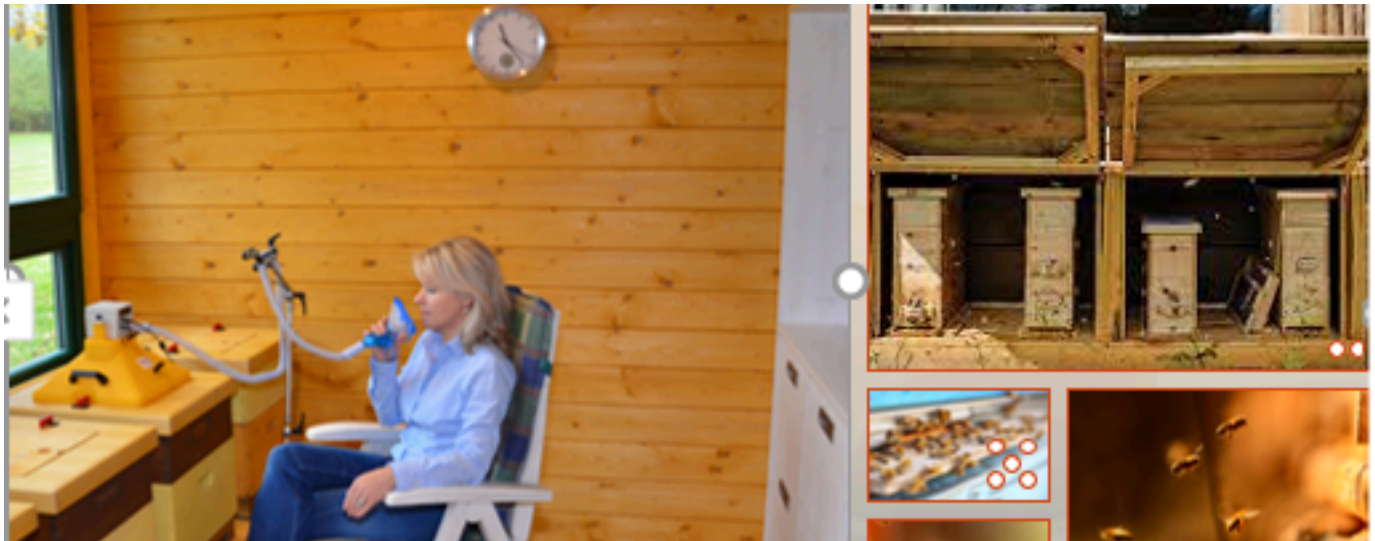


# HIVE AIR AND DEAD BEES

Medicinal Beekeeping for Beekeepers project no. 2021-1-TRO1-KA220-VET-000034632



## IN THIS CHAPTER

### HIVE AIR AND DEAD BEES – WHAT ARE THEY?

### CHARACTERISTICS OF HIVE AIR AND DEAD BEES

### PRO-HEALTHY PROPERTIES OF HIVE AIR AND DEAD BEES

### HIVE AIR AND DEAD BEES HARVESTING, PRESERVATION, PROCESSING AND STORAGE

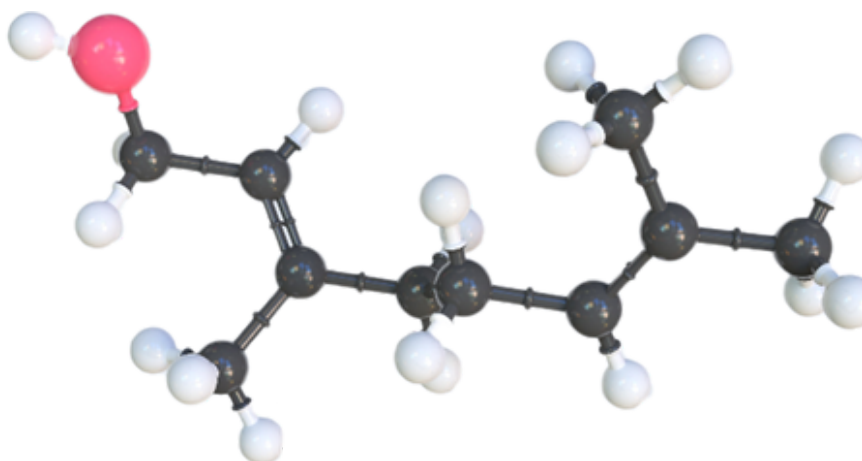
## Hive air – what is it?

