

Beeswax

Beeswax is a multifunctional natural product with a variety of applications. Compared to synthetic waxes like paraffin from mineral oil or wax from animal or plant-based fats like stearin, beeswax is a natural and sustainable alternative. Because of its high value, beeswax is, however, often adulterated with cheaper waxes.



Especially since the high level of colony losses in Central Europe (2016/2017) caused by wax foundations adulterated with stearin, the topic of wax quality has been an important focus point for beekeepers. But beeswax is not exclusively used in beekeeping, but also in the production of candles, in the pharmaceutical field and in cosmetics. A big problem in this regard is that there have not been defined any universal quality standards for beeswax. This means that a lot of the beeswax available today

is marketed as

„pure and unadulterated“ while containing other waxes to different degrees.

We want to address this issue with as much openness and transparency as possible to contribute to maintaining the reputation of beeswax as a high-quality and natural raw material. Therefore, we will provide information about wax quality as well as giving an overview over our quality standards.

How do you detect adulterated beeswax?

Online you can find instructions for some „home remedies“ that are supposed to distinguish adulterated from pure beeswax, e.g. with a scratch or cutting test. Of course, there is no reason not to use these methods, it is however important to be aware that they do not provide any certainty concerning wax adulterations. A very high level of adulteration with other waxes can maybe be detected this way, but even adulteration levels of 20-30% should be difficult to establish if the wax was mixed “professionally”. The smell allows for limited conclusions about the quality of the wax but can also be synthetically influenced. On the other hand, pure beeswax can have a different smell than the one we are used to, depending on origin and external conditions,

without any negative consequences for the quality of the wax.

Real certainty concerning wax quality can only be achieved with analysis in a certified laboratory. Especially the gas chromatography (GC) shall be named here, since it allows for a variety of different adulterants to be detected with certainty.

Which quality parameters are used in the market?

With many offers online, only descriptions like „pure, unadulterated beeswax“, or similar expressions, are used without any verification of the quality. It should also be mentioned that beeswax should generally only be sold with the analysis for its respective lot (amount of wax with the same properties). Pay attention to this and ask about it with such offers – especially online the risk of buying adulterated beeswax is especially high!

Amount of total hydrocarbons

A lot of times the amount of hydrocarbons is used as an

indicator for pure beeswax, as long as they are below 18%. This limit was set by the candle industry ([RAL-GZ 041](#)) and thus refers to wax for producing beeswax candles. Apparently, the RAL standard does, however, allow for a certain degree of adulteration or the value was set very high in order to account for the heterogeneity of beeswax.

With actual pure beeswax, the amount of total hydrocarbons should, according to the most renowned laboratories in the field of wax analysis, be around ca. 14,5% for the European honey bee. Beeswax with 18% total hydrocarbons would very likely be declared at least slightly adulterated in a gas chromatography.

That is why the RAL standard also refers to the additional use of the gas chromatography in order to detect adulterants. In practice, this is, however oftentimes not implemented.

In conclusion, the amount of total hydrocarbons in beeswax can be influenced by mixing beeswax with e.g. paraffin and/or stearin, positively or negatively. Therefore the analysis of total hydrocarbons is not sufficient in order to exclude the possibility of adulteration. Further, the value of 18% is not a proof for purity and should be proven through a GC.

**Pesticides
and Varroacides**

Aside from the purity, the level of pesticides and/or varroacides are often mentioned. Often, beeswax is advertised with terms like pesticide free or low in pesticides, without a clear definition of what those terms mean exactly. Here it becomes also clear that the missing universal quality standards are an issue. Oftentimes this is proven with the help of analysis, the chosen analysis method should however be taken into consideration. Depending on the chosen laboratory and analysis, the LOQ (Limit of Quantification), i.e. the smallest detectable amount of pesticides or varroacides with this method, can vary vastly. Some laboratories offer pesticide analysis with an LOQ of 0,5 mg/kg, while other laboratories can detect residues of up to 0,01 mg/kg – 50 times more! Beeswax that has been analyzed with an LOQ of 0,5 mg/kg and shows the result „free from pesticides/varroacides“ could thus in an analysis at another laboratory still show residues under 0,5 mg/kg. Further, the analysis methods differ vastly in the type and number of analyzed residues. While some pesticide analysis detect residues of 15 pesticides/varroacides, there are alternatives that can detect over 250 substances.

Therefore it is important regarding the residues to not blindly trust the statements of the seller and to not “compare apples with pears.” A close look at the detectable amounts and

the analyzed substances can determine in how far the term „low in pesticides“ or „pesticide-free“ is actually accurate.

Which laboratory analyses are available for beeswax?

As mentioned above, many laboratories offer to analyze beeswax and use a variety of different methods and detection limits.

Some parameters of the RAL standard can be analyzed (dripping point, acid value, saponification value etc.), but those alone don't allow for a whole picture of the quality or purity of the wax. Also the amount of total hydrocarbons is often mentioned, but the GC is much more accurate and certain and thus more suitable for the analysis for adulterations.

Pesticide analyses are offered by many laboratories, but they vary significantly in accuracy and scope. Additionally, the GC can show impurities originating from yeast, bacteria, and viruses, as well as from medicinal products for bees.

Because the analysis of beeswax is quite expensive, the chosen methods often are limited to the expected problem fields, i.e. adulterations and varroacides. This is understandable from an economic point of view and in many cases also sufficient, but it also makes it easy for commercial blending to go undetected and increases the risk of dangerous substances and residues to be overlooked, if they are outside the expected scope of issues.

