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(54) Benævnelse: **Granuleret pimpsten samt fremgangsmåde til fremstilling af granuleret pimpsten**

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Description

Granular pumice is used primarily as lightweight aggregate for a variety of building products and building chemical products. Mention may be made of plasters and renders and mortars, fine concretes, exterior wall cladding boards and lightweight boards and also fire and noise protection boards, insulation products and the like. However, granular pumice is also used as lightweight aggregate for plastics. The advantages of granular pumice are its very low weight, the high compressive strength and also very good thermal insulation. It is also well suited for sound absorption, displays a high breathing activity, is not combustible and is solvent-free and has a neutral odor, and also is 100% mineral and recyclable.

However, as a mineral, porous natural product, pumice displays a certain water absorption capability. As a result, when pumice is used as lightweight aggregate wherever water is used for mixing, somewhat more water has to be added compared to a lightweight aggregate having no water absorption capability or a significantly lower water absorption capability, for example the siliceous foams which are likewise frequently used. This results in the productivity of the mixed composition containing the added pumice being somewhat lower than the productivity of a composition having, for example, siliceous foam as lightweight aggregate.

DE 20 46 395 A1 discloses a binder for oil and organic solvents which consists of hydrophobicized pumice. The pumice can have been treated with a silicone.

The invention addresses the problem of providing a granular pumice whose properties are improved, especially for use as lightweight aggregate to produce a composition to be made up using a liquid.

To solve this problem, in accordance with the invention a granular pumice according to the main claim is provided.

The granular pumice according to the invention, which as a natural material has a certain water absorption capability, is, according to the invention, coated with a hydrophobic surface coating and is thus hydrophobicized. This surface layer applied by means of appropriate treatment of the pumice results in the pumice granules being completely hydrophobic and retaining their hydrophobic property, as long-term experiments have shown. The hydrophobic surface coating consequently gives the granular pumice of the invention a property which has previously not been ensured and has a decisive effect on the range of uses of the pumice or on the properties of the products to which the pumice of the invention is added. Firstly, the hydrophobicized pumice of the invention can be used in a variety of liquid systems or systems containing a fluid such as make-up water and the like or a solvent or the like. Mention may be made of tile adhesives or board adhesives, lightweight plasters and renders, reinforcing trowel-applied mortars and also varnishes, paints and paste-like systems. Many of these systems are not mixed up only on site but have already been ready-mixed and packaged at the factory, so that it has to be ensured that they retain their fluid or paste-like properties unchanged for a long time. This can advantageously be ensured by use of the granular hydrophobicized pumice of the invention, in contrast to the use of siliceous foam which, as described, has an albeit low water absorption capability. In addition, the fact that the pumice of the invention no longer has any water absorption capability allows more precise setting of the water/cement value when using the pumice as lightweight aggregate for mortar and similar compositions. Furthermore, the apparent particle density of the pumice of the invention can be significantly reduced compared to pure pumice, from about 0.9 kg/dm^3 for unhydrophobicized pumice to about 0.5 kg/dm^3 for hydrophobicized pumice according to the invention. This leads to an increased productivity and lower dry bulk density of, for example, the mortar or tile adhesive which is admixed with the pumice according to the invention.

The hydrophobic property of the pumice also enables an improved distribution of this in cement-bonded systems to be achieved, which makes improved, because homogeneous, hydrophobicization of the end product possible. This means that the water absorption capability of the end product is lower compared to other lightweight aggregates.

Overall, the granular hydrophobicized pumice of the invention offers an essential widening of the property spectrum and thus also the use spectrum.

The pumice is, according to the invention, coated with a silane or siloxane layer which is hydrophobic. Such a silane or siloxane layer can be applied using various silanes or siloxanes, either cyclic or linear silanes or siloxanes, with, in particular, linear or branched silanes or mixtures thereof or siloxanes which are virtually insoluble in water being suitable. These include, for example, silicone resins or silicone resin solutions, oligomeric siloxanes and polymeric siloxanes. The use of silicones is also possible. In general, any type of alkylpolysiloxanes and/or alkylalkoxysilanes and also siloxane mixtures of reactive organosiloxanes and polydimethylsiloxanes can be used as hydrophobic coating for the pumice surface. Among these, preference is given to using a mixture of reactive organosiloxane compounds and polydimethylsiloxanes, particularly preferably present as emulsion, for forming the coating.

