

INTERVIEWS / Re-Inventing Pine Oil, a Well-Known Natural Product

Interview with Norbert Topf, graduate engineer, VER Verfahreningenieure GmbH



Mr Topf, you sell pine oil. Where does your raw material come from?

I would like to start with a quote:

“The exterior of a plant is only half of its reality.”

JOHANN WOLFGANG V. GOETHE (1799)

We get all of our raw material from Binderholz, a company based in Brandenburg in Eastern Germany. Binderholz is one of the biggest saw mill operators in Europe. Its site in Baruth (Germany), for example, where they produce different kinds of wood products based on sustainable forestry, has a capacity of 2 million solid cubic metres. [1] The entire raw product and production chain is PEFC certified. We get our raw product, freshly harvested pine wood, specifically from Baruth.

In line with forestry regulations and to ensure sustainability, all the harvested areas are being reforested for generations to come. Thus, we can be sure that we will have enough pine wood for our production process for the next decades.

Can you tell us something about the way you extract your product?

To extract our products (refer to image 1), pine wood pellets, pine hydrosol and our 100% natural essential oil, we use DFT[®] Steam-Fluid-Drying, a process which has been developed specifically for this purpose and patented by me.



Image 1: The Products **pine-pellets, pine-hydrosol, essential pine oil**

As known and according to the prior art, essential oils are produced by the so-called water vapour distillation process or by ex-traction processes with excipients, here specific solvents

Other than many wellknown processes, we use a continuous process where one or several reactors are being heated indirectly using steam at 20 bar or using thermo oil. The pine wood is being inserted into the reactors continuously and afterwards being heated from an ambient temperature of 20°C outside of the reactors to 120°C inside the reactors. During this process step, the herbal water and part of the essential pine oil contained in the pine wood evaporate without the need to add any additives or chemicals – i.e. in the purely aqueous phase. This very gentle process step keeps both the plant substances and the essential pine oil in their pure form. After the evaporation process and the removal of dust and other solids, we condense the herbal water and its ingredients. This step is called separating liquid azeotrope mixture – discharging pine hydrosol containing the plant substances and a small percentage of essential pine oil (about 1.0 vol. %). Also, you get germ-free, 100 % natural essential pine oil. At the same time, we are able to recover the evaporation heat used in process in the form of heating energy (95°C to 97 °C). This process-related energetic advantage can lead to

savings in heating energy of up to 75 % (depending upon the site). And, what I would like to stress here, in some cases, we do not even process the needles or the copse but only the trunk.

Also, the pine wood solids introduced into the reactors with a starting moisture content of 40 to 50 m % will be dried to a final moisture content of 5 to 7 m % at the end of the process. We process these dried solids into pellets using a press with a machine-pressure of about 200 bar so that they are ready for further use. We do not need any additives (binding material) in the process. Thus, in contrast to other processes used for extracting essential oils, our DFT® process converts 100 % of the raw material used into 100 % saleable products.

All of our products are purely organic and 100 % germ-free with a pH value of 4.0. Additionally, our products show other important characteristics such as antiseptic, antibacterial and antiviral behaviour.

Thus, our pine products can be used in different scenarios:

- Our germ-free pine pellets with their antibacterial characteristics are mainly used in the agricultural sector as animal bedding for cows etc. but also for small animals in the domestic environment, i.e. for cats, hamsters, doves, rabbits. Here, the important characteristic is the low pH value of 4 (slightly acidic). Our litter binds the ammonia in animal excrements to a great degree and thus keeps harmful bacteria away from the pets.
- Our pine hydrosol is mainly used as a purely plant-based detergent and disinfectant. But it can also be used as a plant fortifier for the cultivation of crops. [2] Recent studies (2020) from the Julius-Kühn Institute in Berlin have shown that using our pine hydrosol with the rapeseed plant can lead to a significant decrease of the pollen beetle pest. Thus, it is proven that there is a purely organic plant fortifier for organic crop cultivation.
- Our 100 % pure essential pine oil (scots pine, *Pinus sylvestris*) shows all the characteristics of high-purity oils which have been known for decades. A targeted use of these antibacterial and antiseptic effects can heal, amongst others, respiratory diseases or lessen rheumatic complaints.

We must also mention here that the use of essential oils, in this case pine oil, can cause unintended side-effects, i.e. allergic reactions. “The 100 % essential oil concentrate should be kept away from children.”

Another area of application of essential pine oil is its targeted use to combat viral diseases. There has been very successful research regarding the use of pine oil against

the herpes virus. When it comes to other viral diseases, for example the spreading of the Covid-19 viruses, the prophylactic use of pine oil in spreading areas (purely plant-based disinfection) should be investigated as soon as possible.

And most recently, several plastic manufacturers have started tests where they inserted pine oil into their plastic compounds to create a surface with a long-lasting antibacterial effect for their plastic products (i.e. door handles or handrails).

What are the advantages of an extraction on a purely aqueous base?

We have used the DFT® process in Reichstädt (Germany) to extract pine oil on a purely aqueous base and have seen that this allows very gentle processing. We do not use steam or other extraction agents. Instead, we evaporate the water contained in the pine wood which in turn contains the plant substances. This creates an inert native steam atmosphere. As it is a continuous process, it is not necessary to supply auxiliary steam for inertisation. Thus, the plant substances are not being diluted or changed, i.e. they are continuously being discharged from in the process in their purest form. After their discharge, neither the plant hydrosol nor the essential pine oil need additional treatment and can therefore be packaged ready for use.

Do you have any test analyses?