The air inside the hive is called **HIVE AIR**. Due to its specific climate, it is saturated with many volatile substances that are secreted by the bees themselves (pheromones), as well as semi-finished products collected by bees (nectar, pollen, honeydew, resin secretion of leaf buds) and products (honey, bee, propolis and wax). The hive air is often called the hive microclimate. The chemical composition of the hive air reflects the sanitary conditions inside the hive as well as the health condition of the bee colony.



**BEEHIVE AIR THERAPY INHALER**

INHALER <https://www.becurasystem.de/en/2020/10/23/bienenstocklufttherapie-mit-dem-beecura-inhalator-sicher-und-hygienisch/>



MOLECULAR MODEL OF GERANIOL

The chemical composition of hive air is complex and not yet fully understood. It is recognized that there are about 44 volatile substances in the hive air. Among the bee pheromones identified in the hive air are geraniol and nerol, these are volatile compounds secreted by the Nasonow gland.

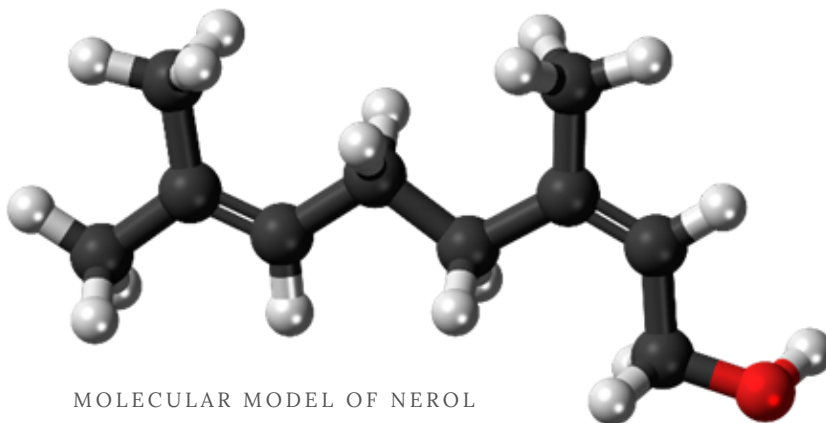
## Hive air - chemical properties

### Geraniol:

- has an antibacterial and antifungal effect

### Nerol:

- has an antidepressant, sedative effect and regulates menopausal problems.

