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# Tonsil<sup>®</sup> – production on 4 continents



Aerial photograph of our works in Moosburg, Upper Bavaria

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Our production facilities (top to bottom): Indonesia, Mexiko, Spain, Peru, Republic South Africa, Brasil



## Development of Tonsil<sup>®</sup>-bleaching earths – historical background

Naturally-active bleaching earths have been used under the name of "fuller's earth" since about 1880. The discovery goes back to information which indicated that, in the orient, the colour of olive oil was sometimes improved by the addition of clay.

Clay Silicates, "Tonsilikate" in German, such as bentonite, can be transformed into highly active bleaching earths by treatment with acid. This discovery was made at the beginning of the last century, when the acidic activation of bentonite - the main constituent of which is montmorillonite – was invented independently in two laboratories. The process was then improved, and a new facility was built at Moosburg, which to this day is still our main plant for the production of Tonsil® bleaching earths. The original use as a colour reduction agent to lighten dark oils has undergone some major changes in the course of the

years, thanks to new modern technologies. Bleaching earths have been developed into adsorption earths, in which context not only the high adsorption capacity of colour bodies and other undesirable oil constituents are of major importance, but also their acidic and catalytic properties, as well as their ionexchanging capability.

Tonsil® is the brand name of our highly-active bleaching earths, which are created from natural bentonites by acid activation. Thanks to persistent research and development, we are in a position today to offer a wide range of tailor-made Tonsil® grades.



Manufacturing oil about 1580 (copperplate by Galle, after Jan van der Straet)

Their properties are especially adapted to suit the requirements of our customers, requirements which often differ very widely. The consistently high quality of our products over decades, and our intensive co-operation with customers all over the world, have made Tonsil® bleaching earths a name which is recognised and appreciated all over the globe as a leader in its field.

We have taken account of this major significance of our bleaching earths, for the manufacture of vegetable and animal oils and fats as a basic foodstuff, by the establishment of production facilities in a variety of different regions. Our "Adsorbents and Additives" Division today operates state-of-the-art plants in Germany, Indonesia, Mexico, Spain, Peru, South Africa and Brazil.

## Structure and effect of Tonsil<sup>®</sup>-bleaching earths

The source material for all activated bleaching earths is the mineral montmorillonite. Montmorillonite is an aluminium hydrosilicate, in which the proportion of silicic acid to alumina is about 4:1.

A single montmorillonite crystal is made up of about 15 layers. As the figure on the right shows, the individual layers feature a total of three layers. The two outer layers are silica sheets, composed of SiO4 tetrahedra, envelope a central sheet of aluminium ions, with the result that each aluminium cation is surrounded in octahedral form by oxygen atoms of the silicate groups. By introducing trivalent aluminium and iron ions into the silica sheets, or bivalent magnesium and iron ions into the central sheet, a sheet package of this nature is negatively charged, which is compensated for by the presence of cations between the individual sheet packages. These cations can be easily replaced by others of stronger binding affinity.

Our crude clays, especially those from Lower Bavaria, contain calcium ions by nature, as well as numerous water molecules embeded between the lavers, which provide this material with its special properites, such as its saponaceous consistency and

the conchoid fracture. A lump of this clay, which is called calcium bentonite for short, is depicted at the top of page 6.

In this initial form, the crude clay cannot be used as a bleaching earth, since it contains well over 40% water, and shows no bleaching activity. To produce highly-active bleaching earths, chemical activation is necessary, which is carried out at our works by means of an elaborate process using mineral acids.

In the first stage of acid activation, the outer calcium ions are replaced by H+ ions, which form what is referred to as an H-bentonite. In the course of



Red = Oxygen; Dark Green = Silicon; Silver = Hydrogen; Light Green = Aluminium; Pink = Calcium

further activation, the individual layers are directly attacked by the mineral acid, and various ions, such as aluminium, iron, calcium and magnesium are released from the lattice. The acid accordingly penetrates from the surface of the crystal deeper and deeper into the crystal structure of the individual layers, which causes the inner surface of these crystal platelets to increase in size, and active acid centers to be formed.