The pumice can also, additionally, be coated with a coating of at least one organic fatty acid or at least one salt of an organic fatty acid. Such acids and salts include, for example, stearic acid and various salts of stearic acid, i.e. stearates (e.g. Na, K, Ca, Al, Zn, Zr or NH_4 stearate or triethanolammonium stearate), oleic acid and various salts of oleic acid, i.e. oleates (e.g. Na and NH_4 oleate) and also tall oil fatty acid and salts thereof and resin acids and salts of resin acids.

In addition, the coating of the pumice surface can also consist of a mineral oil or a mineral oil emulsion. Mineral oils consist essentially of a mixture of paraffinic, naphthenic and aromatic constituents and also alkenes.

It is also possible, in addition, for the coating of the pumice surface to consist of at least one alkane. These also include waxes and wax oil emulsions, optionally on a paraffin basis. PE/HDPE waxes, microwaxes, Fischer-Tropsch waxes, montan waxes, ester waxes, amide waxes, natural waxes, carnauba waxes, PTFE waxes, wax compounds, polymer-wax compounds or PP waxes are also conceivable.

In addition, the pumice surface can also have a coating consisting of bitumen or a bituminous emulsion. This likewise has a strongly water-repellent or hydrophobic behavior.

Apart from the pumice of the invention itself, the invention provides a process for producing pumice of the type described according to Claim 6. The process of the invention is characterized by the features of Claim 6. The hydrophobicizing agent is preferably used as emulsion.

Although it is possible to wet the pumice by dipping in the emulsion, i.e. to pour the pumice into a sufficiently large amount of emulsion, stir it there and allow the emulsion or the hydrophobicizing agent to soak in or become attached and, after a sufficient residence time, take out the pumice, allow it to drip and dry it, an advantageous embodiment of the invention provides for spraying the hydrophobicizing emulsion or a dilution thereof onto the pumice. Spraying-on is advantageously carried out while the pumice is being mixed. That is to say, the pumice is mixed continuously, for example in a plowshare mixer, while the emulsion is sprayed on continuously or intermittently by means of a suitable spraying device so that the emulsion is mixed in as a result of the continuous mixing and thus becomes finely and homogeneously distributed on the surface of the pumice granules. When the emulsion matched to the amount of pumice to be treated and containing a sufficient amount, likewise matched to the amount of pumice to be treated, of added hydrophobicizing agent has all been sprayed on and mixed in, mixing can be continued to achieve further homogenization of the emulsion distribution. At the end of mixing, the pumice is dried in order to drive off the outer phase of the emulsion, i.e. evaporate the water, so that the water-free hydrophobicizing layer is formed.

The basic mixing time should be in the range from 1 minute to 25 minutes, in particular from 10 minutes to 15 minutes, with the emulsion being sprayed on during only part of the total mixing time. For example, spraying-on can be carried out during the first 5 minutes of a total mixing time of 20 minutes and mixing can subsequently be continued for a further 15 minutes in order to homogenize the emulsion or hydrophobicizing agent distribution.

The heat treatment, i.e. the drying of the pumice, is advantageously carried out at a temperature of 0°-200°C, preferably 130°-180°C, so that it is ensured that the water which is generally used as outer phase is driven off as quickly as possible. A preferred drying temperature is about 150°C.

As hydrophobicizing agent, according to the invention, at least one silane or at least one siloxane are used, with the above-described both cyclic and linear or branched silanes and mixtures thereof being used. Linear silanes or siloxanes in particular display no solubility in water.

In addition, it is possible to use one or more of the abovementioned silane- or siloxane-based materials.