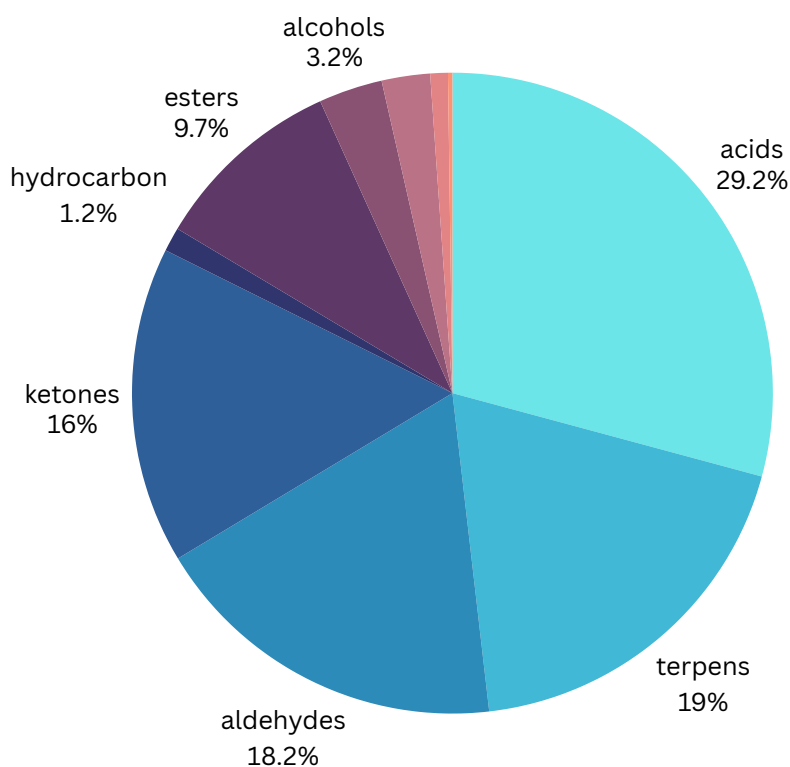


MOLECULAR MODEL OF NEROL

Among the volatile compounds present in the hive air, there are also volatile substances found in bee semi-finished products and in final products obtained from bees, such as honey, bee bread, royal jelly, wax or propolis. During storage or processing in the hive, these substances release numerous chemical compounds into the hive environment.

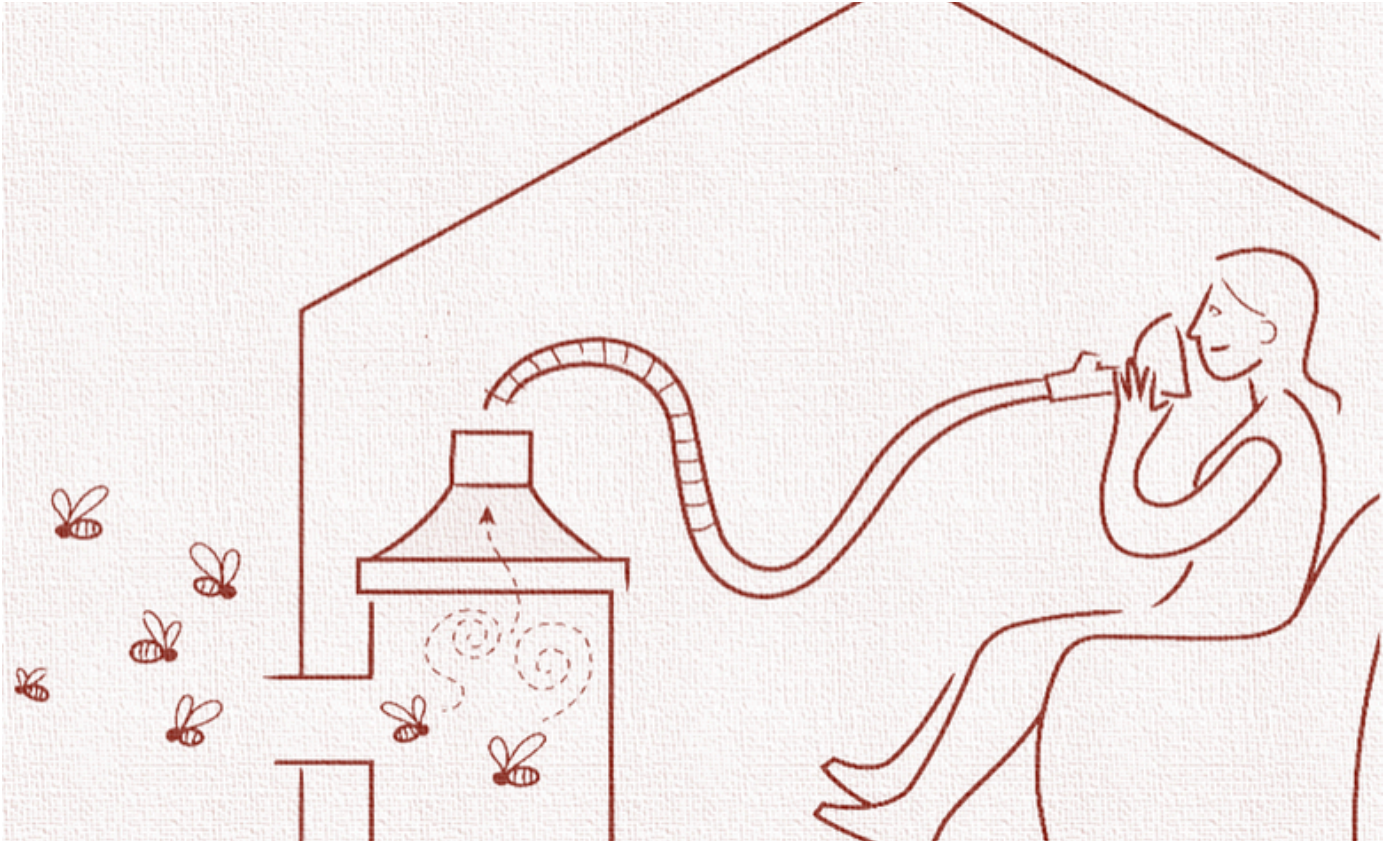
As research has shown, hive air contains about 26.3% of volatile acids (e.g. n-caprylic acid, nonanoic acid, geranic acid, dodecanoic acid, tetradecanoic acid), 17.1% of terpenes (e.g. limonene,  $\beta$ -Linalool,  $\alpha$ -Cubebene, Germacrene, Copaene,  $\alpha$ -Farnesene Terpene,  $\beta$ -Caryophyllene,  $\alpha$ -Humulene,  $\delta$ -Cadinene), 16.4% volatile aldehydes (including benzaldehyde, benzeneacetaldehyde, (E)-2-octenal, nonanal, decanal, 5-hydroxymethylfurfural, (Z)-2-Decenal, (E)-Cinnamaldehyde).

