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(54) Title: USE OF AN ADDITIVE FOR A BUILDING MATERIAL AND METHOD FOR PRODUCING A BUILDING MATERIAL

(57) Abstract: The invention relates to the use of an additive which comprises 60% of lactose at the most and 40% of milk protein at the most, and the milk protein includes 70 to 90% of casein and 10 to 30% of whey protein as well as, optionally, 1.5% of fat at the most, for a hydraulic binder to obtain a higher strength of the building materials produced using the hydraulic binder, wherein the mass ratio additive to hydraulic binder is between 1:130 and 1:62500.

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Use of an additive for a building material and
method for producing a building material

The invention relates to the use of an additive for a hydraulic binder with building materials as well as to a method for producing a building material using the inventive additive, to pellets comprising the additive as well as to a method for producing said pellets.

Milk and milk ingredients have been used in building trade for a long time. From WO 92/12102 a method is known for obtaining uniformly coloured lime-cement plasters on brickwork, wherein milk, milk powder or casein powder is added to a hydraulically setting plaster when being mixed with the mixing water. In particular, the addition of skimmed milk and/or finely distributed casein powder in a quantitative proportion of from 5 to 100g per litre mixing water leads to a uniform colouration of the plaster. It has turned out that with an amount of less than 5g the desired effect is no longer achieved in a satisfying way, whereas more than 100g of the additive per litre mixing water negatively influence curing of the mortar as well as strength of the finished plaster.

Furthermore, the use of ethylene-oxide/propylene-oxide block co-polymers in hydraulically setting masses as well as the thus obtained masses are known from DE 39 20 662 A1. Thus, dust development during the use of dry hydraulic binders shall be reduced. The hydraulically setting masses include 0 to 6 parts by weight of casein.

A binder is shown in CH 193 289, which is provided particularly for fastening wall and floor plates. The adhesion of the binder is improved in that it includes approximately 1.5 per cent per weight of casein, preferably in powder form. For producing said binder, the ingredients casein, a hydraulic binder, such as Portland cement, and casein glue are admixed in powder form, then, water is added.

GB 951 430 A describes a cement mixture which consists by 4 to 10 per cent per weight of a proteinaceous bonding agent, preferably of casein.

The addition of a protein hydrolyzate for hydraulic binders, mortar and concrete and their use in building trade are known from AT-E 40 670 B. Milk proteins can be used as starting mater-

ial for these additives.

The object of the present invention is to increase strength of a building material by providing the hydraulic binders necessary for producing the building material with an additive. For example, concretes, such as gas and porous concrete, all hydraulically curing building blocks, such as solid blocks, hollow blocks etc., mortar and plaster as well as building materials of hydraulically binding light aggregates shall be mentioned as building materials.

According to the invention this is achieved by using an additive for a hydraulic binder, wherein the additive comprises 60% of lactose at the most and 40% of milk protein at the most, and the milk protein includes 70 to 90% of casein and 10 to 30% of whey protein as well as, optionally, 1.5% of fat at the most, wherein the mass ratio of additive to hydraulic binder is between 1:130 and 1:62500. The following materials can be used as hydraulic binder: hydraulic as well as natural hydraulic lime, all types of cement, such as Portland cement, blast furnace slag cement, Roman cement and pozzolanic cement, as well as mixtures thereof.

The ingredients lactose and milk protein are present in skimmed milk powder in the mass ratio required, moreover, a low fat portion is necessary, as the result is not satisfying with a higher portion thereof. Furthermore, whey protein is an indispensable component of the additive, as tests have shown that the addition of casein alone did not lead to any satisfying results. Thus, the use of skimmed milk powder as additive is also advantageous with respect to availability and costs.

It is particularly suitable when the additive is present as pellet, bead, pad or the like, since, thus, not only a convenient handling regarding storage and transport is achieved, but also dosing is substantially facilitated, since, compared to hydraulic binder and aggregate, the additive is admixed in relatively low quantities.

