mucosa and skin. Already in ancient times for its medicinal properties using by Tibetans and Indians. They used it for the cough, colds, fever, inflammation, abscesses and in tumor and gynecological diseases.

The flowers shrubs are used to soften the skin, the leaves are used in colitis and their problems, skin diseases and rheumatoid arthritis. Oil of hay and fruit is applied to the skin in the presence of eczema, lupus, psoriasis, burns, frostbite to treat thrombosis. It is used to support digestive, circulatory disorders and pain.

Seabuckthorn contains carotenoids (α-, β-, γ-carotene, lycopene, zeaxanthin), tocopherols (vitamin E known as containing α-tocopherol), sterols, flavonoids, C 3-glycosides, rutinosides and sophorosides), lipids, tannins and fatty acids (in the soft parts of fruit: linoleic acid, α-linolenic, oleic, palmitic, stearic acid, vaccenic acid, palmitoleic acid, palmitic acid and oleic) and organic acids (oxalic acid, citric acid, tartaric acid, malic acid, quinic acid, and ascorbic acid) [36].

Cinnamon oil

Latin: Cinnamomum cassia

Figure 5. Chinese cinnamon

(at: https://aromaticscience.com/antimicrobial-activities-of-cinnamon-oil-and-cinnamaldehyde-from-cinnamomum-cassia/)

Nowadays cinnamon is not only aromatic spice using in the kitchen. It is known for its beneficial effect on people with diabetes and an extract of cinnamon bark (cinnamon oil) is effective repellent (aromatic essential oils and drugs act against parasites, worms and infections). The most important provider of essential oils and volatile oils is Chinese cinnamon (Latin: *Cinnamomum cassia*), widely cultivated in China, Thailand, India and South-Eastern states. This tree can grow to a height of ten meters, but retains the felling of two meters. In addition, is Ceylon cinnamon (Latin: *Cinnamomum zeylanicum*) provider of quality raw materials, originally from Sri Lanka.

Essential oils are volatile thus lipophilic substances. They are naturally colored to yellow. They are used in the cosmetic and food industries and in pharmacy as well. In addition to essential oils, are also applied directly aromatic drugs and also individual isolated components of essential oils. They may cause irritating to the skin (the skin to feel the heat and redness) or allergies. They constitute an ingredient of ointments used for rheumatism and neuralgic pain [37].

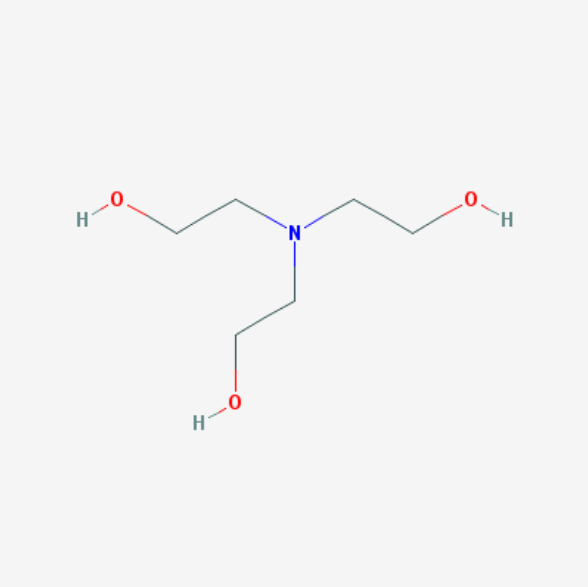
Latin: Cinnamomum zeylanicum

Figure 6. Ceylon cinnamon

(at: https://aromaticscience.com/preventive-effect-of-cinnamon-essential-oil-on-lipid-oxidation-of-vegetable-oil/)

Triethanolamine

Known as Trolamine, Triethylolamine, Trihydroxytriethylamine, Daltogen, 2,2',2"-Nitrilotriethanol, Sterolamide, Tris(2-hydroxyethyl) amine [38]



Molecular Formula: $C_6H_{15}NO_3$

It is a clear, colorless to light yellow, viscous solution. It has properties of alcohols and amines. It becomes a solid upon a room temperature but dissolves in water and oils.

When react with the fatty acid (e.g., oleic acid, stearic acid) is able to convert the acid to a salt. Among its features are also reducing the surface tension during emulsion formation and thus allows water and oil to react. Because of having weak bases (pH=10-11) it is also used as a pharmaceutical pH adjuster or alkalizing agent [39]. For its effects it is used in the manufacturing of care cosmetics (facial care products, shampoos ad.) and the beauty cosmetics (eyeliner, make-up, mascara, perfume ad.) [40].

5.3 Experiment

Mumio powder was dissolved in demineralized water which will produce 2 % mumio solution (pH = 8,47 – 8,91). To the mumio solution was added sodium salicylate and stirred until completely dissolution. Carbomer gradually by thin layers evenly sprinkled on the surface of the solution which will absorb slowly into the solution but does not dissolve. After pouring and waiting for the absorption of the final Carbomer layer into solution the mixture was placed in a holder of the mixing device. The stirrer was set at 500 rpm[4] while gradually adding up to 1000 rpm and stirring for 30 minutes. After this time seabuckthorn oil was added into a mixture. Speed remain the same and the stirring was continued for 10 minutes. After this time was added into a mixture cinnamon oil. Number of revolutions per minute is reduced to 600 and at this speed was stirred for next 20 minutes. The last is added a 20% solution of triethanolamine, stirrer speed is increased again to 1000 rpm and stirred for further 15 minutes. Total time for standard mixing time is 75 minutes. After this time Mumio gel was made.