14.4% ketones (including 2-Nonanone, Pyranone, 2-Decanone, 9-Hydroxy-2-nonanone, (Z)-Geranylacetone); 11.0% hydrocarbons (e.g. Decane, Tridecane, Hexadecane, Octadecane, 9-Nonadecene) 8.7% esters (Methyl salicylate, 2-Octyl acetate, (E)-2-Decenyl acetate), 2.9% volatile alcohols (isopropyl alcohol, 3-hexenol, cyclooctanol, dec-2-en-1-ol), additionally eugenol (2.2%), n-butyl nitrite (0.8%) and (E)-anethole were found (0.2%)



CHEMICAL COMPOSITION OF HIVE AIR

The air of the hive is 25 - 35°C and is characterized by relatively high humidity (70-75%). An additional very important feature of hive air is its purity - it should be free of bacteria, viruses or pathogenic fungi. Breathing clean, antiseptic air, fragrant with honey, pollen and propolis, has a very good effect on well-being and vitality, it also helps in the prevention of treatment of various diseases, this is how the new field of Apitherapy "APIINHALATION" was created.



#### APIINHALATION

SOURCE: [HTTPS://WWW.BEECURASYSTEM.DE/EN/2020/10/23/BIENENSTOCKLUFTTHERAPIE-MIT-DEM-BEECURA-INHALATOR-SICHER-UND-HYGIENISCH](https://www.beecurasystem.de/en/2020/10/23/bienenstocklufttherapie-mit-dem-beecura-inhalator-sicher-und-hygienisch)

## Hive air - pro-healthy properties

The use of beehive air as a treatment option was developed by Heinrich Huttner, an Austrian. Considering the wide spectrum of chemical compounds present in the hive air and their biological activity, hive air has been used in the treatment of respiratory tract diseases, allergic diseases, cardiovascular diseases, as well as nervous and mental diseases. They can be used in the treatment of inflammation of the mucous membrane of the upper respiratory tract, but also bronchitis. It also has a positive effect on blood pressure, improves blood circulation and microcirculation, and seals blood vessels. Observations also confirm the positive effect of bee air on mental health. One of the simplest and most primitive ways to use the hive air is to remove the upper part of the hive, secure it with a dense mesh and breathe the air coming out of it. A more common method of inhaling hive air is breathing hive air through specially developed inhalers consisting of a flexible hose made of plastic and a breathing mask. This device sucks the bees' air directly from the hive, passes through a heated hose to a breathing mask, and the patient can breathe it in.

Heating the hose is to reduce condensation, because along with moisture, active substances contained in the air of the hive are also deposited. Treatments involving inhalation of hive air are carried out in the summer, from May to August. Treatment cycles are carried out in various ways, usually inhalation lasts 15-60 minutes, it can be repeated twice a day and the duration of treatment can be from 12 to 22 days. Some people dealing with apitherapy even offer 8-hour inhalations - all night during sleep.