During the decomposition by acid, an optimum degree of activation is reached. Further chemical treatment reduces the activity again, and finally leads to the dissolution of the crystal and the formation of silicic acid.



Above: Indonesian Clay Below: Porosimeters for determining pore diameters and pore volumes



This description shows that an optimum is passed during the activation process. At this stage, the acidactivated clay has the best bleaching properties for the manufacture of a high-quality bleaching earth.

Another essential quality feature of the bleaching earths is the particle size distribution which is determined by the process stages which follow the chemical activation.

First the remaining insoluble constituents, referred to as the filter cake, is filtered off from the excess acid and the dissolved metallic salts, and washed very thoroughly. All the adhering acid residues and metallic salts are completely removed. Following the washing process, the filter cake is carefully dried, and adjustable classifiers guarantee the desired particle size distribution required to obtain a bleaching earth with high activity and, at the same time, excellent filtration properties.

The activation of the crude bentonite provides the bleaching earths with the following properties:

- The outer calcium ions are replaced by protons, which results in a high ion exchange capability, and special catalytic properties. The bleaching earths are provided with the properties of a solid mineral acid.
- 2. A large number of acid sites are formed in the montmorillonite crystals, due to the removal of metal ions from the crystal lattice and the formation of silanol groups and amorphous silicic acid, which is bound to the montmorillonite crystal.
- 3. Thanks to the development of a large internal surface, the original small surface area of the raw material is increased many times over. Depending on the type of bleaching earth, this ranges between 120 and 300 m<sup>2</sup>/g, while the crude clay, for comparison, features some 70m<sup>2</sup>/g.
- 4. Careful drying and classification of our bleaching earths ensure easy and fast filtration.

This enables the essential properties of the bleaching earths, and their most important quality features to be defined:

- Adsorptive capacity
- Acid properties
- Catalytic properties
- Ion exchange capacity
- Particle size distribution

# Application of Tonsil®-bleaching earths in the food industry

Bleaching earths have been used in the refinement of edible oils and fats since the end of the 19th century, while our Tonsil<sup>®</sup> bleaching earths have been used for this purpose for about 100 years. Even today, this application is still one of the most important areas of use for bleaching earths. The entire oil and fat production worldwide currently stands at more than 100 million metric tons per year, while reliable forecasts indicate a further increase in production and demand over the decades to come. These figures alone indicate the importance which bleaching earths have in the supply of nourishment for the world's increasing population.

For reasons of consumption capability, and especially storage stability, by far the larger proportion of crude oils and fats have to be subjected to processing: i.e. they undergo industrial refining. With the current state of the art, a distinction is drawn between two different processes: the traditional alkali process and physical refining. The key difference between the two processes is the method by which the free fatty acids contained in the oil are removed. As can be seen from the process diagram (page 9), this takes place, with the traditional alkali process, by means of diluted lyes



and soda solutions, while with physical refining, the fatty acids are removed by destillation.

The aim of both these processes is to obtain a stable fully-refined product, which, based on international quality criteria, features in general oil and fat which are free of colour, taste and smell, and which can be subjected to further processing for the widest possible scope of applications. This very general quality definition of a refined oil is, as a rule, laid down much more accurately by individual specific numbers, referred to as characteristic values.

### Content of free fatty acids (ffa content)

Fully refined oils of good quality (refined, bleached, and deodorized products of high quality) feature ffa contents of less than 0.1% (normal range 0.01 – 0.05%, in most cases related to oleic acid content). The ffa content of crude oils depends to a high degree on their quality. In very general terms, the quality deteriorates as the ffa content rises. Good crude oils have ffa ranges of less than 5%, mostly in the range of 0.5 - 3%. Crude oils with higher contents than 10% ffa are to be regarded as spoiled and, in most cases, are no longer suitable for use in the food

industry. As a rule, they are difficult to refine.

