

Building material granulate, method for producing a building material granulate on the basis for mineral grains and use of same

5 The invention relates to a construction material granulate based on mineral grains in the form of fine sand grains, particularly desert sand grains, a method for producing a construction material granulate based on mineral grains in the form of fine sand grains, particularly desert sand grains, and the use of the construction material granulate for producing concrete, particularly for use as
10 an additive in producing concrete. A use of desert sands and fine sands for producing concrete is made possible by means of the invention.

15 Sand and gravel are substantial components of concrete. Due to the growing construction industry, particularly in emerging countries, the quantities of sand required for producing concretes are often no longer available to a sufficient degree, so that some countries are already dependent on importing sand and gravel. Due to the global deficiency in quantities of suitable sands for producing
20 concretes, previously unused resources such as desert sand or excess fine sand are increasingly gaining attention. Previously, the fine sand components present in the sand fractions were largely separated out and backwashed into gravel extraction sites. In Germany alone, the fraction of fine sand previously unused and thus
25 stored is up to 40 million tonnes per year. In addition, the stored fine sand fractions cause serious environmental damage. The grain structure of fine sands and desert sands is characterized by a rounded geometry and smooth surface. Because of this quality, fine sands and desert sands are not suitable for producing con-
30 cretes.

Methods are known from the prior art, wherein so-called polymer concretes are produced from fine sand fractions by adhering the individual sand grains using polyester resins, methyl methacrylic
35 resins, epoxy resins, or other reactive resins, for example. A corresponding method is known from DE 20 2006 012 396 U1, for example.

According to the teaching of DE 10 2015 114 554 A1, desert sand is

solidified with water glass, in combination with polymeric sulfur and microcrystallized silica, in order to produce artificial sandstone.

5 A method is known from DE 10 2014 006 942 B3, wherein the round grain structure of desert sand is transitioned to an angular grain structure by thermal processing, so that the sand is then suitable for producing concretes. DE 32 48 537 C2 discloses a method where-
10 in an additive usable for the concrete industry is provided by sintering desert sand at temperatures of up to 1600 °C. Due to the temperatures required, however, said method is comparatively intensive in terms of cost and energy and is therefore unsuitable for producing additives needed by the concrete industry on a mas-
15 sive scale.

The object of the present invention is thus to enable an inexpensive use of desert sands and/or fine sands for the construction industry.

20 The object is achieved according to the invention by a construction material granulate having the features of claim 1, a method according to claim 7, and uses according to claims 14 and 15. Advantageous embodiments and refinements of the invention can be implemented having features described in the subordinate claims.

25 According to the conception of the invention, aggregates having smooth or round surfaces, such as occur with desert sand grains and fine sand grains, are made suitable for use in the form of a construction material granulate for producing concrete. According
30 to the invention, a broken granulation of fine sands, particularly desert sands, is used. A broken granulation of fine sands, particularly desert sands, can preferably be provided by grinding in a grinding facility. A broken granulation in the sense of the invention is understood to be principally a ground granulation.

35 For the construction material granulate according to the invention based on mineral grains in the form of fine sand grains, particularly desert sand grains, a fraction of a broken granulation of fine sand, particularly desert sand, is bound in a hydraulically

setting binder matrix. Binding the broken granulation of fine sand, particularly desert sand, in a binder matrix, produces construction material granules based on fine sand, particularly based on desert sand, and usable for further processing in the construction industry. The construction material granulate according to the invention can be advantageously stored as bulk material.

The binder matrix advantageously comprises at least one hydraulic binder, such as cement, and/or at least one latent hydraulic binder for holding together the construction material granules in the set state, and thereby binding the fraction of broken grains of fine sand, particularly desert sand, in the structure of the construction material granules.

For the construction material granulate according to the invention, it can be provided that the fraction of broken grains of desert sand comprises a grain spectrum up to a size of 0.125 mm.

The fine sands used can, by definition, comprise grains having a grain size between 0 mm and 0.2 mm.

The construction material granulate according to the invention can advantageously comprise a total fraction of untreated mineral grains, that is, unbroken, round, smooth mineral grains in the form of fine sand grains, particularly desert sand grains, of up to 50 percent by mass.

In contrast to desert sands, unwashed fine sands typically have fractions of grains having a size of less than 0.063 mm, and thus having an advantageous effect on granulating, as smaller grain sizes promote agglomeration.

