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(54) ORE PELLETISATION

PELLETISIERUNG VON ERZEN

BOULETAGE DU MINERAI

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EP 0 604 452 B2

Description

[0001] This invention relates to ore pelletisation processes which comprise forming an intimate mixture of particulate ore and particulate binder in the presence of moisture, forming green pellets by agitation of the mixture (for instance by rolling or tumbling) and firing the green pellets to produce ore pellets.

[0002] Bentonite has been a widely used particulate binder but numerous proposals have been made to use synthetic or natural organic polymers.

[0003] One class of natural polymers that has been used are various soluble starches. Another class are soluble cellulose derivatives which are usually esters (especially carboxymethyl cellulose) or ethers (especially hydroxyethyl cellulose). Another class are soluble gums such as xanthan gum or guar gum. It has been proposed to use mixtures of binder clay (bentonite) with the polymers. For instance Clum et al in Mining Engineers 1978 (NY) 30(1), page 53 show the results obtained using binders comprising guar gum, hydroxyethyl cellulose, polyoxyethylene oxide, and also bentonite.

[0004] There have been numerous proposals to use various soluble particulate synthetic polymers. Thus the particulate binder may comprise synthetic polymer particles often having a size up to 300μm formed by polymerisation of water soluble, ionic, ethylenically unsaturated monomer or monomer blend to form water soluble polymer particles. The monomer blend is free of cross linking agent, so as to avoid cross linking with the consequential risk of insolubility.

[0005] For example we describe in EP-A-225171 the use, as particulate binder, of water soluble synthetic polymer that has intrinsic viscosity 3 to 16dl/g and that is an anionic polymer and we describe in EP 0288150 the use of cationic polymers.

[0006] The use as pelletisation binder of soluble anionic synthetic polymer has several advantages over the use of bentonite, but it can suffer from one disadvantage in that it is difficult to achieve adequate dry strength in the ore pellets at economic dosages. Even if the dosage is increased in order to improve dry strength, there may then be other disadvantages, such as stickiness and aggregation of pellets in the drum and instability during the pelletising process.

[0007] Similarly, the use of natural polymers alone has not proved entirely satisfactory since they may not lead to the optimum combination of green strength, dry strength and drop number.

[0008] In US 5000783, the abrasion resistance and growth properties of pellets using a starch binder are improved by adding a dispersible polymer, but it is stated that this does not improve dry strength or drop number. In Example 9, a mix of 85 parts starch, 14 parts guar gum and 1 part polyacrylic acid is used. Binders of 10-45% by weight of a water-in-oil emulsion of a vinyl addition polymer and 55-90% of a polysaccharide which may be a gum are described in US 4751259.

[0009] In an ore pelletisation process according to the invention, particulate ore is mixed with particulate binder in the presence of moisture and the mixture is pelletised, and the particulate binder is a dry powdered particulate composition and is a blend of 1 part ionic synthetic water soluble polymer with from 2 to 30 parts of soluble natural polymer which is guar gum. Throughout this specification, parts are parts by weight. The gum may have been treated in known manner to increase its solubility, for instance it may be a phosphated guar gum.

[0010] The amount of synthetic polymer is generally at least 0.005% and usually at least 0.01% (by weight of the total mix) but the amount is generally not more than 0.1% and is frequently less, for instance below 0.06%. Amounts of 0.01 to 0.04% are often suitable.

[0011] The total amount of water soluble synthetic and guar gum used in the invention is usually at least 0.03% and often at least 0.05%. It is generally undesirable for it to be more than 0.3% and it is usually below 0.2%. Amounts of 0.05 to 0.1 or 0.15% are often suitable.

[0012] The amount of the guar gum is usually at least 0.02% and generally at least 0.04%. Although the amount can be, for instance, 0.2% or even more it is preferably below 0.15% and generally below 0.1%. It is very surprising that these low amounts of guar gum give a beneficial effect, since it is usually necessary to use relatively large amounts, typically 0.4% or more, to obtain beneficial binding results when using natural polymer.

[0013] The amount of the guar gum is generally (per part by weight of the soluble synthetic polymer) at least 3 parts and frequently at least 5 or 6 parts. It is normally below 15 parts, and is generally below 10 parts.

[0014] The binder preferably also includes sodium carbonate or other water soluble monomeric additive of the type described in EP 225171. The amount of this is generally from 0.2 to 2 parts, often around 0.7 to 1.5 parts, per part by weight of the synthetic polymer.