The materials were added in amounts of[5]:

Table 3. **Composition of Mumio Gel**

Index of ingredients	**Volume in 200 ml [%]**	**Weight [g]**	**Volume [ml]**
Mumio solution [2%]	93,4	-	186,8
SS	0,5	1	-
Carbomer	1,3	2,6	-
RO	0,5	-	1
SC	0,5	-	1
TEA [20%]	3,8	-	7,6

[4] Rotate per minute.

[5] Selected ratio of components are the optimal ratio.

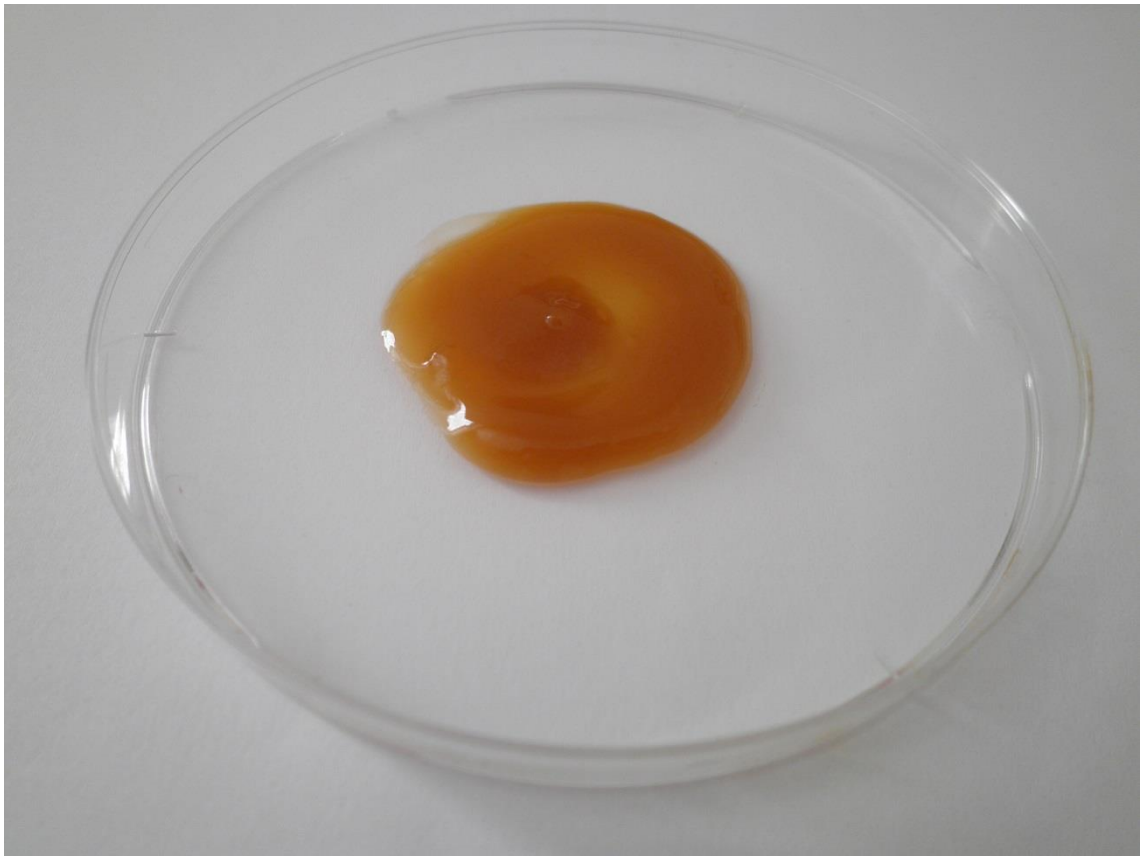


Figure 7. Visual image of mumio gel

5.3.1 Effect of incubation time of carbomer in mumio solution

After pouring the carbomer into solution, followed absorption of the last layer of carbomer (without waiting time) the first sample of mixture was placed under the mixing device. The resulting gel, after 75 minutes of standard stirring contained visible lumps which did not dissolve during stirring.

A second sample of gel that absorbed carbomer sixty minutes before mixing lumps still contains but much smaller and less than a gel which was blended without waiting time.

The third sample was placed under the mixing device after twenty hours of standing. There was not lumps after finish stirring. The gel was homogeneous.

Table 4. **Incubation time of carbomer, pH and viscosity of the gel**

Gel	**Sample 1**	**Sample2**	**Sample 3**
Incubation time [h]	0	1	20
pH	5,06	5,03	4,99
Viscosity [MPa]	7 540	7 593,33	7 096,66

As seen in the table above the incubation time of carbomer has no significant effect on the pH of the gel. But the same cannot be said about viscosity samples. The results of measuring the viscosity of the first and second sample differs significantly less than the third sample.[6] Lumps are caused by incomplete dissolution of gelling agent - carbomer. However, nothing prevents the effects of a gel.