According to the invention, silanes or siloxanes may be used, with use being made of

A1) silane of the general formula

R^3-Si-$(OR^2)_3$

where

R^2 is a methyl or ethyl radical and

R^3 is an alkyl radical having from 3 to 12 carbon atoms, or an aminoalkyl radical having from 1 to 6 carbon atoms or a radical of the general formula H_2N-$(CH_2)_xR^4$-$(CH_2)_y$-, where

R^4 is an oxygen, sulfur, -NH-

or

-NH-CH_2-CH_2-NH- radical and

x $\geq$ 2 and

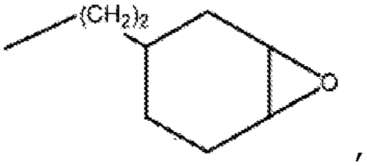
y $\geq$ 2, or

a radical of the general formula

$(R^2O)_3Si$-$(CH_2)_x$-NH-$(CH_2)_x$-,

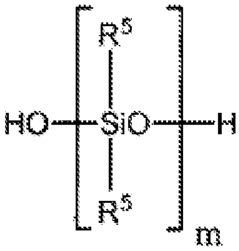
R^2 and x are as defined above,

or



,

A2) a siloxanol of the general formula



$$HO\left[\begin{matrix} R^5 \\ | \\ SiO \\ | \\ R^5 \end{matrix}\right]_m H$$

where

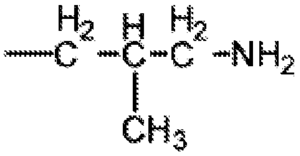
R^5 is a methyl or phenyl radical but at least 90% of the radicals R^5 are methyl radicals and m = 20 to 250.

Constituent A1) is an alkoxysilane of the general formula R^3-Si-$(OR^2)_3$. While the radical R^2 has the meaning alkyl radical having 1 or 2 carbon atoms, examples of the radical R^2 are methyl and ethyl radicals, the radical R^3 is characterized in that it has a reactive group and is bound via carbon to the silicon atom. R^3 can have the following meanings:

(1) R^3 = aminoalkyl radical whose alkyl radical has from 1 to 6 carbon atoms. Examples of such radicals are the ethyl, propyl, butyl and hexylamine radicals,

with preference being given to the radicals

$-(CH_2)_3-NH_2$ and



$$-\overset{H_2}{C}-\underset{CH_3}{\overset{H}{C}}-\overset{H_2}{C}-NH_2$$

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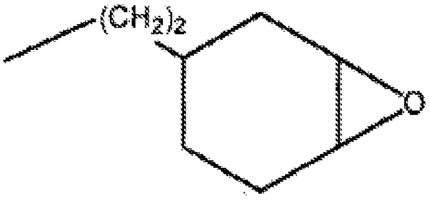
(2) R^3 = radical of the general formula $H_2N-(CH_2)_xR^4-(CH_2)_y-$, where R^4 is an oxygen, sulfur, -NH- or $-NH-CH_2-CH_2-NH-$ radical and $x \geq 2$ and $y \geq 2$. Examples of such radicals are $H_2N-(CH_2-)_3-$ and $H_2N-(CH_2)_2-NH-(CH_2)_3-$.

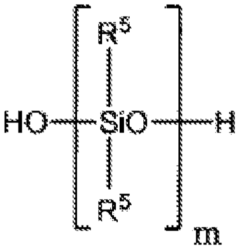
(3) $(R^2O)_3Si-(CH_2)_x-NH-(CH_2)_x-$. Examples of such radicals are $(C_2H_5O)_3Si-(CH_2)_3-NH-(CH_2)_3-$ and $(CH_3)_3Si-(CH_2)_2-NH-(CH_2)_2-$.

(4) R^3 = radical of the general formula



Radicals having the meaning $-(CH_2)_3-NH_2$, $-(CH_2)_2-NH-(CH_2)_3-NH_2$ or (4) are particularly preferred as radicals R^3.

Constituent A2) is an α,ω-siloxanol of the general formula



$$HO-\left[\begin{array}{c}R^5\\|\\SiO\\|\\R^5\end{array}\right]_m-H$$

where R^5 is a methyl or phenyl radical. At least 90% of the radicals R^5 have to be methyl radicals. Particular preference is given to α,ω-dimethylsiloxanols. m is from 20 to 250 and is preferably from 30 to 80.

The silanes A1 or siloxanols A2 can be used either alone or in any mixtures with one another.

The mixtures can, as solutions, contain solvents such as alcohols, in particular in the absence of water, or in the presence of water be in the form of emulsions.

These products can have an active content of 0.1-100% in water as emulsion or in solvents such as alcohols, hydrocarbons as solution.