### Colour values

In the edible oil industry, the Lovibond-scale is generally used. Different cells are available (1 1/4", 2", and 5 1/4"). Yellow and red colour values are measured (blue and white values are available, but are seldom used). Bleached and deodorized oils should exhibit colour values of between 1.0 and 3.0 Lovibond red and 10-30 Lovibond yellow (5 1/4" cell); in other words, a pure yellow colour. The colour of crude oils is, in most cases, of little information value.

Main area of application for Tonsil<sup>®</sup> bleaching earths is edible production

![](_page_4_Picture_0.jpeg)

Above: Lovibond Tintometer for colour determination of oils and fats **Below: Bleaching apparatus** for laboratory research into oils and fats

The totox value is being increasingly used as a characteristic value for the overall degree of oxidation (total oxidation) of triglyceride.

This is calculated using the formula:  $Totox = 2 \times PV + AnV$ 

Totox values of >30 are indicative of oxidated oils and fats.

### Gums (phosphatides)

These substances are naturally present in most oil plants, and pass out of the cell walls and membranes into the crude oil during oil production. In some vegetable oils, soybean oil in particular, the phosphatide content can amount to as much as 2.5%, but as a rule, it lies in the range from 0.1 - 1.3%. The gums are phosphoric acid esters owf diglycerides (phosphatides) and need to be removed as far as possible from the oil because of their negative effect on stability, colour and taste. Refined, bleached, and deodorized products of high quality should

show phosphorous contents which are well below 5ppm (normal is 1 – 3 ppm P).

### Colour bodies and pigments

Most triglycerides (which are in fact the main constituents of oils and fats) feature only a slight natural colour (colourless to pale yellowish). The deep colour of many crude oils results from small quantities of various colour bodies and pigments, the most important of which are carotene and carotenoids (yellowish-red to deep red colour), as well as chlorohpyll and its derivates (deep green colour). While carotene can be regarded as a more or less valuable accompanying substance (antioxidant, provitamin), with numerous attempts accordingly being made to obtain it, chlorophyll is a pro-oxidant, and, because of its intense colour, severely impairs

quality and must be completely removed. Strict specifications prescribe the limit value at 50 ppb (= 0.05 ppm).

#### Heavy metal contents

Heavy metals are present in oils and fats in small quantities (mostly Fe, Cu, Ni and As), either complexed in gums and pigments or as metallic soaps (especially after hydrogenation). These act as powerful oxidising catalysts, causing the formation of radicals, and therefore need to be removed in their entirety. Arsenic frequently occurs as a natural

![](_page_4_Figure_13.jpeg)

![](_page_4_Figure_14.jpeg)

![](_page_4_Picture_15.jpeg)

### Degree of oxidation

The quality of edible oils depends directly on the quantity of oxygen absorbed. The peroxide value (PV) determines the content of peroxides formed in the oil, while the anisidine value (AnV) indicates the content of oxidation products (aldehydes, ketones). A high content of peroxides (PV>10) and a high anisidine value (AnV>10) are typical of oils with a high oxidation level.

The UV absorption of the oil (UV extinction) characterises the content of isomerised, polyunsaturated fatty acids, from which conclusions can be drawn as to the peroxide content of the oil prior to refining. As a rule, UV extinctions provide information on whether oils or fats have been refined (lard. olive oil).

impurity in fish oils, and has the effect of a powerful poison on hydrogenation catalysts. Refined, bleached and deodorized products of high quality should not exceed the threshold value of 0.1 ppm for individual metals.

A series of other characteristic values exists, such as the iodine values (IV), the saponification value, melting points, the solid fat content (S.F.C.), etc., which are of less significance for the refining process, but which nevertheless play an important part in the hydrogenation of fats.