[6] Viscometer measuring range is 20000 MPa.

Figure 8. Visual image of effectiveness of incubation time of carbomer (from left to right: 0h, 1h, 20h)

5.3.2 Effectiveness of antimicrobial active substances

It is a test that will prove if the medicine has sufficient antimicrobial activity. In this case, was used as antimicrobial agent sodium salicylate. Positive results should indicate that the medicine does not provide a place for survival or reproduction for microbes. If a medicine has this property it could be assumed that it will protect the patient from infection. Antimicrobial preservative effectiveness can be influenced by the composition of medicine or container in which it is put.

Microbial effectiveness are expressed in logarithmic reduction of the number of viable fetuses compared to the values obtained for freshly inoculated preparations.

Table 5. **Logarithmic reduction of germs in the form of bacteria**[7]

Logarithmic reduction of germs (Topic preparation)					
	6 h	24 h	7d	14 d	28 d
Bacteria A	2	3	-	-	NI[8]
Bacteria B	-	1	3	-	NR[9]

A line requirements are more stringent than those in the line B. It is always better to achieve the more stringent requirements. In other cases must be achieved at least the requirements line B.

For this testing were used the second sample of a mumio gel, *Pseudomonas aeruginosa* and *Styphylococcus albicans.* Both are species of microorganisms present in the human body and their application is regulated by degree [41].

Results were negative for both of microorganisms, means that nothing grew up on the mumio gel. The antimicrobial agent sodium salicylate proved its antimicrobial activity.

[7] 5. General texts. 5.1 General texts about sterility. 5.1.3 Efficacy of antimicrobial preservation

[8] Without increasing of number

[9] Without finding

6 MUMIO IN THE FORM OF HYDROGEL

6.1 Hydrogel

Hydrogels are then substances that are formed by the hydrophilic substances, which are capable in its three-dimensional structure to retain up to 95 % water.

In medicine and tissue engineering is for this substance a large number of applications. Namely creating a kind of supporting skeleton, network, or "scaffold" into which are then captured and the new cell tissue is then regenerated better. These substances may also be used as carriers for controlled release of drugs. This means that the hydrogel network is more condensed, tightly holding the active substance. It will take a while when your body unravels its dense network.

Like others of its use is in the healing of wounds. When the skin scrapes or you cut yourselves, it should be a blow to keep it in moisture. Hydrogels in this case form an invisible film between the wound and surrounding area, and thus protects the wound from infection from the outside and can also absorb excess secretions. It supports separation of necrotic tissue, has a cooling and soothing effect. Moreover, it does not stick to the wound.

Hydrogels are manufactured in a compact form (such as a hydrogel envelope) or amorphous (such as amorphous gels). The disadvantage of high water content is only limited ability to absorb fluid from the wound and the need for relatively frequent dressing changes the intensity of the secretion of the wound. Optimal use them on wounds with moderate to weak strong secretion. There are also a hydrogel covers, which combine moisturizing and healing effects of hydrogel absorption properties of hydrocolloids or calcium alginate [42]. Are macromolecular substances the majority of synthetic, rather sparsely networked covalent ties, ties or strong Ionic dipoles of the side groups of macromolecules, with a strong affinity to the water, in the water swells. Chemical composition and method for Crosslinking makes their properties (e.g. bandwidth, optical characteristics, elasticity, strength, biocompatibility, etc.) [43].

6.2 Mumio hydrogel

Mumio hydrogel is made by three steps. First is to prepare the polymer solution from PVA and agar (both from Fluka, Switzerland). The second is to blend mumio powder and sodium salicylate and the last step is to let solution cool.

6.2.1 Materials needed

Polyvinyl alcohol

Molecular forma $(C_2H_4O)_X$

Polyvinyl alcohol is a synthetic, white, crystalline substance. It ranks among the thermoplastic polymer. Is adhesive, gels upon contact with water so in the pharmaceutical industry it is used to increase viscosity such as a lubricant and protective agent in eye drop. It is used as an emulsifier and a protective colloid [44] It has an important role in biomedical and biochemical application because of its nontoxicity and biocompatibility. But the disadvantages are low mechanical strength and poor thermal stability [45].

Agar

It has a creamy color and comes in powder form. Agar is natural polysaccharide which is found in red seaweed. It is widely grown in Japan, India and New Zealand. It dissolves in boiling water and for its gelling property is used as a thickener and stabilizer, as a culture medium for microorganisms, and is contained in soups, ice team or cosmetics [46]. Gelling and good mechanical property are its characteristics, it melt on heating and reset on cooling, this cycle could be repeated for many times and it has no change on mechanical properties of the gel [47].

The rest of materials needed are mumio powder and sodium salicylate.

6.3 Experiment

In mumio hydrogel, PVA and agar have functions as a base polymer, but agar itself plays gelling agent. Mumio powder and sodium salicylate are wound healing agents.

A solution of PVA and the agar is partially dissolved in a sealed glass bottle which was then cooked up to the temperature 120° C (about 20 minutes). After reaching this temperature was allowed to cool the solution of 50° C. Then adds mumio powder and sodium salicylate. Solution is stirred until complete dissolution of all substances and quickly poured solution into Petri dishes (20ml to each). If the pouring will delay the solution solidifies. After pouring solution into Petri dishes contents were allowed to solidify in air at room temperature (approx. 23° C). In a short time (several seconds to few minutes) content will solidify and hydrogel occurs.