## Hive air - pro-healthy properties

Apitherapyhouses are small wooden buildings with built-in beehives. Hives can be placed inside or outside the place intended for people, they are covered with a dense mesh preventing bees from getting out of the hive and at the same time allowing the flow of hive air inside.



APITHERAPY HOUSE

In apitherapyhouses there are chairs or couches placed above the hives, which allows you to feel the heat, sounds and vibrations emitted by the bees. The effect of the warmth of the bee colony on humans, which is an element of biotherapy, is also beneficial. Staying in the apitherapy house, a person is also subjected to acoustic influences - the sound of bees moving in the hive, as well as the movement of their wings. It has been found that this sound effect affects brain structures, having a relaxing and antidepressant effect, reduces mental fatigue and makes it easier for the patient to fall asleep.

# Dead bees – what are they?



DEAD BEES

Dead bees, found most often after the winter period, are dead bees that beekeepers find on the bottom of the hive. Raw material is a blackbrown mass with a specific smell. On closer examination, whole undisturbed bees and various parts of bees (head, legs, abdomen, wings, etc.) are visible.

The causes of deadbees may be various, it may be due to the weakness of the bee colony, bad weather conditions, incorrect distribution of supplies in the hive or their depletion, and sometimes bee diseases. The weight of the dead bees may reach 205-300 g. From an economic point of view, dead bees is undesirable, but it can be used for medicinal purposes.



DEAD BEES

## Dead bees – chemical properties

Dead bees contain about 8-10% of water, while after drying, its content decreases to about 3-4%. The chemical composition of dead bees is not constant in terms of chemical composition. Protein content ranges from 47.8-65%, melanin content from 20.0 to 25.0%, wax and lipid substances from 11.0 to 27.7%, chitin from 11.00 to 24.0% and trace minerals constitute 1.8-2.5% (mainly iron, zinc, tin, nickel, cadmium, copper and cobalt).



CHEMICAL COMPOSITION OF DEAD BEES

## Dead bees – pro-healthy properties

Chitosan is used in medicine due to its antibacterial, anti-inflammatory and analgesic properties; it stops bleeding and helps wound healing, which is why it is, among others, component of dressing materials. It is also used as a carrier in mucoadhesive drug delivery systems. Chitosan is also used as a dietary supplement to support weight loss, due to blocking the absorption of fats, although its effect has not been fully confirmed by research.

The CHITOSAN-MELANIN COMPLEX, on the other hand, has strong antioxidant, anti-radiation, detoxifying, antimicrobial and antimutagenic properties. Preparations based on chitosan-melanin complex, containing other substances, such as an extract obtained from Siberian pine needles. This preparation turned out to be effective in:

- gastroenterology (improvement of bowel function),
- cardiology (renewal of the heart muscle after a heart attack, atherosclerosis),
- neurology (improvement of cerebral microcirculation in multiple sclerosis, Parkinson's disease and after cerebral hemorrhage),
- endocrinology, diseases of the musculoskeletal system,
- pancreatitis
- immunological diseases.

Dead bees are also used to prepare decoctions, ethanol extracts and extracts obtained with supercritical liquid CO<sub>2</sub>. Decoctions and ethanol extracts from dead bees turned out to be an effective drug used in prostatic hyperplasia.

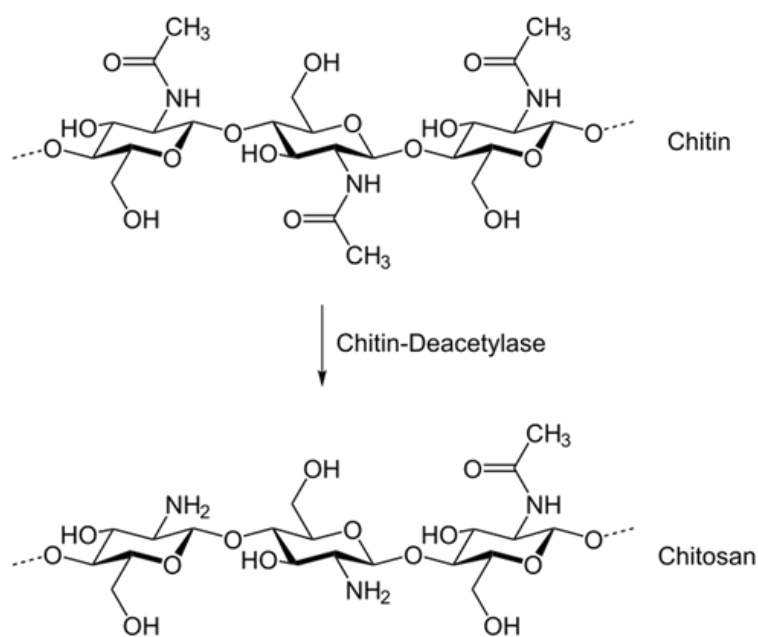
- dead bees ether extract (10-20%) has proven to be effective in the treatment of diseases such as:
- atherosclerosis,
- gastrointestinal disorders (dysbacteriosis, indigestion, constipation),
- sexual disorders (impotence and frigidity).
- in the form of compresses, dead bees, rubbed with vegetable oil, can be used in patients suffering from circulatory system diseases (varicose veins, thrombophlebitis).