When producing a building material which comprises the additive, a hydraulic binder, an aggregate as well as water a preferred mass ratio of additive to hydraulic binder is between 1:500 and 1:5000, as the best test results have been yielded in these ranges with respect to strength of the building material.

With a mass ratio of hydraulic binder to aggregate between

1:3.5 and 1:4.5, there is a favourable mass ratio of additive to hydraulic binder between 1:130 and 1:40000, wherein sand, gravel, ballast, grit and the like are used as aggregate. For a mass ratio of hydraulic binder to aggregate between 1:2.5 and 1:3.5, there is a preferred mass ratio of additive to hydraulic binder between 1:200 and 1:62500, since a higher strength has been achieved with these values in experiments as compared to a building material without an additive.

Furthermore, a method for producing a building material is shown, containing a hydraulic binder with an additive which comprises 60% of lactose at the most and 40% of milk protein at the most, wherein the milk protein includes 70 to 90% of casein and 10 to 30% of whey protein as well as, optionally, 1.5% of fat at the most, wherein the mass ratio additive to hydraulic binder is between 1:130 and 1:62500 and the mass ratio water to hydraulic binder is between 1:0.45 to 1:0.65.

For producing such a building material it is favourable to choose the mass ratio additive to hydraulic binder between 1:500 and 1:5000, wherein the mass ratio water to hydraulic binder shall be between 1:0.45 and 1:0.65, as the best test results have been yielded in this range.

For producing a building material, it is, with respect to storage and transport as well as to an easier dosage, particularly convenient to provide the additive in the form of pellets, beads, pads or the like. For this purpose, pellets are suitable which comprise 5 to 15% of the additive as well as 85 to 95% of sand, wherein the sand preferably comprises at least 50% of silica sand and has a granulation below 0.5mm.

In order to produce such pellets, 5 to 15% of the additive are dry mixed with 85 to 95% of sand, then tempered with water and mixed and finally pressed into pellet form and dried.

The present invention will now be explained in more detail by way of examples a) to n), without being restricted thereto. The table shows the prism strength of a building material in N/mm² after 3, 7, 28 days and in examples g) to h) also after 56 days, wherein 1440g of cement as hydraulic binder, 5760g of sand as aggregate, 792g of water as well as the respective amount of skimmed milk powder as additive indicated in the table were used in examples a) to l) for producing the building material.

In examples a) to c) the building material was produced by

dissolving the additive in water by means of a stirring device and ultrasound.

For comparison, examples m) and n) are indicated in each case, the values of which were obtained without admixing an additive to the building material. In example m) 1440g of cement, 5760g of sand and 792g of water were used, in example n) 1800g of cement, 5400g of sand and 990g of water.

Example	Additive in per cent per weight	prism strength in N/mm ²		
		after 3 days	after 7 days	after 28 days
a)	0.005	54.74	65.94	76.87
b)	0.008	50.30	64.36	75.35
c)	0.01	54.68	63.12	75.10
m)	0	48.13	58.02	67.80
n)	0	51.09	60.15	68.90

No stirring device was used in examples d) to f).

Example	Additive in per cent per weight	prism strength in N/mm ²		
		after 3 days	after 7 days	after 28 days
d)	0.005	54.7	59.67	75.92
e)	0.008	54.99	69.83	78.74
f)	0.016	45.93	66.41	73.27
m)	0	48.13	58.02	67.80
n)	0	51.09	60.15	68.90

The inventive pellets were dissolved in an ultrasonic bath and by the aid of a stirring device, leading to the results of examples g) to i).

Example	Additive in per cent per weight	prism strength in N/mm ²			
		after 3 days	after 7 days	after 28 days	after 56 days
g)	0.00155	59.37	70.46	81.56	79.85
h)	0.00194	58.12	69.68	81.24	82.03
i)	0.0023	51.09	67.18	75.17	
m)	0	48.13	58.02	67.80	
n)	0	51.09	60.15	68.90	

In examples j) to l) the pellets were dissolved without a stirring device.