These products can have an active content of from 0.1 to 99.9% by weight of silanes A1 or of siloxanols A2 dissolved or emulsified in water or dissolved in solvents such as alcohols or hydrocarbons.

A modification of the preparation according to the present invention is characterized in that the components A1) and A2) are not present individually but as their reaction product which can be obtained by completely or partly reacting the components A1) and A2) with one another taking into account the stoichiometric ratios by heating to from 150 to 200°C before emulsification of these components. It has been found that when such a modified preparation according to the invention is used, good results in respect of the water-repellent effect are likewise achieved.

As hydrophobicizing agent, it is optionally possible, in addition, to also use at least one organic fatty acid or at least one salt of an organic fatty acid. Here, reference is once again made to the organic fatty acids mentioned by way of example above or salts of the organic fatty acids.

In additon, the use of a mineral oil as hydrophobicizing agent is also conceivable.

The same applies to the use of an alkane as hydrophobicizing agent.

In addition, the use of bitumen as hydrophobicizing agent is also conceivable.

The content of hydrophobicizing agents, measured in g, in the emulsion should according to the invention be 0.1%-2.5%, in particular 0.3%-1%, of the amount of pumice to be wetted in g. This means that, to hydrophobicize 1 kg of pumice, with a weighed-out amount of, for example, 0.5% of hydrophobicizing agent, the emulsion contains an amount of 5 g, for example, of hydrophobicizing agent. The amount of outer phase used, i.e., for example, water, is advantageously also determined by the amount of pumice to be wetted. Thus, the amount of outer phase, in particular water, measured in g, should be 1/5-1/3, in particular 1/4, of the amount of pumice to be wetted, likewise measured in g. Based on the example of 1 kg of pumice, 250 g, for example, of water (= 250 ml of water) in which, for example, the abovementioned 5 g of hydrophobicizing agent are emulsified should be used.

In various studies and comparative tests, the properties of the pumice according to the invention have been checked and compared with various comparative materials.

A particular amount of pumice according to the invention was firstly produced. Pumice having the trade name "ROTOCELL" from ROTEC GmbH & Co. KG and having a particle size of 0.09-0.3 mm and a bulk density of 390 kg/m^3 +/- 15% was used as starting material. 400 g of this pumice were weighed out dry.

100 ml of water (= 100 g ≙ 25% of the mass of pumice) were then measured out to produce an emulsion. 2 g of hydrophobicizing agent, namely a reactive organosiloxane/PDMS mixture which is obtainable under the trade name "Sitren 595" from Evonik Goldschmidt GmbH (2 g ≙ 0.5% of the mass of pumice), were added to the water. The water and the hydrophobicizing agent were mixed by shaking and the hydrophobicizing agent was thus finely emulsified. The amount of water can naturally be varied. The important thing is that the content of hydrophobicizing agent added is always in the required ratio to the mass of pumice to be wetted, and is also all added to the pumice. The more emulsion in which the amount of siloxane based on the mass of pumice is emulsified that is produced, the more emulsion also has to be mixed with the pumice.

In the next step, the pumice was introduced into a mixer which mixes the pumice by means of a kneading hook. On commencement of mixing, the emulsion was sprayed on using a spray bottle while mixing was carried out continuously. After the spraying-on operation was complete, after about 5 minutes, stirring was continued for another 15 minutes.

When stirring was complete, the wetted pumice was taken out and placed in a dish in a drying oven at 150°C for drying. The dried pumice was subsequently taken out and cooled in the air of the room.

In a long-term test, the water uptake capability of the pumice according to the invention was firstly examined.

For this purpose, an amount of exactly 500 ml of distilled water was placed in each of two upright cylinders having a reading-off volume of 1000 ml. Exactly 100 g of pumice, obtainable under the trade name "ROTOCELL" and having a particle size of 0.09-0.3 mm, which had not been hydrophobicized according to the invention, were placed in the one upright cylinder. Exactly 100 g of the hydrophobicized "ROTOCELL" pumice produced as described above were placed in the other upright cylinder.

The unhydrophobicized pumice sank immediately after addition. After escape of the air from the pore volume of the pumice, a reading-off volume of 620 ml was determined.