## **Dead bees - harvesting, preservation, processing and storage**

In order for dead bees to be used for medicinal purposes, it must come from bees without symptoms of mite, bacterial or fungal infection. It also cannot be moldy. In order to preserve them, dead bees are dried at a temperature of up to 45°C, crushed and stored in tightly closed, clean packaging in a cool and dry place, preferably in a glass container. Bee dust preserved in this way retains its healing properties for up to 1 year

The most widely used direction of using dead bees is to obtain CHITOSAN from it. Chitosan is a derivative of chitin, obtained as a result of its partial deacetylation. Chitosan-melanin complex is also obtained from chitin for therapeutic purposes.

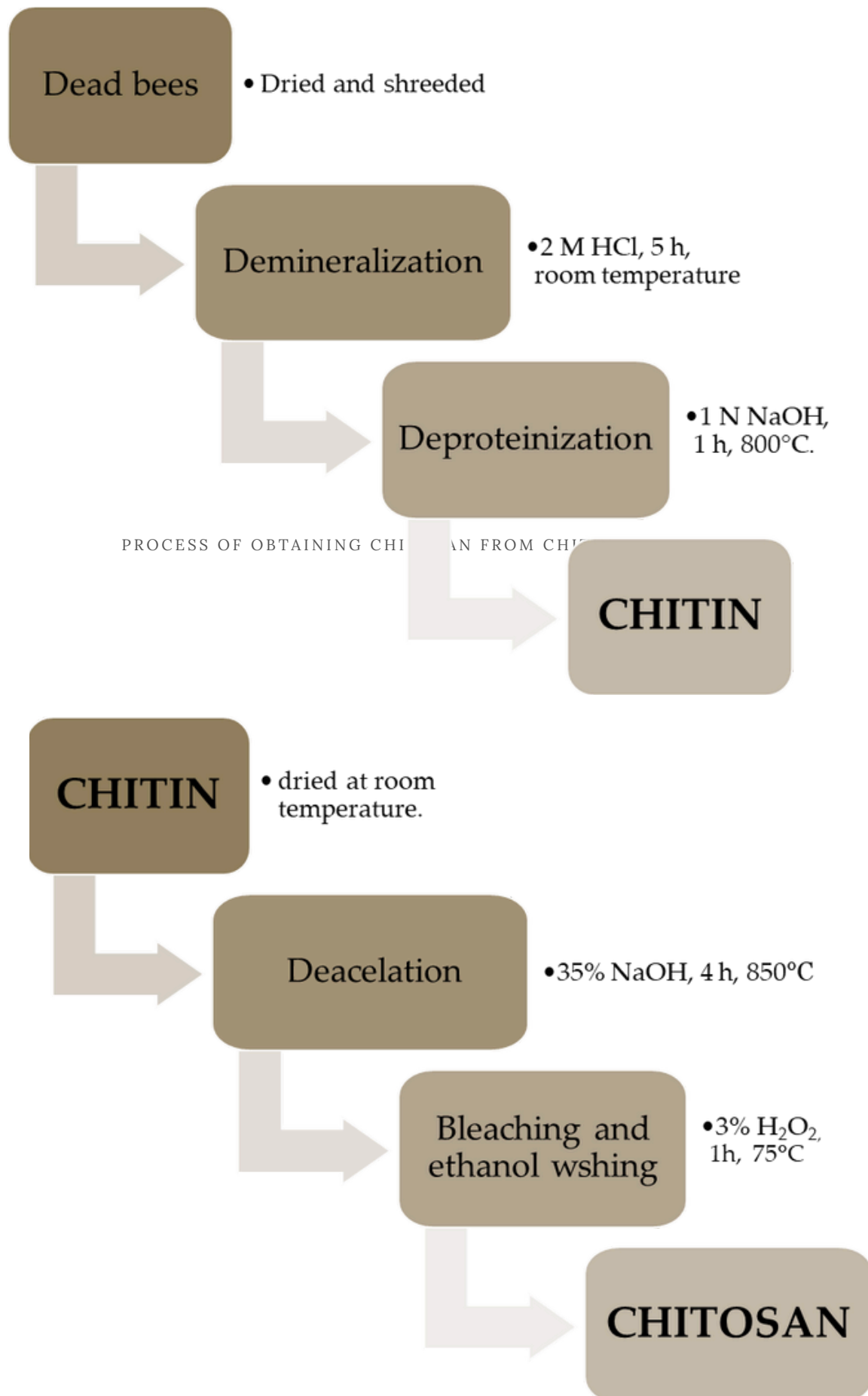




PROCESS OF OBTAINING CHITOSAN FROM CHITIN