[0015] Preferred binders comprise 1 part by weight soluble synthetic polymer, 0.7 to 1.3 parts by weight sodium carbonate and 2 to 12 parts by weight guar gum.

[0016] The components of the binder may be premixed or they may be supplied to the pelletising process separately but preferably substantially simultaneously.

[0017] The total amount of binder (water soluble synthetic polymer plus natural polymer plus sodium carbonate or other salt) is typically in the range 0.03 to 0.3%, often around 0.05 to 0.2%.

[0018] The polymer can be cationic, for instance as described in EP 0288150, but is generally anionic as in EP

225171. The amount by weight of sodium acrylate or other anionic monomer is generally in the range 5 to 90% by weight, with the balance preferably being acrylamide. It is normally preferred for the polymer to be a copolymer of acrylamide with 10 to 40%, often 15 to 30%, sodium acrylate.

[0019] However it can be desirable to use larger amounts of sodium acrylate, e.g., 50 to 80%, typcially around 70%. Intrinsic viscosity can be in the range 2 or 3 to 16dl/g, often in the range 5 to 12dl/g, but in some instances can be higher, for instance up to 25dl/g.

[0020] It is generally desired that the soluble synthetic polymer should be wholly linear in which event it will normally have been polymerised in the absence of any added cross linking agent. However it can be advantageous for the synthetic polymer to be a water soluble, partly cross linked polymer. The amount of cross linking agent should be selected so that it is insufficient to render the polymer particles predominantly water insoluble but sufficient to give a useful benefit, particularly an increase in the dry strength of the ore pellets, provided that the amount is such that the particles still behave predominantly as water soluble polymer particles, for instance as regards their film-forming and rheological characteristics. The amount of cross linking agent typically is 5 to 50ppm, preferably 7 to 20ppm when the IV is 2 to 7dl/g and 2 to 30ppm, preferably 5 to 15ppm, when IV is 7 to 16dl/g. These IV's are measured on the polymer in the absence of cross linking agent and the amounts of cross linking agent are calculated as methylene bis acrylamide. Different, generally larger, amounts will be required to obtain the same rheology and solubility characteristics using other cross linkers. Generally the amount of cross linking agent is below 18ppm, measured as methylene bis acrylamide.

[0021] In this specification, IV values are determined by conventional single point IV measurement in dl/g at 20°C.

[0022] The components of the particulate binder used in the invention are supplied as a dry powdered particulate composition. The particles may be aggregates, for instance as described in EP 0326382. The size of the binder particles is normally below 300μm, generally below 200μm and preferably below 150μm, but is generally above 20μm.

[0023] The particulate ore is preferably an iron ore but can be any other mineral ore that is capable of being pelletised, for instance a zinc ore. The materials and process conditions can be broadly as described in EP 225171, except that the binder must include the defined large amount of guar gum. Bentonite can be used as part of the binder.

[0024] In Examples 1 and 2 below, pelletisation processes were conducted as in the examples of EP 225171 using various combinations of guar gum and anionic polymer the latter formed as in EP 225171. The results were as follows.

Example 1

[0025]

Product A -	a 20% anionic polyacrylamide blended 50/50 with sodium carbonate
Product B -	a guar gum
Product C -	a 2/7 active polymer blend of A and B

	Green Strength/Kg	Dry Strength/Kg	Drop Number	% Moisture
0.09% C	1.00	2.80	29.3	10.3
0.10% B	1.31	2.26	37.0	9.7

Example 2

[0026]

Product D -	a 1/5 active polymer blend of A and B

	Green Strength/Kg	Dry Strength/Kg	Drop Number	% Moisture
0.12% D	1.18	8.15	21.3	10.5
0.12% B	1.30	6.08	45.0	10.0

[0027] A combination of an anionic polyacrylamide blend with sodium carbonate and guar gum gives acceptable green properties whilst increasing the dry strength over that obtained with guar gum on its own.

[0028] In the two examples described, the dry strength has been increased by 24.0 and 34.0% respectively as a result of blending the guar gum with the synthetic polymer. Thus, even though dry strength tends to be a problem with

binders based on synthetic polymer, the addition of the synthetic polymer to the guar gum increases the dry strength attainable using a similar amount of the natural polymer in the absence of the synthetic polymer.

Claims

1. An ore pelletisation process comprising mixing particulate ore with particulate polymeric binder in the presence of moisture and pelletising the mixture, characterised in that the particulate polymeric binder is a dry powdered particulate composition and is a blend of one part by weight ionic synthetic water soluble polymer with 2 to 30 parts by weight of soluble natural polymer which is guar gum.