In contrast, the pumice which had been hydrophobicized according to the invention did not sink. A reading-off volume of 720 ml was determined.

After introduction of the pumice and determination of the reading-off volumes, the upright cylinders were closed by means of films so as to be airtight and left to stand in the absence of vibrations.

The samples were allowed to stand for a week, after which the reading-off volumes were determined again. The same reading-off volumes as in the first reading immediately after introduction of the pumice were found, i.e. in the case of the upright cylinder containing the unhydrophobicized pumice, a volume of 620 ml; in the case of the cylinder containing the pumice which had been hydrophobicized according to the invention, a volume of 720 ml. Thus, no changes have occurred.

It can be seen from this that the pumice which has been hydrophobicized according to the invention does not absorb any water, i.e. it is completely hydrophobic.

In a further experiment, three different test specimens of which one contained the inventive pumice which had been produced as described above while the other two contained other aggregates were produced, with properties of the initially produced specimen composition and also properties of the finished specimens being examined.

A commercial tile adhesive (adhesive mortar) based essentially on cement (portland cement), finely particulate aggregates (ground limestone, silica sand) and additives (methylcellulose, dispersion powder, cellulose fibers, high-alumina cement) was used as starting material. Of this three amounts of mortar, each of exactly 600 g, were weighed out.

150 g of a commercial siliceous foam (lightweight foam) having a particle size of 0.1-0.3 mm were added to the first amount. 150 g of the "ROTOCELL" pumice having a particle size of 0.09-0.3 mm but not hydrophobicized were added to the second amount of mortar. 150 g of the above-described "ROTOCELL" pumice according to the invention, hydrophobicized, were added to the third amount of mortar.

Each sample was subsequently mixed with water. 345 g of water were added to the first sample, 375 g to the second sample and 345 g of water to the third sample.

The productivity of the respective samples was then firstly measured. The productivity of the first sample containing the siliceous foam was 870 ml. The sample containing the untreated pumice displayed a productivity of 815 ml. The sample containing the pumice according to the invention displayed a productivity of 900 ml. This means that the pumice according to the invention led to a mortar composition having the greatest productivity, which can be attributed to the hydrophobic property of the pumice and, resulting therefrom, its displacement of water and its homogeneous distribution in the composition.

The fresh overall densities of the made-up samples were subsequently measured. This was 127 kg/dm^3 in the case of the sample containing the siliceous foam, 127 kg/dm^3 in the case of the second sample containing the untreated pumice and 122 kg/dm^3 in the case of the sample containing the pumice according to the invention. This means that the sample containing the pumice according to the invention had a lower density.

In the next step based on the trial for tile adhesives in accordance with DIN EN12002, a test specimen in the form of a mortar prism was produced from each composition in order to examine the deformation behavior of the mortar. The respective prism had a length of 160 mm, a width of 80 mm and a height of 80 mm. The prisms produced in each case were dried for a number of days and subsequently measured.

The individual measurements are shown together with the respective amounts of constituents used in the composition in the following table.

Sample:	I	II	III
Lightweight aggregate:	Siliceous foam, particle size: 0.1-0.3 mm	Unhydrophobicized pumice, particle size: 0.09-0.3 mm	Hydrophobicized pumice, particle size: 0.09-0.3 mm
Adhesive mortar (g):	600	600	600
Mass of aggregate (g)	150	150	150
Amount of water (g)	345	375	345
Productivity (ml)	870	850	900
Fresh overall density of mortar (kg/dm^3):	1.27	1.27	1.22
Test specimen:	160 × 80 × 80	160 × 80 × 80	160 × 80 × 80

Mortar prism L×W×H (mm):			
Dry weight (g)	229	227	223
Dry overall density (kg/dm^3):	0.224	0.221	0.218
Fracture load in bending (kN):	0.487	0.408	0.449
Bending tensile strength (N/mm^2):	0.143	0.12	0.132
Fracture load in compression (kN):	4.39	3.56	4.52
Compressive strength (N/mm^2):	0.7	0.6	0.71

Firstly, the dry weight of the specimens was measured. This was 229 g in the case of the test specimen containing the siliceous foam, 227 g in the case of the test specimen containing the untreated pumice and 223 g in the case of the test specimen containing pumice according to the invention. This means that the test specimen containing the pumice according to the invention was the lightest of all the test specimens.