Example	Additive in per cent per weight	prism strength in N/mm ²		
		after 3 days	after 7 days	after 28 days
j)	0.00155	52.5	67.10	78.20
k)	0.00194	53.75	64.38	72.81
l)	0.0023	55.88	67.82	74.37
m)	0	48.13	58.02	67.80
n)	0	51.09	60.15	68.90

Claims:

1. Use of an additive which comprises 60% of lactose at the most and 40% of milk protein at the most, and the milk protein includes 70 to 90% of casein and 10 to 30% of whey protein as well as, optionally, 1.5% of fat at the most, for a hydraulic binder to obtain a higher strength of the building materials produced using the hydraulic binder, wherein the mass ratio additive to hydraulic binder is between 1:130 and 1:62500.
2. Use according to claim 1, characterised in that the additive is present in the form of skimmed milk powder.
3. Use according to claim 1 or 2, characterised in that the additive is present as pellet.
4. Method for producing a building material using the additive according to any one of claims 1 to 3, characterised in that the additive, a hydraulic binder as well as an aggregate are tempered with water, wherein the mass ratio additive to hydraulic binder is between 1:500 and 1:5000.
5. Method for producing a building material using the additive according to any one of claims 1 to 3, characterised in that the additive, a hydraulic binder as well as an aggregate are tempered with water, wherein the mass ratio additive to hydraulic binder is between 1:130 and 1:40000, wherein the mass ratio hydraulic binder to aggregate is between 1:3.5 and 1:4.5.
6. Method for producing a building material using the additive according to any one of claims 1 to 3, characterised in that the additive, a hydraulic binder as well as an aggregate are tempered with water, wherein the mass ratio additive to hydraulic binder is between 1:200 and 1:62500 and the mass ratio hydraulic binder to aggregate is between 1:2.5 and 1:3.5.
7. Method for producing a building material containing a hydraulic binder using an additive according to any one of claims 1 to 3, wherein the additive comprises 60% of lactose at the most and 40% of milk protein at the most, wherein the milk pro-

tein contains 70 to 90% of casein and 10 to 30% of whey protein, as well as, optionally, 1.5% of fat at the most, characterised in that the additive, a hydraulic binder as well as an aggregate are tempered with water, wherein the mass ratio additive to hydraulic binder is between 1:130 and 1:62500 and the mass ratio water to hydraulic binder is between 1:0.45 and 1:0.65.

8. Method for producing a building material according to claim 7, characterised in that the additive, a hydraulic binder as well as an aggregate are tempered with water, wherein the mass ratio additive to hydraulic binder is between 1:500 and 1:5000 and the mass ratio water to hydraulic binder is between 1:0.45 and 1:0.65.

9. Pellet comprising an additive to be used according to any one of claims 1 to 3, characterised in that the pellet comprises 5 to 15% of the additive as well as 85 to 95% of sand, wherein the sand comprises at least 50% of silica sand and has a granulation below 0.5mm.

10. Method for producing a pellet according to claim 9, characterised in that 5 to 15% of the additive are dry mixed with 85 to 95% of sand, then tempered with water and mixed and finally pressed into pellet form and dried.

INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER

INV. C04B24/10 C04B24/14 C04B28/02 C04B40/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 92/12102 A (LEHRL ERNST [DE]) 23 July 1992 (1992-07-23) cited in the application	1,2,4-8
Y	claims 1,2,5	3,9,10
X	GB 2 156 333 A (KRUSZ LEON; KUSTRA ZYGMUNT GEORGE ALEXANDE) 9 October 1985 (1985-10-09) claims 3,4; example 1	1
Y	DE 102 57 879 B3 (DYCKERHOFF AG [DE]) 26 February 2004 (2004-02-26) claim 8	3,9,10
A	EP 1 321 445 A (HALLIBURTON ENERGY SERV INC [US]) 25 June 2003 (2003-06-25) abstract	1-10
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 473 285 A (HALLIBURTON ENERGY SERV INC [US]) 3 November 2004 (2004-11-03) abstract -----	1-10
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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