2. A process according to claim 1 in which the synthetic polymer is an anionic polymer.

3. A process according to either preceding claim in which the amount of synthetic polymer is 0.005 to 0.1% and the amount of the guar gum is from 0.05% to 0.2%, by weight of the total mixture.

4. A process according to any preceding claim in which the amount of guar gum is 3 to 10 parts by weight per part by weight synthetic polymer.

5. A process according to any preceding claim in which the synthetic polymer is formed of a blend of 10 to 90% acrylamide and 90 to 10% sodium acrylate and has intrinsic viscosity 2 to 16dl/g.

6. A process according to any preceding claim in which the synthetic polymer is formed of a blend of 60 to 90% by weight acrylamide and 40 to 10% by weight sodium acrylate and has intrinsic viscosity 5 to 9dl/g.

7. A process according to any preceding claim in which the ore is iron ore in the form of particles mainly below 250μm.

Patentansprüche

1. Erz-Pelletisierverfahren, umfassend das Mischen von teilchenförmigem Erz mit teilchenförmigem polymerem Bindemittel in Anwesenheit von Feuchtigkeit und das Pelletisieren der Mischung, dadurch gekennzeichnet, daß das teilchenförmige polymere Bindemittel eine trocken pulverisierte teilchenförmige Zusammensetzung ist und eine Mischung aus einem Gewichtsteil ionischem, synthetischem wasserlöslichem Polymer mit 2 bis 30 Gewichtsteilen löslichem natürlichem Polymer ist, bei dem es sich um Guargummi handelt.

2. Verfahren nach Anspruch 1, in welchem das synthetische Polymer ein anionisches Polymer ist.

3. Verfahren nach irgendeinem der beiden vorstehenden Ansprüche, in welchem die Menge an synthetischem Polymer 0,005 bis 0,1% und die Menge an Guargummi 0,05 bis 0,2%, bezogen auf das Gewicht der gesamten Mischung, beträgt.

4. Verfahren nach irgendeinem vorangehenden Anspruch, in welchem die Menge an Guargummi 3 bis 10 Gewichtsteile pro Gewichtsteil synthetisches Polymer beträgt.

5. Verfahren nach irgendeinem vorangehenden Anspruch, in welchem das synthetische Polymer aus einer Mischung von 10 bis 90% Acrylamid und 90 bis 10% Natriumacrylat gebildet ist und eine Grenzviskosität von 2 bis 16 dl/g aufweist.

6. Verfahren nach irgendeinem vorangehenden Anspruch, in welchem das synthetische Polymer aus einer Mischung von 60 bis 90 Gewichts-% Acrylamid und 40 bis 10 Gewichts-% Natriumacrylat gebildet ist und eine Grenzviskosität von 5 bis 9 dl/g aufweist.

7. Verfahren nach irgendeinem vorangehenden Anspruch, in welchem das Erz Eisenerz in Form von Teilchen hauptsächlich unterhalb von 250 μm ist.

Revendications

1. Procédé de bouletage de minerai comprenant le mélange de minerai particulaire avec un liant polymère particulaire en présence d'humidité et le bouletage du mélange, caractérisé en ce que le liant polymère particulaire est une composition particulaire pulvérulente sèche et est un mélange d'une partie en poids de polymère synthétique ionique soluble dans l'eau et de 2 à 30 parties en poids de polymère naturel soluble qui est une gomme de guar.

2. Procédé selon la revendication 1 où le polymère synthétique est un polymère anionique.

3. Procédé selon l'une quelconque des revendications précédentes, où la quantité de polymère synthétique est de 0,005 à 0,1 % et la quantité de gomme de guar est comprise entre 0,05 % et 0,2 % en poids du mélange total.

4. Procédé selon l'une quelconque des revendications précédentes, où la quantité de gomme de guar est de 3 à 10 parties en poids par partie en poids de polymère synthétique.

5. Procédé selon l'une quelconque des revendications précédentes, où le polymère synthétique est formé d'un mélange de 10 à 90 % d'acrylamide et 90 à 10 % d'acrylate de sodium et a une viscosité intrinsèque de 2 à 16 dl/g.

6. Procédé selon l'une quelconque des revendications précédentes, où le polymère synthétique est formé d'un mélange de 60 à 90 % en poids d'acrylamide et de 40 à 10 % en poids d'acrylate de sodium et a une viscosité intrinsèque de 5 à 9 dl/g.

7. Procédé selon l'une quelconque des revendications précédentes, où le minerai est du minerai de fer sous forme de particules dont la majorité a une taille inférieure à 250 μm.