### Use of Tonsil<sup>®</sup> in the industrial oils and chemical sector

![](_page_5_Picture_1.jpeg)

### Industrial triglycerides

After refining, industrial triglycerides are used mostly for the manufacture of paints and varnishes, for soap production, and for the manufacture of fatty acids and their oleochemical subproducts. In most cases, the basis taken is raw animal body fat, which is processed in the same way as edible oils and fats (see page 9. General process diagram showing how edible oils and fats are obtained); the bleaching conditions, however, are generally harder, and subsequent deodorization is frequently done away with.

### Linseed oil

The majority of linseed oil produced in Europe is used in the manufacture of paints and varnishes (lacquers). The crude linseed oil is in most cases degummed with water and acid, and then bleached under standard conditions (T = 90 - 100 °C, t = 30 min, p = 50 - 100mbar). In order to attain the specifications of Gardner colour values 3 - 4 and phosphor content of P<5 ppm, Tonsil<sup>®</sup> qualities with very high levels of bleaching activity are often used, for preference from the Supreme or Optimum range.

### Castor oil

Brazil and India are the largest producers of castor seed, and also the largest exporters of refined castor oil. A distinction is drawn between what is referred to as pressed

oil, from the pressing of the seed, and the extraction oil, which is acquired by hexane extraction, and which, in comparison to pressed oil, is rather difficult to bleach. In many cases, too, a blend of both oils is refined. The bleaching process is mostly carried out with Tonsil® Optimum qualities at mild temperatures (about 90 °C), often with the addition of activated carbon (up to 30% proportion in relation to the bleaching earth), in order to avoid the water splitting off from the ricinoleic acid (12-hydroxy oleic acid). Castor oil and its sub-products have a broad range of applications in the pharmaceutical and chemical sectors, as well as in the paint and varnish industries.

### • Biodiesel from rapeseed oil

By means of inter-esterification with methanol, rapeseed oil methyl ester (RME) can be manufactured from fully refined rapeseed oil and is sold as fuel under the tradenames "Biodiesel" or "Biofuel", or simply RME. Rapeseed methyl ester is used as an

![](_page_5_Picture_12.jpeg)

![](_page_5_Picture_13.jpeg)

additive to Diesel fuel and frequently as a Diesel substitute, in particular in the public local transport sector (busses, taxis), by local authorities, in the forestry sector, and in agriculture. The fully refined rapeseed oil used as an intermediate product has hitherto been manufactured in the conventional manner, and in most cases is of food grade oil quality.

#### Fatty acids/soaps

To manufacture fatty acids and their oleochemical sub-products (fatty acid esters, fatty alcohols, fatty nitriles, fatty amines, etc.), and to manufacture soap, use is often made not only of beef fat and mutton fat, palm stearin, and palm kernel oil, but also of byproducts from the vegetable oil refining process (split fatty acids, fatty acid distillates), and lowerquality vegetable oils with high FFA contents (> 10%). On a major industrial scale, triglycerides are split using steam at high temperature and under pressure, and on a smaller scale by saponification using sodium lye or other alkalis. The triglycerides used can in most cases be bleached very economically, prior to splitting, with Tonsil® bleaching earths, with the exception of what are referred to as sour oils, vegetable oils with an extremely high FFA content. Fatty acids, by contrast, can only be bleached with difficulty (because of the negative polarity); for bleaching soaps, Tonsil® bleaching earths are entirely unsuitable since they are completely neutralised and become glutinous.

### Hydrocarbons on a mineral oil base

During the 'fifties' and 'sixties' there were still a large number of products from mineral oil fractionation being refined by acidulation and bleaching. For reasons of costs and environmental protection, this process has been replaced by more modern hydrogenation processes (hydrotreating, hydrofinishing, etc.). It can be foreseen that acid treatment using concentrated sulphuric acid will largely disappear in this sector, in particular with regard to the refining of paraffins and the regeneration of used motor oils.