In November 2020, we asked the Institute of Plant and Wood Chemistry of the Technical University Dresden/Germany (Prof. Dr. rer. nat. habil. Steffen Fischer) **to perform a complete analysis of our 100 % pure essential pine oil [3]**. In August 2020, the well-known “Julius-Kühn Institute” in Berlin performed further analyses of the pine hydrosol.

In December 2019, AmiSTec GmbH/Austria (lead by CEO Prof. Dr. med. J. Peter Guggenbichler) did some research on the use of pine hydrosol and pine oil as detergents and object care products [4]. He recommends the use of our products in hospitals and public institutions.

Regular examinations of the antibacterial effect and sterility of our pine litter pellets performed by external laboratories such as the LGS Servicegesellschaft mbH are part of our production process and of our product liability.

What can you tell us about antimicrobial and antibacterial characteristics of pine oil?

I would like to start by referring to a work by Prof. Dr. Kornelia Smalla a.o., published in Holz-Zentralblatt no. 147 on December 8th, 2000 [5]. Back then, they proved that it is specifically the wood of the pine tree that can create an antibacterial effect. The source of these antibacterial characteristics is in particular the plant substance of the pine tree.

More or less by accident, we saw in 2014 that our pine tree litter pellets showed the same positive effect. Thus, from 2014 to 2018, we did extensive research in the field of poultry management and using pine tree pellets as litter for dairy cows. We could observe a significant decrease in the bacterial load in the milk of these dairy cows. In poultry management, the use of our pellets has led to a considerable improvement of animal health and a higher fattening performance since 2014 (until today). We have also been able to achieve a significant decrease in the use of antibiotics – in particular in turkey rearing and fattening. Sometimes, no antibiotics were used at all in turkey rearing... which proves that animal-rearing is possible without antibiotics!

Let's get back to our products pine hydrosol and pine oil. As I have already mentioned, Prof. Dr. med. P. Guggenbichler from Austria has done some research and I quote "...has proven excellent antibacterial and antimicrobial characteristics..." [4].

We are currently doing more research for all of our products based on pinewood.

Thinking about Covid-19: What are possible use cases for pine oil here?

That is definitely a valid question and without having to be a prophet here, I would like to say that we need to take a closer look at sanitation based on purely plant-based raw materials.

We will need to collaborate with other scientific fields such as materials research, the pharmaceutical industry and human medicine. But also veterinary medicine: Here, I would like to point out that, for example, products based on pine wood have been used against the H5N8 virus, better known as "Avian Flu". Some keywords to be mentioned here are animal rearing without antibiotics and suppressing antibiotic resistant microbes.

In addition to using it as a disinfectant: Where else could you use pine oil in the Home and Personal Care sector?

In addition to the use cases already mentioned, it would make sense to use our purely plant-based products to produce alcohol-free disinfectants and cleaning agents for the recreation and sports sector, e.g. in fitness studios, public swimming pools. There are many possibilities but in the end only the feasible and the affordable ones will prevail.

What is your supply capacity?

As of today, the production capacity of our plant in Reichstädt (Germany), which was planned in 1995 and has been in use since 1997, is as follows:

Product	Brand	Quantity per year
Litter pellets w/ pH4	DEUTSCHE-EINSTREU	Up to 5,000 tons
Essential oil w/ pH4	MAERKISCHES-KIEFERNÖL	Up to 10,000 litres
Hydrosol w/ pH4	MAERKISCHES-KIEFERNWASSER	Up to 1,500,000 litres

We are already designing a project with our engineers aiming for a much higher production capacity.

Product	Brand	Quantity per year
Litter pellets w/ pH4	DEUTSCHE-EINSTREU	150,000 tons
Essential oil w/ pH4	MAERKISCHES-KIEFERNÖL	450,000 litres
Hydrosol w/ pH4	MAERKISCHES-KIEFERNWASSER	100,000,000 litres

To implement the expansion project, we need an exact market analysis for distributing the Pine Wood related products. These analyses are currently being carried out. If the market studies turn out favourably – I would like to point out the study “Market report “GLOBAL PINE OIL MARKET”, November 2020” here – we can start building our large scale plant in 2022 and start production in 2024!

List of references (all documents only available in German):

[1] www.binderholz.com/fileadmin/user_upload/pdf/pruefzeugnisse-zulassungen/PEFC.pdf

[2] Dipl.-LM-Chem. S. Kümmeritz, Biologische Tests mit Kiefernhydrolat gegen den Rapsglanz-käfer August 2020, Institut für ökologische Chemie, Pflanzenanalytik und Vorratsschutz, JKI-Berlin Bundesforschungsinstitut für Kulturpflanzen.

[3] Prof. Dr. rer. nat. habil. S. Fischer, Analysebericht der Extrakte von Pinus sylvestres Nov. 2020, Institut für Pflanzen-und Holzchemie, Technischen Universität Dresden.

[4] Prof. Dr. med. P. Guggenbichler, Bewertung der Antimikrobiellen Tests für Kiefernhydrolat und Kiefernöl Dez. 2019, Firma AMiSTec GmbH aus Österreich.

[5] Prof. Dr. Dr. hc. Kornelia Smalla u.a., Kiefernholz als natürlicher antibakterieller Rohstoff... Holz-Zentralblatt Nr. 147 Dezember 2000, Institut für Epidemiologie und Pathogendiagnostik am JKI-Braunschweig Bundesforschungsinstitut für Kulturpflanzen.

[6] Translated by Diploma Translator Andrea Frankenbach

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