Furthermore, the dry overall density was measured. This was 0.224 kg/dm^3 in the case of the test specimen containing the siliceous foam, 0.221 kg/dm^3 in the case of the test specimen containing the untreated pumice and 0.218 kg/dm^3 in the case of the test specimen containing the pumice according to the invention. The test specimen containing the pumice according to the invention thus displayed the lowest dry overall density.

The fracture load in bending, the bending tensile strength, the fracture load in compression and the compressive strength were then measured. The detailed measurements may be found in the table.

The fracture load of the specimen containing the siliceous foam was 0.487 kN. While the fracture load of the specimen containing the untreated pumice was, at 0.408 kN, significantly below the value for the specimen containing siliceous lightweight foam, the specimen comprising the pumice according to the invention had a measured value of 0.449 kN, approximately in the region of the specimen containing siliceous lightweight foam.

The bending tensile strength of the siliceous foam specimen was 0.143 N/mm^2. Here too, the specimen comprising the untreated pumice was, at 0.12 N/mm^2, significantly lower, while the specimen comprising the pumice according to the invention gave a value of 0.132 N/mm^2, once again approximately in the region of the siliceous foam specimen.

In the case of the fracture load in compression, the specimen containing the pumice according to the invention displays the highest measured value at 4.52 kN, while the specimen containing the siliceous foam had a value of 4.39 kN and the specimen comprising the untreated pumice had a value of 3.56 kN. In the case of the compressive strength, too, the specimen comprising the pumice according to the invention had, at 0.71 N/mm^2, the highest value, compared to 0.7 N/mm^2 in the case of the siliceous foam specimen and 0.6 N/mm^2 in the case of the specimen comprising the untreated pumice.

The comparative experiment shows that use of the pumice according to the invention makes it possible to mix, for example, a tile adhesive which firstly has a very good productivity and secondly, as the various test specimens showed, has very good mechanical properties compared to, in particular, the mortar/test specimen containing the siliceous foam.

Patentkrav

1. Granuleret pimpsten, kendetegnet ved, at overfladen er belagt med en hydrofob belægning, som består af en silan eller en siloxan, idet der som silan er anvendt:

A1) silan med den almene formel

$R^3\text{-Si-}(OR^2)_3$

idet

R^2 er en methyl- eller ethylgruppe, og

R^3 er en alkylgruppe med 3 til 12 carbonatomer eller en aminoalkylgruppe med 1 til 6 carbonatomer eller en gruppe med den almene formel $H_2N\text{-}(CH_2)_xR^4\text{-}(CH_2)_y\text{-}$, hvor R^4 betegner en oxygen-, svovl-, -NH- eller -NH-CH_2-CH_2-NH-gruppe, og

x er ≧ 2, og

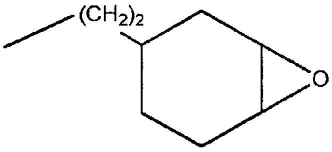
y er ≧ 2 eller

en gruppe med den almene formel

$(R^2O)_3Si\text{-}(CH_2)_x\text{-NH-}(CH_2)_x\text{-}$,

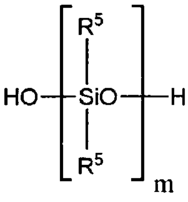
R^2 og x er defineret som ovenfor

eller er



at der som siloxan er anvendt

A2) en siloxanol med den almene formel



$$HO\left[\begin{array}{c}R^5\\ |\\ SiO\\ |\\ R^5\end{array}\right]_m H$$

idet

R^5 er en methyl- eller phenylgruppe, at i det mindste 90 % af grupperne R^5 dog er methylgrupper, og m = 20 til 250.

2. Pimpsten ifølge krav 1, kendetegnet ved, at belægningen endvidere består af i det mindste en organisk fedtsyre eller i det mindste et salt af en organisk fedtsyre.

3. Pimpsten ifølge krav 1, kendetegnet ved, at belægningen endvidere består af en mineralolie eller en mineralolieemulsion.