The requirement for highly active Tonsil<sup>®</sup> bleaching earths may have dropped in terms of volume in certain individual sectors as a result of this, but in the main it has secured its place in the market. This can be attributed in particular to its simple and economical application, and the environmentally-friendly disposal of the spent bleaching earths, for example in the cement industry (see also section entitled " Instructions for the use of spent bleaching earths").

#### Paraffins and waxes

The bleaching and subsequent treatment of paraffins and waxes with our highly active Tonsil<sup>®</sup> bleaching ea cc te ea 0. sh of qu nu bl cc • La m ree an

![](_page_5_Picture_24.jpeg)

earths are normally carried out under atmospheric conditions in open batches under stirring at temperatures of about 90 – 120°C. The bleaching earths are usually applied in volumes ranging from 0.5 - 3.0% for economical reasons, the 5 % mark should not be exceeded. Depending on the quality of the paraffins and waxes used, different Tonsil<sup>®</sup> qualities are applied, from the standard range or as a number of special qualities. The specification for the bleached waxes lies within the range of the ASTM colour values (D 1500) from 0.5 - 1.0 and less.

### Insulating oils

Large volumes of insulating oils are processed to make transformer oils and cooling oils, which are required to feature special electrical characteristics and a high level of ageing stability. Post-treatment with highly active Tonsil® bleaching earths, especially Tonsil® 411, offers the security that contaminant traces of impurities, such as electrolytes, products of oxidation, etc., can be removed and that no corrosive sulphur is added. In most cases, bleaching is carried out under atmospheric conditions at about 100 °C

![](_page_6_Picture_0.jpeg)

Left: Disposing of waste oil

and a contact time of 30 minutes. If desired, the procedure referred to as the "silver strip test" can be included in our quality certificate as a test feature.

#### • Rolling oils

Our Tonsil® bleaching earths are used mainly in the aluminium industry, but also in other metalprocessing industrial sectors, for purifying rolling oils, functioning, for example, as sliding and lubricant agents in the manufacture of foils and films. Rolling oils, as a rule, are made from mixtures of aliphatic hydrocarbons with a variety of different additives. In the course of use these rolling oils become contaminated with metal abrasion fragments, water and other lubrication oils, which finally leads to their replacement and redistillation.

Thanks to the use of our highly active Tonsil® bleaching earths, the service life of these rolling oils can be substantially extended. In practice, a number of different systems are used, mostly Tonsil® bleaching earths in powder form, in mixtures with filter acids in the ratio 1:4 - 5, or Tonsil® bleaching granulates in suitable filter cartridges.

The mixtures are applied to the used rolling oil in open stirring tanks, the suspension is heated, and then filtered off after about 20 - 40 minutes of contact time. Horizontal plate filters are often used for the filtration process, with continuous filter paper.

### Waste oils

Another special area of application for Tonsil® bleaching earths is the preparation of waste oils for the regeneration of lubricant oils (motor and engine oils). The traditional process, referred to as contact distillation, has been replaced more and more over the past few years by distillation processes, which operate without acidulation with concentrated sulphuric acid, and therefore avoid the creation of acidic tars (acid sludge), which are hard to dispose of (see diagram on page 13).

Mill train in an aluminium

production plant

After the rough mechanical cleaning and dehydration of the waste oils, the main stages of the process are those of contact distillation:

- Heat treatment at about 300 °C to break down the oil additives
- The acidification stage with concentrated sulphuric acid, and the seperation of the precipitated acidic resins
- The bleaching step during contact distillation under vacuum at about 300 °C, which comes next in the sequence.

In the distillation process (see diagram on page 13), the acidification process is done away with entirely; by contrast, the waste oil is distilled over as far as possible in special columns under vacuum, and broken down into two to three fractions. These fractions are, as a rule, treated separately with bleaching earth under vacuum, at temperatures from 260 – 340 °C. The base oils achieved with differing viscosities in most cases show ASTM colour values from 2.5 – 3.5; depending on the requirement, they are blended and reformulated using additives.