The CHITIN from dried crushed dead bees is obtained by through successive stages. 1st is demineralization, then deproteinization. The demineralization could be carried out by treating dead bees with 2 M HCl for 5 hours at room temperature. The deproteinization could be carried out by treating the crushed raw material with 1 N NaOH solution for 1 hour at 80°C. Next, the mass was filtered and dried at room temperature. Each process was accompanied by washing the raw material until neutral wash water (pH = 7).

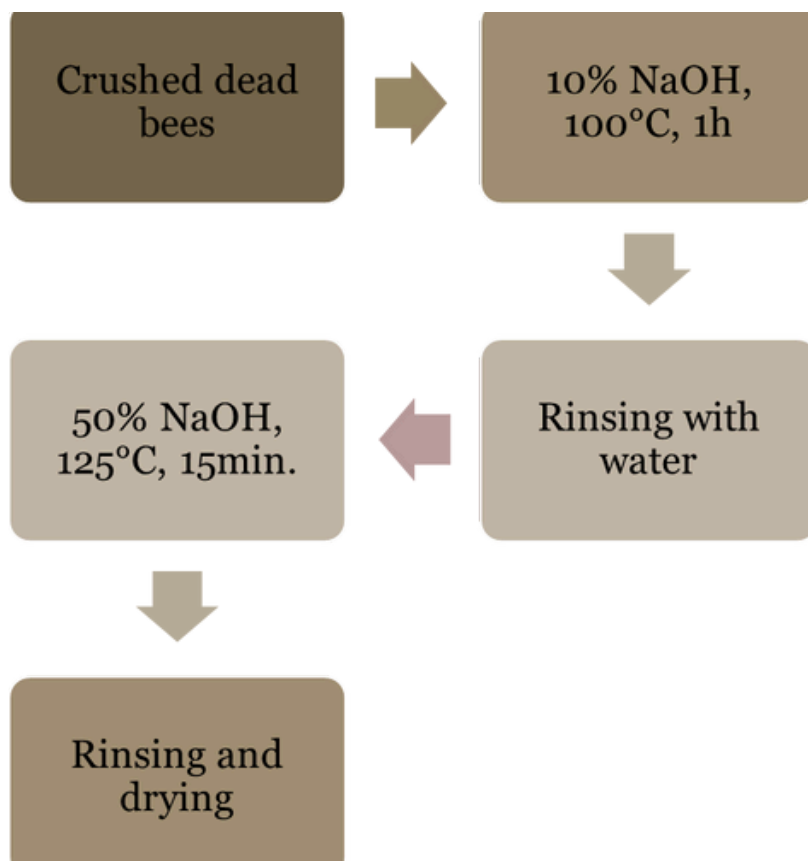
In this way, chitin is obtained from which **CHITOSAN** is obtained by deacetylation of chitin with 35% aqueous solution of NaOH for 4 hours at a temperature of 85°C and dried at 50-55°C. Next, the resulting mass is decolorized with a 3% solution of H<sub>2</sub>O<sub>2</sub> and washed with ethanol. The reaction product is a light beige mass with a specific smell.