The materials were added in amounts of[10]:

Table 6. Composition of mumio based hydrogel

Index of ingredients	Volume in 200 ml [%]	Weight [g]	Volume [ml]
PVA	2	4	-
Agar	2	4	-
Mumio	1	2	-
SA	1	2	-
DW	94	-	188

[10] Selected ratio of components are the optimal ratio.

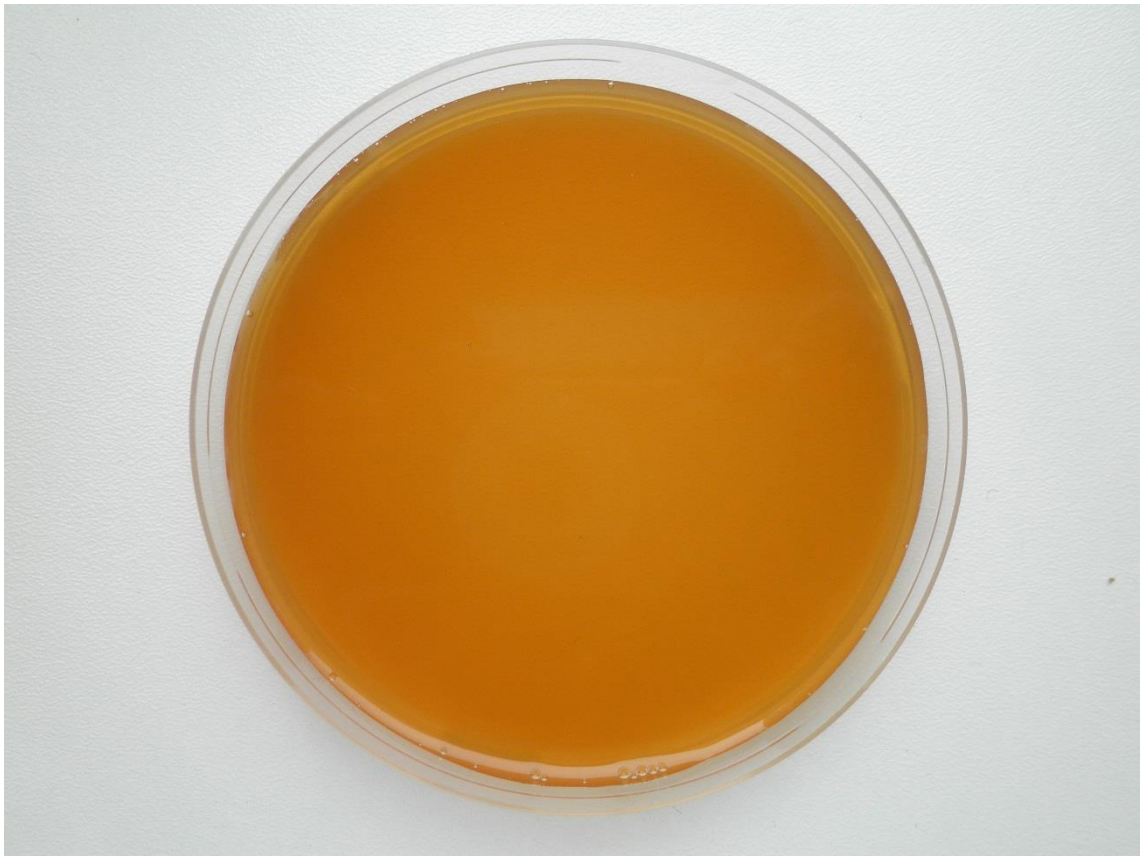


Figure 9. Visual image of mumio based hydrogel

6.3.1 Moisture content

Hydrogel samples were left to dry in air box with the room temperature (about 23°C for 24 hours). After one day they had a constant weight. Than the water had been pouring into Petri dishes (20ml each) and samples were left to swell back. Hydrogel swelled back again and again, but not all volume of water. Only about 60% after the second drying.

Mumio based hydrogel after drying.