Under these very hard bleaching conditions with waste oils, bleaching earths funciton both as cracking catalysts as well as adsorption media. In the crack process, long-chain polymers and oxidised components are split and then distilled off. Nonvolatile impurities, such as acidic tars and resins, and sulphonic acids are adsorbed. The secondary raffinate which is obtained after treatment with bleaching

![](_page_6_Figure_16.jpeg)

earth is a high-quality lubricant, which is no way inferior to the primary raffinates in terms of its performance properties. High active Tonsil® bleaching earths make a major contribution in this context to the regeneration of valuable raw materials.

### Solvents for dry cleaning

A number of different filter cartridges are used in the dry cleaning sector which, among other constituents, contain highly active Tonsil® bleaching earths, and serve to purify the washing liquor. This liquor consists essentially of chlorinated hydrocarbons, or, more recently, of pure hydrocarbons (solvents) and different tenside additives. In this special area of application, Tonsil<sup>®</sup> 414 FF has proved its worth in particular, since it is capable of adsorbing fatty acids, fats and oils, paints, acid traces, and many other impurities from the washing liquor, and so substantially improves the cleaning properties and service life of the liquor.

### **Research and Development**

![](_page_7_Picture_1.jpeg)

Thanks to very close co-operation with our customers, based on mutual trust, we have come to know many of their problems, tasks, and goals. This in turn means that we can tackle the local pecularities of the individual markets directly at the location concerned.

New findings and developments are made accessible to everyone concerned, thanks to an intensive arrangement for the exchange of information and experience between the R&D laboratory, the Production Division, Application Service, and Sales in the region, as well as by means of the worldwide interlinked association of our Bleaching Earths Division. Because of the global control of our activities, new findings can be used for our customers' benefit rapidly and efficiently.

In many countries of the world, Tonsil<sup>®</sup> is a synonym for activated bleaching earths; and for us, this is both a challenge and an obligation for the future.

Top: Atom adsorption spectrometer for metal analysis Middle: HPLC instrument for the determination of polycyclic aromatic hydrocarbons Bottom: Element analyzer for C, H, N and S-analysis

Research and Development are of outstanding strategic importance in our company. The aim of our activities is to provide our customers with the most suitable Tonsil® qualities for their needs, and so offer the greatest possible efficiency – maximum utilisation value for the lowest possible costs – in the use of our products. Five R&D laboratories, equipped to the latest state of the art, close to our production facilities, and the engagement of qualified and experienced technical personnel, form the foundation for the continuous development of new products, and for the rapid and flexible optimisation of existing Tonsil® qualities in Europe, America, Asia and Africa.

![](_page_7_Picture_7.jpeg)

# Securing raw materials – certified acquisition of bentonite

Highly active Tonsil<sup>®</sup> bleaching earths have hitherto been manufactured mainly from domestic reserves of bentonite. We obtain this raw material from open-cast quarries in the area around our Moosburg plant.

Thanks to the intensive exploration work by our geologists, the bentonite reserves for all our types of bleaching earths have already been precisely determined today in cartographic terms (by means of borehole charts) for the next fifteen years, and excavation secured by contract with the landowners. According to caution estimates, related to our present state of exploration and average requirements, domestic bentonite reserves are forecast to be sufficient for at least 30 years. Up to now, however, new reserves have repeatedly been found, in approximately the same volumes as are already being exploited from open-cast bentonite mining.

Irrespective of this secured raw material base for our Moosburg plant, clay minerals, for preference sheet silicates and, of course, bentonites in particular, are being tracked down in every geologically favourable region, and examined and assessed for their industrial potential.

![](_page_7_Picture_12.jpeg)

Over the years, we have accordingly acquired a vast store of knowledge about many bentonite deposits all over the world, and invested in many new production sources.

The bentonite deposits, most of which are lenticular in shape, are located beneath a layer about 30-40 metres thick, composed mostly of sand or marl, which is carefully extracted in the open-cast process; the bentonite which lies beneath is then selectively removed.