Which quality does the beeswax in Europe have?

Beeswax in modern beekeeping follows a cycle: Foundations from „old“ beeswax are added to the hives and later in the year the honey is harvested from the foundations. After extracting the honey, most foundations are melted and turned into new foundations or the additional wax is sold for other purposes (cosmetics, candles etc.). Because the demand for beeswax in the industry is constantly increasing and is way above the supply the European beekeepers can provide, beeswax is imported from other countries outside the EU, primarily Asia. Unfortunately, the imported wax is often analyzed insufficiently and does not meet the criteria of pure

beeswax. Because that wax becomes a part of the beekeeping cycle and is mixed with local wax, leads to a very low level of available beeswax in Europe that is not at least slightly adulterated (except for pure capping beeswax and closed wax cycles). This manifests in the amount of total hydrocarbons in beeswax, that, depending on the country, lies between 15,5-20% instead of 14,5% already. This is not a new development and a low level of paraffin in beeswax is not an issue for the bees. It just turns into a problem when the amount of adulteration with paraffin or stearin is high, as the wax scandal 2016/2017 shows.

Generally it can be said, that normally the beeswax coming directly from beekeepers in the EU has a decent quality, but almost always a certain degree of adulteration as well as low levels of residues from pesticides from the agricultural sector and/or varroacides from beekeeping. According to our experience, this is true for all European countries, but the degree can vary significantly depending on the country of origin.

Is all beeswax the same?

When talking about beeswax up until now, we were referring to wax from the European honeybee (*Apis mellifera*). There are however several subspecies of honeybees, whose wax differs from each other. The wax from the African honeybee for example has on average lower total hydrocarbons than that from the European honeybee. While these differences are presumably genetic and are not very significant, the external circumstances are relevant as well. Depending on the honey and pollen the beeswax can smell and look slightly differently without any influence on its quality.

What is special about African beeswax?

As mentioned before, the African beeswax has a slightly different composition than beeswax from other continents. The reason for importing African beeswax is on the one hand side that because of the beekeeping technique without foundations more wax is available and on the other hand that in more remote areas of Africa, it is possible to get completely pure and pesticide free beeswax. The pesticides are especially important because the spreading of modern agricultural techniques based on pesticide use makes it very difficult to find wax without any residues anywhere in the world. On top of that, the African honeybee is more tolerant towards the varroa mite and beekeepers usually don't have to

treat their bee colonies for it, so there are oftentimes no varroacide residues in the beeswax either.

Often the use of African beeswax is criticized because the bees are allegedly smoked and killed while harvesting the honey. This kind of honey harvest can still be found in some areas in Africa, but this does not mean that it is appropriate to generalize this critique. Beekeeping in Africa and the competences associated with it differ significantly between African countries and thus also lead to different quality levels of bee products. One reason for assuming that the bees are killed in the process of harvesting is among others probably the intense smoky smell of African beeswax.

While the problem is quite prevalent in some countries, the practice is not or rarely used in others. This depends in our experience more on the processing of the wax than on the beekeeper. African beekeepers tend to use more smoke than European beekeepers because the bees react more aggressively than the ones bred here but that does not automatically mean that the bees die in the process. Also the timeframe of use during the harvest is limited to a few minutes, while with wrong processing the beeswax is

often cooked for hours over an open fire.

In conclusion, the African beeswax, depending on origin and supplier can have an excellent quality that is rarely found in Europe, America and Asia. At the same time the wax can differ from the European beeswax in colour and smell, which is, however, not a problem in beekeeping. It is important not to generalize but to look at the respective lot and to make sure that the bees were kept species appropriate.

Which quality standards do we use?

All beeswax we offer fulfills at least the RAL norms for candle making. Because there are no binding quality criteria for wax in beekeeping, we offer our wax with an extensive analysis report for the respective lot and make a recommendation on whether we think the beeswax is appropriate for the use in beekeeping. This is based on the number of hydrocarbons and the result of the GC, as well as on the pesticide analysis. Most important for our evaluation is not only the maximum of pesticide residues but the total amount of pesticide-/varroacide residues. Our maximum limit for beeswax for beekeeping is 0,5

mg/kg, we talk about beeswax low in pesticides, when there are no residues over 0,1 mg/kg. We only call beeswax pesticide free when there are no residues found using the most extensive and accurate method (currently an LOQ of 0,01 mg/kg testing for ca. 260 substances).

Other than conventional beeswax we also offer organic beeswax as well as beeswax from organic beekeepers. The latter is imported beeswax for certified organic suppliers that is completely residue free and unadulterated but cannot be sold as an organic product because of general import restrictions for beeswax in the EU. This does not say anything about the quality or safety of the beeswax but is from our point of view caused by unintentional flaws in the EU law.

Which laboratories do we use?

For adulteration analysis we mainly use gas chromatography and supplement those with analyses of the total hydrocarbons and, if needed, an analysis via NMR (Nuclear Magnetic Resonance) for Triglyceride.

For pesticide analysis we currently mainly use [Intertek](#) or [Eurofins](#), because they have, to our knowledge, the broadest spectrum of pesticides/varroacides covered in their analysis, as well as the lowest LOQs i.e. can also find small amounts of residues.

Of course, we can arrange for further analysis if needed.

Openness and transparency are the most important factors for us when selling beeswax – we don't want to offer the cheapest „beeswax“ but real beeswax of a high quality at competitive prices, verifiable through reasonable analyses and communicated openly and honestly.