THE SCHEME LABORATORY TECHNOLOGY OBTAINED OF CHITIN AND CHITOSAN FROM HONEY BEE

# Dead bees - harvesting, preservation, processing and storage

The **chitosan-melanin complex** from bee dust is obtained by treating the crushed bee dust with 10% sodium hydroxide solution at 100°C for 1 hour (removal of proteins and part of melanins). After rinsing with plenty of water, the residue is treated with 50% sodium hydroxide solution at 125°C for 15 minutes. After washing the lye with water and drying by sublimation, a light brown product is obtained.



PROCESS OF OBTAINING THE CHITOSAN-MELANIN COMPLEX

A **decoction of dead bees** is obtained by boiling with water (in the right proportions). After cooling and straining, a tablespoon of honey may be added to the decoction. The decoction is stored in a dark and cool place.

**Ethanol extract**, in turn, is obtained by pouring deadbees with 70% ethyl alcohol and storing for 10-12 days, shaking every day. After filtration, the extract is stored in a dark glass vessel at room temperature.



DEAD BEES' PRODUCTS

# References

- Kędzia B., Hołderna-Kędzia E. Apiterapia. Leczenie miodem i innymi produktami pszczelimi. 2020. Wydawnictwo SBM Sp. z o.o.
- Kędzia B., Hołderna-Kędzia E. Lecznicze właściwości osypu pszczół. Materiały konferencyjne. VI Lubelska Konferencja Pszczelarska. 2015, 48-52.
- Khaydarova H. A., Ikhtiyarova G. A., Khaydarov A.A., Mengliyev A. S. Method of obtaining a chitosan aminopolysaccharide from *behat apis millifera*. 2019. Chemical Journal of Kazakhstan 2 (66), 69-74
- Nemtsev S.V., Zueva O.U., Khismatoullin R.G., Khismatoullin M.R., Varlamov V.P. Bees As Potential Source Of Chitosan.
- Aida A. Abd El-Wahed, Mohamed A. Farag, Walaa A. Eraqi, Gaber A.M. Mersal, Chao Zhao, Shaden A.M. Khalifa, Hesham R. El-Seedi. Unravelling the beehive air volatiles profile as analysed via solid-phase microextraction (SPME) and chemometrics. Journal of King Saud University – Science. 2021. 33, 101449.
- Guardia T. Identifying the chemical compounds of beehive air. 1st International Beehive Air Therapy Conference. 12th- 13th Feb, 2022.
- Guardia T., Stângaciu S. Antimicrobial properties of the beehive air. A short review. 1st International Beehive Air Therapy Conference. 12th- 13th Feb, 2022.
- Szczurek, A.; Maciejewska, M. Beehive Air Sampling and Sensing Device Operation in Apicultural Applications—Methodological and Technical Aspects. Sensors 2021, 21,4019. <https://doi.org/10.3390/s21124019>
- Beehive Air Therapy: Requirements for the Treatment of Patients. <https://www.beecurasystem.de/en/2021/04/14/bienenstocklufttherapie-voraussetzungen-fuer-die-behandlung-von-patienten/>
- Apiterapia - zdrowie z ula, inne metody leczenia. <http://www.apiterapia.net/inne/inne.html>
- Lecznicze właściwości osypu pszczół. <https://pasieka24.pl/index.php/pl-pl/pasieka-czasopismo-dla-pszczelarzy/150-pasieka-1-2017/1623-lecznicze-wlasciwosci-osypu-pszczol>

# References

- How to make added value products with dead bees.  
<https://teca.apps.fao.org/teca/en/technologies/8774>
- Osyp pszczół jako produkt do produkcji chitozanu.  
<https://pasieka24.pl/index.php/pl-pl/pasieka-czasopismo-dla-pszczelarzy/162-pasieka-2-2017/1652-osyp-pszczol-jako-produkt-do-produkcji-chitozanu>