In our bentonite laboratory, the thorough examinations of samples from all production quarries, referred to as preliminary tests and clay impact tests, are constantly monitored with regard to quality and the respecting of the predetermined specifications, and compared with the data from the quarry plans. Overall quality assurance in our mining facilities in Germany is based on DIN ISO 9001/14001, and has been certified accordingly since 1992.

All open-cast quarries are completely replanted after the bentonite has been removed, the morphology restored, and handed back to the landowner in

almost the same geotechnical condition as it originally was. At the request of the local authorities or the owners, however, measures may also be taken which will avoid, for example, the creation in the future of monocultures, and which will improve the fertility of the soils or prevent severe erosion. The establishment of moist biotopes at suitable locations is a possibility which is eagerly taken up.

The actual recovery of bentonite is controlled to meet the requirements of our clay chemical plant, closely matched to the needs and wishes of our customers.

Mining raw clay from open-cast pits

## Certified manufacture of highly active Tonsil<sup>®</sup>-bleaching earths

Thanks to very careful monitoring of the raw materials which we use and a large number of quality control procedures during the production process, through to the goods departure inspection before dispatch, we have been able to guarantee for many years that our Tonsil® bleaching earths are of excellent and consistent quality.

With the introduction of a certified quality assurance system at our main plant in Moosburg, based on DIN ISO 9001/14001, in 1992, all measures have been directed towards quality assurance according to this standard, and implemented into a fully documented system. This has undoubtedly led to the raising of our quality level still further in the manufacture of Tonsil® bleaching earths, and to increasing the performance of our production facilities.

A large silo storage system makes it possible for us to carry out deliveries to our customers promptly and reliably at all times.

Average samples are taken from all Tonsil<sup>®</sup> deliveries which are dispatched, by means of an automatic sampling system. These samples are run through the physical and chemical inspections of our quality control process, and only after careful examination of these date is the product approved for dispatch.

If desired, our customers receive a quality certificate with every consignment, which, as a rule, contains the following examination features:

- Humidity (water content at 110 °C, 2h)
- pH (10% suspension filtered)
- Dry screening residue to 63 micron
- Filtration time
- Apparent bulk density (indicative)

The bleaching activitiy is determined as a matter of routine, as an especially important parameter for assessing the quality of our various different Tonsil® bleaching earths.

![](_page_8_Picture_12.jpeg)

Laser instrument for particle size analysis

### Bleaching activity

The bleaching activity of a specific Tonsil<sup>®</sup> quality should, as far as possible, remain constant. Guaranteeing this is one of our most important tasks. To determine whether this is being done, bleaching tests are carried out for comparison with a standardised bleaching earth and the bleaching earth which is to be tested. To do this, within the scope of our international Süd-Chemie standard methods, a test oil is used, difficult to bleach and defined according to acid value and colour. The colours of the bleached oils can be compared colorimetrically with one another, and tested in the spectral photometer; this ensures that even the smallest colour variation can be reliably detected. In order to achieve a better assessment of the bleaching activity for our client, the comparison bleaching tests are often also carried out with the corresponding oil samples from our customers' refineries.

The assessment of these quality tests, over many years, provides an impressive picture of the consistency of quality of our Tonsil® bleaching earths, and of the considerable fluctuation in the oil qualities of the different oil seeds.

![](_page_8_Picture_17.jpeg)

Grinding and drying installation at our Moosburg facility

### Humidity

The humidity of the Tonsil<sup>®</sup> bleaching earths is adjusted to 3-9% in our combined grinding and drying facility, and checked on every single consignment at the goods dispatch inspection. If specially requested, a determination can also be made using the Karl Fischer titration method, which, in terms of precision of measurement, provides largely identical results to the drying method.

### Acidic properties

As a matter of routine, the acidity of our Tonsil® bleaching earths is also inspected. To do this, the residual acid content and the pH value of the aqueous extract is determined. Usually, the pH value is located in the weak acidic range, special qualities may deviate from it.