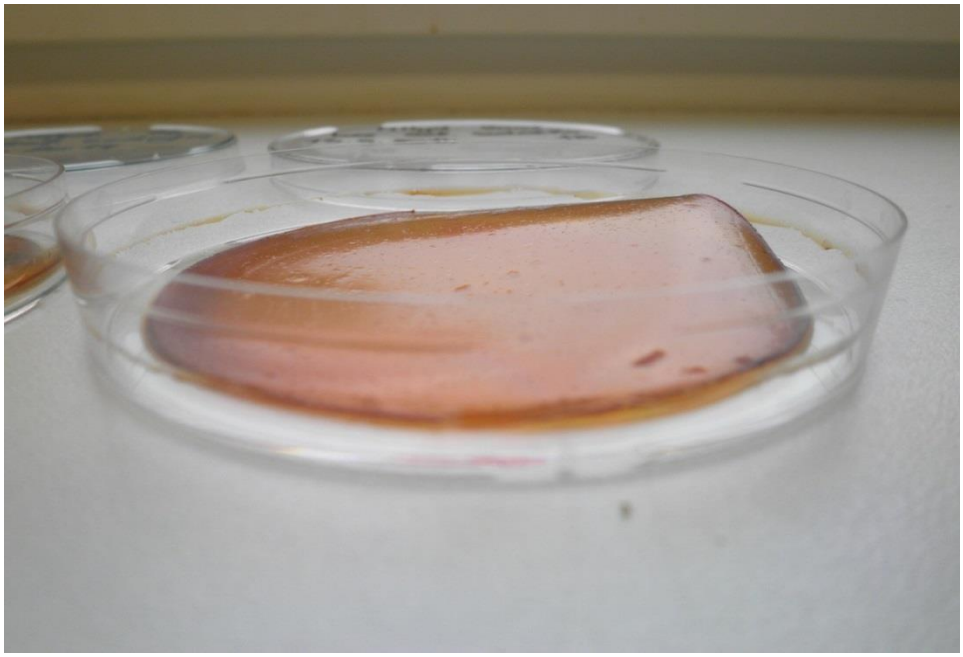


Figure 10. Visual image of Mumio hydrogels after drying

Mumio based hydrogel after swell water back.

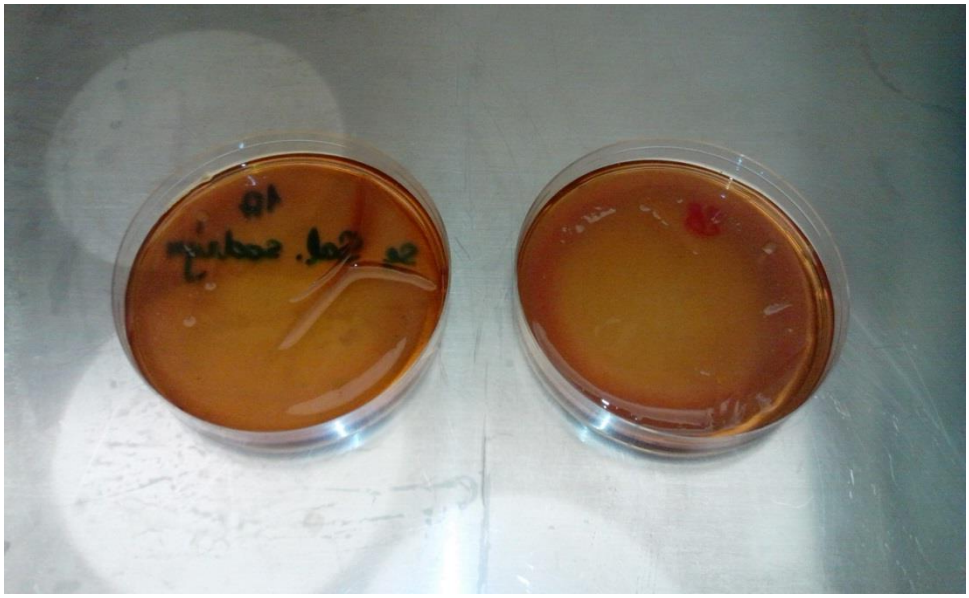


Figure 11. Visual image of Mumio hydrogels after swelling

CONCLUSION

Offers of pharmaceutical products is today much. They are in the form of drops, capsules, tablets or gels and in the new hydrogel form. On the internet market you can choose from a large range of offers. Advertisements promise at least improve the health situation and some of them miracle. From the history is a mumio one of those miraculous natural products.

According to the studies above in which the effects of mumio were proven and mumio is considered as a product that strengthening immunity, prevent infection, has regeneration effects and anti-inflammatory effect, it is non-toxic, antimicrobial and does not cause any allergic reactions etc. It can be said that the mumio as a pharmaceutical material is fully compliant. It helps with rheumatic problems, muscle and joint pains, abdominal pain, back pains and much more. In contrast, no studies have ever detected mumio side effects or if it is harmful. Therefore, it is submitted that they are completely safe.

Mumio is not used only as medicine that prevent immune system. It is used like a food supplement, too. Many people are sensitive to chemical drugs or to the drug substance. Mumio may could replace them. It has a potential to be more widely used in pharmaceutical and medical industry because it is create completely by natural itself, no chemicals, no afraid of allergic to drugs.

The big advantage is that mummy has a wide range of activities. You can take it as preventing and as a treatment for the disease. Storage is very easy.

One of the disadvantages of mumio is the smell and some people it may not be well tolerated. Therefore, in the preparation of gel added a few of cinnamon essential oil which has a strong smell (in a good meaning) and also has positive effects.

Another disadvantage is not the mumio itself but its availability. Internet market offers cheap mumio tablets but how many percent of mumio is in tablets and if it really works you will know after use it.

Results of experimental

Mumio gel that was produced was applied to the eye invisible sports injuries (sore legs, knees, ankles, hips). Likewise applied abdominal pain, muscle and back pain. The gel was applied twice daily for two weeks. The results of such use can be confirmed only orally by users. But after using mumio all the pain, except to the hip, resolved. The pain of ankle and knee from gymnastic hurt for the last two months continuously. But after applying the mumio gel ankle pain subsided completely, only knees still felt a slight tug. Hydrogel, which was used to bruise resolved in less time than the usual time (bruise from practicing Taekwondo - about a week), after four days. After two days, the hydrogel which was used on a small cut on a hand, the skin was healed.