It can therefore be provided that a total fraction of up to 50 percent by mass of an unbroken granulation of mineral grains comprising an unbroken granulation of fine sand, particularly desert sand, is bound in the binder matrix of the granulate.

The construction material granules of the construction material granulate according to the invention preferably comprise a size spectrum up to a diameter of 16 mm, preferably up to a diameter of 8 mm. Depending on the granulating method or depending on the

granulating plant or pelletizing plant, the granules can comprise a substantially round shape or a substantially cylindrical shape. The granules according to the invention can also be referred to as pellets, without influencing the substance of the invention.

5 For the method according to the invention for producing a construction material granulate based on round, smooth, mineral grains in the form of fine sand grains, particularly desert sand grains, a broken granulation of fine sand, particularly desert sand, is provided. The broken granulation of fine sand, particularly desert sand, can preferably be provided by grinding in a grinding facility. A fraction of the broken granulation of fine sand, particularly desert sand, is granulated by means of a frac-
10 tion of a granulating agent forming a hydraulically setting binder matrix. After granulating, a drying step can be provided, wherein the granules obtained can dry separately from each other.
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According to the conception of the method according to the invention, round, smooth, mineral grains in the form of fine sand grains, particularly desert sand grains, are first ground, wherein a broken grain structure is provided. A fraction of the broken granulation of fine sand, particularly desert sand, is then mixed
20 with a granulating agent forming a hydraulically setting binder matrix, and granulated, wherein the broken fine sand grains, particularly broken desert sand grains, are bound in granules.

The granulating of the mixture of a fraction of the broken grains of fine sand, particularly desert sand, and the granulating agent can be done by means of a granulating plant or a pelletizing plant, such as are known from the prior art.
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A grain spectrum of the broken granulation of desert sand having a grain size of up to 0.125 mm can preferably be used. The grain size of the desert sand grains can be influenced by breaking or grinding in a grinding facility.
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According to a preferred embodiment variant of the method according to the invention, a broken granulation of fine sand, particularly desert sand having a grain size of less than 1 mm is used for granulating, wherein the fraction of grains smaller than 75 μm
35 should be at least 25 percent.

Furthermore, according to an advantageous embodiment variant of the method according to the invention, it can be provided that an unbroken granulation of a fine sand, comprising at least 30% grains having a grain size of less than 1 mm, is granulated directly with the granulating agent. In this case, small fractions of unbroken grains up to a grain size of no greater than 2 mm can be granulated.

According to an embodiment variant of the method according to the invention, it can further be provided that the granulating agent comprises at least one hydraulic binder and/or at least one latent hydraulic binder and water, wherein the at least one hydraulic binder and/or the at least one latent hydraulic binder and the water are added separately while granulating.

According to a preferred, simple embodiment variant, cement and water can be used as the granulating agent. Granulating can be done such that the fraction of the broken granulation of fine sand, particularly desert sand, is first provided on a granulating pan or granulating plate. The fraction of broken granulation of fine sand, particularly desert sand, is then sprayed with the water and added to the fraction of cement. Circular motion of the granulating pan or the granulating plate mixes the fraction of broken granulation of fine sand, particularly desert sand, the fraction of water, and the fraction of cement and forms granules. According to one embodiment example, a fraction ratio of 7 parts of broken granulation of fine sand, particularly desert sand, 3 parts of cement, and 1 part of water can be used for granulating.

According to a further advantageous embodiment variant of the method according to the invention, it can be provided that the granulating agent comprises a binder suspension, provided separately, and formed from at least one hydraulic binder and/or at least one latent hydraulic binder and water. For the present embodiment variant, the fraction of broken granulation of fine sand, particularly desert sand, is mixed with a binder suspension and granulated. The binder suspension is a mixture of water and a hydraulic binder, preferably cement, suspended under the effect of high shear forces. A fraction of the cement required for the binder suspension can be advantageously replaced by a latent hydraulic

binder. It can further be provided that a fraction of the broken granulation of fine sand, particularly desert sand, up to a grain size of 0.125 mm, is used for preparing the binder suspension. It is thereby possible to make use of a fraction of the broken granulation of fine sand, particularly desert sand, already as a cement substitute in the binder suspension provided as a granulating agent.