### Particle size distribution and filtration properties

The particle size distribution of Tonsil® bleaching earths is determined by means of gentle air-jet screening in the size range from 25 to 150 microns, using standardised screens. The determination of the very fine particles, of less than 25 micron,

The apparent bulk density of our Tonsil® bleaching earths depends on the raw material used, the degree of acid activation and the particle size distribution, and under normal circumstances is between 300 and 800 g/l for powder material and 500 – 1,000 g/l for granular bleaching earths. For the majority of Tonsil<sup>®</sup> bleaching earths in bulk (silos, trucks, railway waggons, etc.), and for their storage in a silo facility. This information is included on each of our quality certificates.

is carried out in a laser interferometer, in suspension or in an air jet. The instrument is controlled by a small computer, which calculates the particle size distribution from the interference pattern of the laser.

The filtration properties are determined by means of a filtration test, in accordance with the internal Süd-Chemie standard methods. With this test, the time is measured which a predetermined quantity of a bleaching earth oilsuspension requires for filtration.

Our FF qualities are tested particularly thoroughly, since they must necessarily feature a precisely-defined particle size distribution in order to guarantee optimum

filtration performance in modern pressure leaf filters. Many filter manufacturers have designed their filter systems on the basis of our Tonsil® Optimum 210 FF bleaching earth, and linked their guarantee declaration regarding the systems to the use of FF qualities of Tonsil® bleaching earths.

### Apparent bulk density

### Instructions for storage and transport

### Instructions for the use of spent bleaching earths

There are a range of possiblities for the use of spent bleaching earths.

- They can be added directly to the extracted meal, in installations with their own extraction systems.
- Oils and fats can be recovered by means of extraction with solvents or dilute sodium lye, and, depending on the quality, they can be used for human foodstuffs or animal feeds, as well as for technical applications.
- One indirect energy utilization is the introduction of spent bleaching earths into biogas reactors. The biogas yield can be substantially increased as a result.
- By means of combustion in the cement industry or in brickworks, spent bleaching earths which contain oil can be employed as a mineral raw material, and put to rational use as an energy carrier.

Bleaching earths containing a proportion of 30 – 35% residual oil have a calorific value which is comparable to brown coal (lignite).

• Bleaching earths containing oil can also be added to plant waste to make compost. The mineral residue is used for soil improvement. In order to guarantee the high level of activity of Tonsil® bleaching earths unchanged over a considerable period of time, it is highly recommended that storage be carried out in the proper manner, as follows.

### Storage in paper/plastic sacks, Big Bags, and Jumbo Bags

Proper storage conditions can only be established in closed storage rooms with low floor, wall and air humidity levels. Tonsil® bleaching earths should not be stored in the vicinity of chemicals with a strong odour of volatile substances, since the vapours given off will be largely adsorbed by the Tonsil® bleaching earths, and could lead to contamination of other substances during subsequent use.

In order to exclude such risks, it is absolutely essential for Tonsil® bleaching earths to be stored in seperate areas.

### Storage in silo facilities (loose)

If an annual consumption of at least 200 tons of Tonsil<sup>®</sup> bleaching earths is assumed, a silo facility is the most economical means of storage.

For filling and emptying the silo, we recommend the use of a pneumatic or screw conveyor transport system. A detailed proposal for a suitable installation can be obtained from our Technical Service Department.

The compressed air used for pneumatic conveying should be dry and completely free of oil, in order to exclude any possible contamination. Pipes which lead into the storage silo, or lead from the silo into the corresponding plant, should, as far as possible, follow the shortest route.

Any pipe bends which may prove necessary should feature the largest possible angle (more than 90°), in order to exclude the possibility of the material being incorrectly comminuted, and so incurring increased filtration times.

This applies in particular to the use of FF qualities (FF = fast filtration).

### Süd-Chemie – Adsorbents und Additives

![](_page_9_Picture_20.jpeg)

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