What effect it has in shared use with other drugs have not been proven but in the future it would be a study to consider.

BIBLIOGRAPHY

[1],[11] FROLOVA, L. N., T. L. KISELEVA, V. K. KOLKHIR, A. I. BAGINSKAYA, T. E. TRUMPE. Antitoxic properties of standard dry mumijo extract. *Pharmaceutical Chemistry Journal*. April 1998, Vol. 32, No. 4, p. 197-199.

[2] FROLOVA, L. N., T. L. KISELEVA, L. A. BARATOVA, G. V. BAIBAKOVA, A. L. KSENOFONTOV. Study of the amino acid fraction of dry mumijo extract. *Pharmaceutical Chemistry Journal*. February 1998, Vol. 32, No. 2, p. 103-108.

[3],[15] PAWLAS, Martin. *Mumio, doplněk stravy*. Brno, 2013. Bachelor thesis. Masaryk University. Supervisor: Mgr. Jana Juříková, Ph.D.

[4],[14],[17] AIELLO, Anna, Ernesto FATTORUSSO, Marialuisa MENNA, Rocco VITALONE, Heinz C. SCHRÖDER a Werner E. G. MÜLLER. Mumijo Traditional Medicine: Fossil Deposits from Antarctica (Chemical Composition and Beneficial Bioactivity). *Evidence-Based Complementary and Alternative Medicine* [online]. 2011, vol. 2011, s. 1-8 [cit. 2014-05-26]. DOI: 10.1093/ecam/nen072. Available at: http://www.hindawi.com/journals/ecam/2011/738131/

[5] LÁSZLÓ GALGÓCZY. In vitro antibacterial effect of a mumijo preparation from Mongolia. *African Journal of Microbiology Research*. 2011-10-16, vol. 5, issue 22, s. -. DOI: 10.5897/AJMR11.798. Available at: http://www.academicjournals.org/ajmr/abstracts/abstracts/abstract 2011/16Oct/Galgóczy et al.htm

[6],[47] ZANDRAA, Oyunchimeg, Lenka JELÍNKOVÁ, Niladri ROY, Tomáš SÁHA, Takeshi KITANO, Nabanita SAHA a Martin ZATLOUKAL. Viscoelastic Properties and Morphology of Mumio-based Medicated Hydrogels. P. 261-271. DOI: 10.1063/1.3604487. Available at: http://scitation.aip.org/content/aip/proceeding/aipcp/10.1063/1.3604487

[7],[9] HNÁTKOVÁ, Eva. *Využití biologicky rozložitelných polymerů pro konstrukční prvky v oblasti medicíny* [online]. Zlín, 2010 [cit. 2014-05-26]. Available at: http://hdl.handle.net/10563/14180. Bachelor thesis. Tomas Bata University. Supervisor: Ing. Vladimír Sedlařík, PhD.

[8] PARKÁN, Martin. *Syntetické polymery pro využití v biomediciálních aplikacích - využití při léčbě chronických ran* [online]. Zlín, 2011 [cit. 2014-05-26]. Available at: http://hdl.handle.net/10563/15581. Bachelor thesis. Tomas Bata University. Supervisor: doc. Ing. Berenika Hausnerová, PhD.

[10],[12] *Přírodní farmaka* [online]. [cit. 2014-05-26]. Available at: http://www2.zf.jcu.cz/~moudry/databaze/Prirodni_farmaka.htm

[13] What is mumio. *Mumio* [online]. c1997 - 2014 [cit. 2014-05-26]. Available at: http://mumio7.com/what-is-mumio.html

[16] SAHA, Nabanita, Oyunchimeg ZANDRAA a Tomáš SÁHA. *Cosmetic polymer gel use as external healing agent for injuries, dermatitis and eczema comprises solution of mumio powder, polyacrylic acid, triethanolamine solution, sodium salicylate, aromatic agent and eventually other regular additives* [patent]. Industry model, WO2011153969-A2. Granted 15.12.2011.

[18],[25] What is mumio. *Mumio* [online]. c1997 - 2014 [cit. 2014-05-26]. Available at: http://mumio7.com/what-is-mumio.html

[19],[22],[26] Mumijo (Mumio, Mountain balsam): Summary of Russian studies. *Mumijo* [online]. c1998 - 2012 [cit. 2014-05-26]. Available at: http://www.mumijo-mumio.com/russian.htm

[20] Protocol n. 34560/2011. Health Institute in Ostrava. 2011

[21],[23],[24] WINDMANN, Wolfgang. *Mumio: černé zlato Himaláje*. 1. pub. Olomouc: Fontána, © 2006, 107 p. ISBN 80-733-6302-X.

[27],[29] HÄGERSTRÖM, By Helene. *Polymer gels as pharmaceutical dosage forms: rheological performance and physicochemical interactions at the gel-mucus interface for formulations intended for mucosal drug delivery* [online]. Uppsala: Acta Universitatis Upsaliensis, 2003 [cit. 2014-05-26]. ISBN 91-554-5705-3.

[28] Gel. *Velký lékařský slovník* [online]. © Maxdorf 2008 - [cit. 2014-05-26]. Available from: http://lekarske.slovniky.cz/pojem/gel

[30] Sodium salicylate. *Pubchem compounds* [online]. 28 October 2009 [cit. 2014-05-26].