The use of the binder suspension prepared in high-performance mixers as a granulating agent has the advantage that a particularly high level of homogeneity is achieved, having positive effects on the uniformity of quality parameters such as compressive strength, grain spectrum, and surface finish of the granulates produced.

The quality of the granulates produced can be advantageously achieved by varying the composition of the granulating agent.

Changes in quality or adjustments to quality can thus be made beyond the typical scale of the options known from the prior art for changing technological parameters of granulating plants, such as the dwell time, rotational speed, or temperature.

It can further be provided by the method according to the invention that at least one additive is used when granulating, selected from a group comprising: a flow agent, a concrete liquefier, an air-entraining agent, a hardening accelerator, a stabilizing agent, a sealant. The at least one additive can be mixed in separately when granulating, or mixed into the separately provided binder suspension of the granulating agent.

It has been found that when mixing in an unbroken granulation of mineral grains comprising an unbroken granulation of fine sand, particularly desert sand, up to a ratio of 50 percent by mass, stable granules can be provided using the method according to the invention and are suitable for soil compacting as a bulk material or as an additive in concrete production. It can therefore be provided that when granulating, an additional fraction of an unbroken granulation of mineral grains comprising an unbroken granulation of fine sand, particularly desert sand, is used up to a total fraction of 50 percent by mass.

The invention further relates to a use of the construction material granulate according to the invention as an additive for concrete production or as bulk material for soil compacting.

Claims

1. A construction material granulate based on mineral grains in the form of fine sand grains and/or desert sand grains, wherein a fraction of a broken granulation of fine sand and/or desert sand, is bound in a hydraulically setting binder matrix.
2. The construction material granulate according to claim 1, characterized in that the binder matrix comprises a hydraulic binder.
3. The construction material granulate according to any one of the claims 1 or 2, characterized in that the binder matrix comprises a latent hydraulic binder.
4. The construction material granulate according to any one of the claims 1 through 3, characterized in that the fraction of broken granulation of desert sand comprises a grain spectrum from 2 mm preferably in a grain spectrum up to a size of 0.125 mm.
5. The construction material granulate according to any one of the claims 1 through 4, characterized in that a total fraction of up to 50 percent by mass of an unbroken granulation of mineral grains comprising an unbroken granulation of fine sand and/or desert sand, is bound in the binder matrix of the granulate.
6. The construction material granulate according to any one of the claims 1 through 5, characterized in that the granules comprise a size spectrum up to a diameter of 16 mm, preferably up to a diameter of 8 mm.
7. A method for producing a construction material granulate based on mineral grains in the form of fine sand grains and/or desert sand grains, wherein a broken granulation of fine sand and/or desert sand, is provided and a fraction of the broken granulation of fine sand and/or desert sand, is granulated by means of a fraction of a granulating agent forming a hydraulically setting binder matrix.

8. The method according to claim 7, characterized in that the broken granulation of fine sand and/or desert sand, is provided by grinding in a grinding facility.
- 5 9. The method according to any one of the claims 7 or 8, characterized in that a grain spectrum of the broken granulation of desert sand having a grain size from 2 mm preferably in a grain spectrum up to a size of 0.125 mm is used.
- 10 10. The method according to any one of the claims 7 through 9, characterized in that the granulating agent comprises at least one hydraulic binder and/or at least one latent hydraulic binder and water, wherein the at least one hydraulic binder and/or the at least one latent hydraulic binder and the water are added separately while granulating.
- 15 11. The method according to any one of the claims 7 through 9, characterized in that the granulating agent comprises a binder suspension, provided separately, and formed from at least one hydraulic binder and/or at least one latent hydraulic binder and water.
- 20 12. The method according to any one of the claims 7 through 11, characterized in that at least one additive is used when granulating, selected from a group comprising: a flow agent, a concrete liquefier, an air-entraining agent, a hardening accelerator, a stabilizing agent, a sealant.
- 25 13. The method according to any one of the claims 7 through 12, characterized in that when granulating, an additional fraction of an unbroken granulation of mineral grains comprising an unbroken granulation of fine sand, particularly desert sand, is used up to a total fraction of 50 percent by mass.
- 30 14. A use of the construction material granulate according to claims 1 through 6, produced according to the method according to claims 1 through 13, as an additive in concrete production.
15. The use of the construction material granulate according to claims 1 through 6, produced according to the method accord-

ing to claims 1 through 13, as bulk material for soil compaction.