4. Pimpsten ifølge krav 1, kendetegnet ved, at belægningen endvidere består af i det mindste en alkan.

5. Pimpsten ifølge krav 1, kendetegnet ved, at belægningen endvidere består af bitumen eller en bituminøs emulsion.

6. Fremgangsmåde til fremstilling af pimpsten ifølge et af de foregående krav, kendetegnet ved, at den granulerede pimpsten fugtes med en emulsion indeholdende i det mindste et i den yderste fase fordelt hydrofoberingsmiddel, som danner den indre fase, og efterfølgende tørres, idet hydroforberingsmidlet på overfladen af pimpstensgranulaterne danner en hydrofob belægning, som består af en silan eller en siloxan, idet der som silan anvendes:

A1) silan med den almene formel

$R^3\text{-Si-}(OR^2)_3$

idet

R^2 er en methyl- eller ethylgruppe, og

R^3 er en alkylgruppe med 3 til 12 carbonatomer eller en aminoalkylgruppe med 1 til 6 carbonatomer eller en gruppe med den almene formel $H_2N\text{-}(CH_2)_xR^4\text{-}(CH_2)_y\text{-}$, hvor R^4 betegner en oxygen-, svovl-, -NH-

eller

$\text{-NH-}CH_2\text{-}CH_2\text{-NH-}$gruppe, og

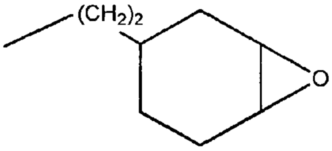
x er $\geqq 2$, og

y er $\geqq 2$ eller

en gruppe med den almene formel $(R^2O)_3Si\text{-}(CH_2)_x\text{-NH-}(CH_2)_x\text{-}$,

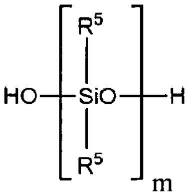
R^2 og x er defineret som ovenfor

eller er



og at der som siloxan anvendes:

A2) en siloxanol med den almene formel



$$HO\left[\begin{array}{c} R^5 \\ | \\ SiO \\ | \\ R^5 \end{array}\right]_m H$$

idet

R^5 er en methyl- eller phenylgruppe, at i det mindste 90 % af grupperne R^5 dog er methylgrupper, og m = 20 til 250.

7. Fremgangsmåde ifølge krav 6, kendetegnet ved, at emulsionen sprøjtes på.

8. Fremgangsmåde ifølge krav 6 eller 7, kendetegnet ved, at pimpstenen blandes under og efter tilsætningen af emulsionen.

9. Fremgangsmåde ifølge krav 8, kendetegnet ved, at blandingstiden ligger mellem 1 min - 25 min, navnlig 10 min - 15 min.

10. Fremgangsmåde ifølge et af kravene 6 til 9, kendetegnet ved, at den fugtede pimpsten tørres ved en temperatur mellem 0° - 200°C, fortrinsvis mellem 130° - 180°C, navnlig ved ca. 150°C.

11. Fremgangsmåde ifølge et af kravene 6 til 10, kendetegnet ved, at der endvidere anvendes et hydroforberingsmiddel af i det mindste en organisk fedtsyre eller i det mindste et salt af en organisk fedtsyre.

12. Fremgangsmåde ifølge et af kravene 6 til 10, kendetegnet ved, at der som hydrofoberingsmiddel endvidere anvendes mineralolie.

13. Fremgangsmåde ifølge et af kravene 6 til 10, kendetegnet ved, at der som hydrofoberingsmiddel endvidere anvendes en alkan.

14. Fremgangsmåde ifølge et af kravene 6 til 10, kendetegnet ved, at der som hydrofoberingsmiddel endvidere anvendes

bitumen.

15. Fremgangsmåde ifølge et af kravene 6 til 14, kendetegnet ved, at den ydre fase er vand.

16. Fremgangsmåde ifølge et af kravene 6 til 15, kendetegnet ved, at indholdet i g af hydrofoberingsmidlet i emulsionen er 0,1% - 2,5%, navnlig 0,3% - 1 % af mængden af den pimpsten i g, der skal fugtes.

17. Fremgangsmåde ifølge et af kravene 6 til 16, kendetegnet ved, at mængden i g af den ydre fase, navnlig vand, er 1/5 - 1/3, navnlig 1/4 af mængden i g af den pimpsten, der skal fugtes.