[31] Carbomer. *EWG's Skin Deep* [online]. © 2007-2014 [cit. 2014-05-27]. Available at: http://www.ewg.org/skindeep/ingredient/701088/CARBOMER/

[32],[34] Carbomer. *Cosmetics Info: the science and safety behind your favorite products* [online]. c2013 [cit. 2014-05-26]. Available at: http://cosmeticsinfo.org/ingredient/carbomer-0

[33],[35] What is carbomer. *WiseGeek: Clear answers for common question* [online]. © 2003 - 2014 [cit. 2014-05-26]. Available at: http://www.wisegeek.org/what-is-a-carbomer.htm#

[36] Seabuckthorn. *Drugs.com: Know more. Be sure* [online]. © 2000-2014 [cit. 2014-05-26]. Available at: http://www.drugs.com/npp/sea-buckthorn.html

[37] Skořicí proti komárům? In: *OSEL: Objective Source E-Learning* [online]. 20.07.2004 [cit. 2014-05-26]. Available at: http://www.osel.cz/index.php?clanek=836

[38] Triethanolamine. *EWG's Skin Deep* [online]. © 2007-2014 [cit. 2014-05-27]. Available at: http://www.ewg.org/skindeep/ingredient/706639/TRIETHANOLAMINE/

[39] Triethanolamine. *Making cosmetics* [online]. © 2012-2014 [cit. 2014-05-26]. Availale at: http://www.makingcosmetics.com/Triethanolamine_p_280.html

[40] Triethanolamine. *Cosmetics info* [online]. © 2013 [cit. 2014-05-26]. Available at: http://cosmeticsinfo.org/ingredient/triethanolamine

[41] *Český lékopis 2009: Doplněk 2013*. 1. vyd. Praha: Grada Publishing, 2009, 1176 s. ISBN 978-80-247-4679-1.

[42] Hydrogely v léčbě ran. *Zelená hvězda* [online]. 17. 8. 2012 [cit. 2014-05-26]. Available at: http://www.zelenahvezda.cz/pacientska-sekce/p-rany/hydrogely-v-lecbe-ran

[43] Hydrogel. *Velký lékařský slovník* [online]. © Maxdorf 2008 - [cit. 2014-05-26]. Available at: http://lekarske.slovniky.cz/pojem/hydrogel

[44] Polyvinyl alcohol. *World of chemicals* [online]. © 2013 [cit. 2014-05-26]. Available at: http://www.worldofchemicals.com/chemicals/chemical-properties/polyvinyl-alcohol.html

[45] Polyvinyl alcohol (PVA). *Encyklopedia Britannica* [online]. 26 May 2014 [cit. 2014-05-26]. Available at: http://www.britannica.com/EBchecked/topic/469236/polyvinyl-alcohol-PVA

[46] All about agar. *Science Buddies* [online]. © 2002 - 2014 [cit. 2014-05-26]. Available at: http://www.sciencebuddies.org/science-fair-projects/project_ideas/MicroBio_Agar.shtml

LIST OF ABBREVIATIONS

SS	Sodium salicylate
DW	Demineralized water
SO	Seabuckthorn oil
CO	Cinnamon oil
TEA	Triethanolamine
PVA	Polyvinylalcohol

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APPENDICES

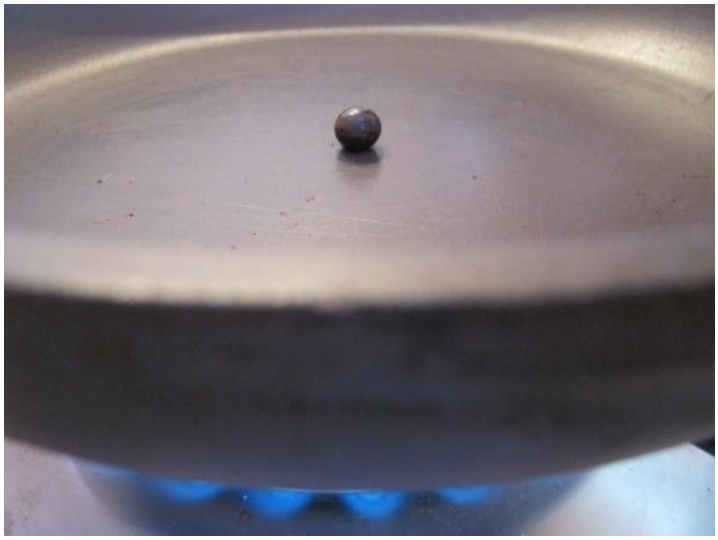
Appendix I.: Indefinable products

Appendix II.: Making mumio gel

Making mumio hydrogel

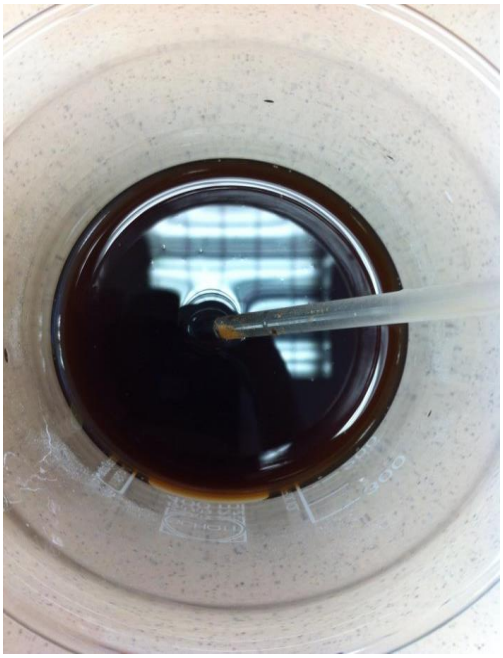
APPENDIX I.:

Mr. M. Pawlas was attracted by „indefinable products“ so he attempted to determine how the indefinable products look like (no chemical analysis) in his work (Bachelor thesis). He let mumio warmed to 140 ° C. After a total ten minutes of heating, tablet get rounded (spherical shape). After cooling and grasping crumbled and after placed into water the particles were less soluble. [3]

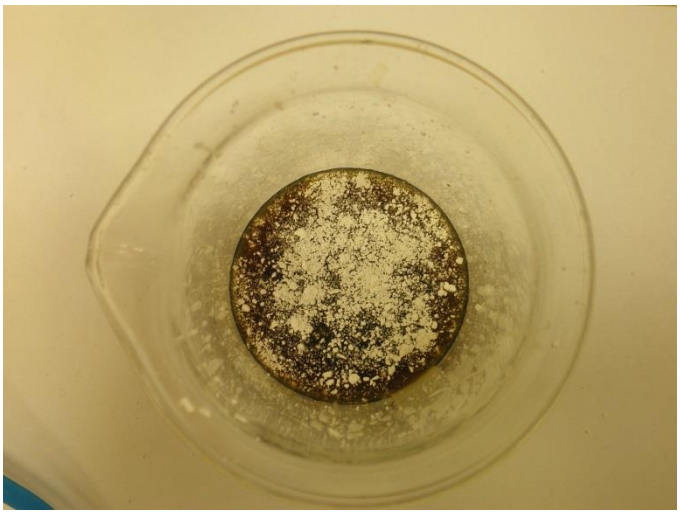


APPENDIX P II:

Making mumio gel:



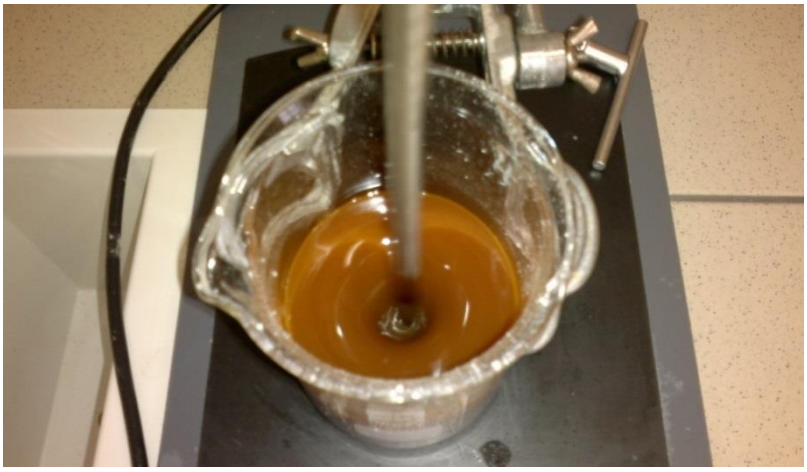
Visual image of dissolving state of mumio powder and SS in DW



Visual image of mumio solution with carbomer

Visual image of carbomer absorbed into mumio solution

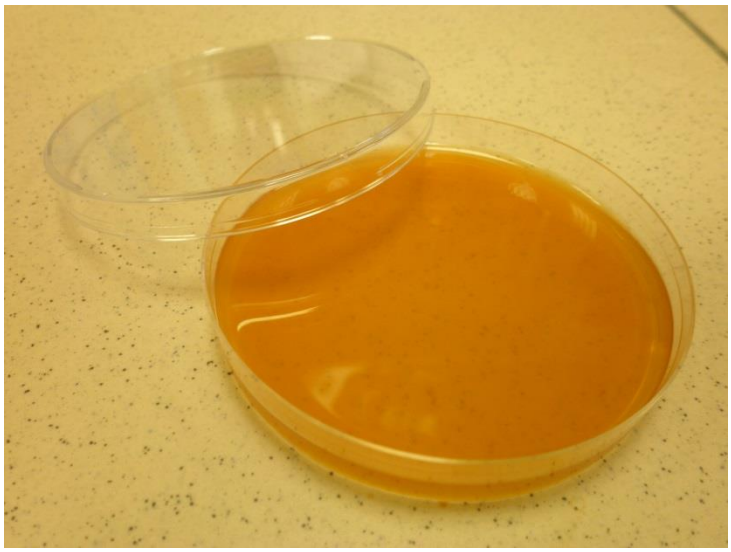
Visual image of mumio mixture under mixing machine



Visual image of mumio mixture after 70 minutes of mixing

Making mumio hydrogel:

Visual image of dissolved PVA and agar after boiling



Visual image of mumio based hydrogel