

DUST CONTROL OF ABSORBENT POLYMERS

The present invention relates to attrition-resistant absorbent polymers having reduced levels of unassociated dust and to a process for the preparation of such polymers.

In the gel polymerization of absorbent polymers, that is, water-swella-
ble polymers, monomers are polymerized in aqueous solution. Certain
additives, such as crosslinking agents, may be incorporated into the monomer
mixture. The product of the polymerization process is typically dried and
subjected to mechanical means of particle size reduction and classification
including chopping, grinding, and sieving. During such particle size reduction,
ultrafine particles or dust, that is, particles having a mean diameter less than
about 10 microns, are unavoidably created.

WO 94/22940, discloses a water-swella-
ble polymer composition and
process for the production thereof. The composition has reduced dusting
tendencies and is attrition-resistant. The reduced dusting is due to coating
the polymer particles with a dedusting agent selected from hydrophilic
compounds such as aliphatic polyols and polyalkylene glycols. WO 94/22940
states that employing compounds such as these does not detrimentally affect
the performance of the polymer. However, it has been discovered that when
the water-swella-
ble polymer products of the process of WO 94/22940 are
swollen with an aqueous fluid, the surface tension of the fluid in contact with
the swella-
ble polymer product and air is decreased from that of a fluid in
contact with untreated polymer products. This is unfortunate because surface
tension of the contacting fluid at equilibrium is one of the measures of the
performance of a water-swella-
ble polymer.

Surface tension of the contacting fluid at equilibrium is used as a
measure of performance because water-swella-
ble polymers yielding a fluid
with higher surface tension generally tend to "wick" better, that is, the polymer
transports aqueous fluids by capillary flow more efficiently and holds the fluids
more strongly. As U.S. Patent No. 5,352,711 discusses, wicking is very
important for absorbent devices such as diapers or sanitary articles. The

effect of surface tension on capillary flow and capillary pressure is described more fully by the Lucas-Washburn equation as discussed by P.K. Chatterjee, "Absorbency", Elsevier, Amsterdam, 1985, pp. 36-37.

5 Industry would find great advantage in a water-swellable, attrition-resistant polymer composition which does not dust, for example, which comprises no more than 2.5 parts per million (ppm) unassociated particles less than 10 microns in diameter, and which substantially maintains or increases the surface tension of aqueous fluids when the latter are in equilibrium with the composition and air as compared to compositions
10 comprising greater than 2.5 ppm unassociated particles less than 10 microns in diameter. Industry would further find advantage in a new process which reduces the level of particles less than 10 microns in diameter in a given composition by at least 80 percent and/or provides a composition comprising no more than 2.5 ppm unassociated particles less than 10 microns in
15 diameter while substantially maintaining or increasing the surface tension of an aqueous fluid when it is in equilibrium with the composition and air.

Accordingly, the subject invention provides a composition comprising gel-polymerized, water-swellable polymer particles, the particles bearing on their surface a physical coating of a hydrophobic dedusting agent, wherein the
20 composition comprises no more than 2.5 ppm unassociated dust having a maximum diameter less than or equal to 10 microns. The surface tension of an aqueous fluid in equilibrium with the composition and air is substantially maintained or increased as compared to untreated gel-polymerized, water-swellable polymer particles. The composition absorbs at least 20 grams of a
25 0.9 weight percent aqueous saline solution under a pressure of 0.3 psi (21,000 dynes/cm²), that is, a 60 minute 0.3 psi (21,000 dynes/cm²) AUL greater than 20 grams/gram as measured in accordance with the Absorption Under Load Test set forth in U.S. Patent No. 5,147,343. The composition is attrition-resistant in that it contains less than 100, preferably less than 65 ppm
30 of unassociated dust having a maximum diameter less than or equal to 10 microns after having been roll-milled for 20 minutes.

The subject invention further provides a process which comprises:

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- (a) preparing a water-swellaable hydrogel by gel polymerization;
- (b) drying and sizing the hydrogel to form a composition comprising dried and sized particles, the composition having a first amount of unassociated dust having a maximum diameter less than or equal to 10 microns; and
- 10
- (c) contacting the composition with an effective amount of a hydrophobic dedusting agent to form an attrition-resistant, dedusted composition, wherein the attrition-resistant, dedusted composition is characterized by:
- 15
- (1) a 60 minute 0.3 psi (21,000 dynes/cm²) AUL greater than 20 grams/gram whereupon the attrition-resistant, dedusted composition has a second amount of unassociated dust having a maximum diameter less than or equal to 10 microns, the second amount being less than 20, preferably less than 10, more preferably less than 5, most preferably less than 1 percent of the first amount and/or the second amount of unassociated dust being less than 2.5 ppm of the attrition-resistant, dedusted composition;
- 20
- (2) a tendency to generate a third amount of unassociated dust having a maximum diameter less than or equal to 10 microns upon roll-milling of the attrition resistant, dedusted composition for 20 minutes, the third amount being less than or equal to the first amount, preferably less than 100, more preferably less than 65 ppm of the attrition resistant, dedusted composition; and
- 25
- (3) a surface tension such that when an aqueous fluid is in equilibrium with the attrition resistant, dedusted composition and air, the surface tension of the aqueous fluid is substantially maintained or increased as compared to an untreated gel-polymerized, water-swellaable polymer composition.
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As used herein, the term "substantially maintain or increase the surface tension" means that when an aqueous fluid is in equilibrium with another fluid and the attrition-resistant, water-swellaable polymers treated with a hydrophobic dedusting agent of the present invention, the surface tension of the aqueous fluid, as measured by a surface tension test disclosed hereinafter, is decreased by less than 10 percent, preferably less than 5 percent, when compared to water-swellaable polymers that are not treated with a hydrophobic dedusting agent. More specifically, the aqueous fluid employed in the surface tension test disclosed herein is a 0.9 percent NaCl solution and the other fluid is air.

As used herein, the term "unassociated dust" means the portion of a water-absorbent polymer particle composition having a maximum diameter less than or equal to 10 microns, which portion is rendered airborne when air is applied to the composition. More specifically, the air is applied and the portion is measured using a pulsed jet disperser described below.

As used herein the term "physical coating" means that the dedusting agent is in contact with both the polymer particles and dust without chemically reacting, for example, no surface crosslinking reaction occurs between the dedusting agent and the polymer particles or dust.

The water-swellaable or lightly crosslinked hydrophilic polymers that are employable in the present invention can be any of the known hydrophilic polymers which are capable of absorbing large quantities of fluids. In particular, water-absorbent polymers useful in this invention are water-absorbent polymers which contain carboxyl moieties. Preferably, at least 0.01 equivalent of carboxyl groups are present per 100 grams of the water-absorbent resin. Many of these polymers are commercially available.

Among preferred carboxyl-containing water absorbent polymers are hydrolyzates of starch-acrylonitrile graft copolymers, partially neutralized products of starch-acrylic acid or starch-polyvinyl alcohol graft copolymers, saponification products of vinyl acetate acrylic ester copolymers, derivatives of copolymers of isobutylene and maleic anhydride, hydrolyzates of acrylonitrile copolymers, crosslinked products of hydrolyzates of acrylonitrile

copolymers, crosslinked carboxy methyl cellulose, hydrolyzates of acrylamide copolymers, crosslinked products of hydrolyzates of acrylamide copolymers, partially neutralized products of polyacrylic acids and crosslinked products of partially neutralized polyacrylic acids.

5 Examples of some suitable polymers and processes, including gel polymerization processes, for preparing them are disclosed in U.S. Patent Nos. 3,997,484; 3,926,891; 3,935,099; 4,090,013; 4,093,776; 4,340,706; 4,446,261; 4,683,274; 4,459,396; 4,708,997; 4,076,663; and 4,190,562. Such hydrophilic polymers are prepared from water-soluble α,β -ethylenically
10 unsaturated monomers such as monocarboxylic acids, polycarboxylic acids, acrylamide and their derivatives.

 Suitable α,β -ethylenically unsaturated monomers include, for example, acrylic acid, methacrylic acid, crotonic acid, isocrotonic acid and alkali metal salts and ammonium salts thereof; itaconic acid, acrylamide, methacrylamide
15 and 2-acrylamido-2-methyl-1-propane sulfonic acid and its salts. The preferred monomers include acrylic acid and methacrylic acid and their respective salt forms such as alkali metal or ammonium salts.

 The resultant polymer is typically pre-sized and dried using means well-known in the art. Suitable drying means include fluidized bed driers,
20 rotary driers, forced air ovens, and through-circulation band driers,. In some instances, drying will occur in two or more stages, that is, multi-stage drying. In multi-stage drying, the pre-sized polymer particles are partially dried in the initial stage or stages, for example, the pre-sized polymer particles are dried to less than 25, preferably less than 20 percent moisture level. Drying to less
25 than 10, preferably less than 5 percent moisture level, is accomplished during the completion of drying stages. During the initial stage or stages of drying, the pre-sized particles typically fuse together into sheets. Following the completion of drying, the polymer is more completely sized to form particles having an average diameter less than 0.8 mm. During such sizing, dust,
30 characterized by extremely small particle sizes, may result, that is, particles having sizes less than or equal to 10 microns may be formed. The amount of dust generated will vary based on manufacturing procedures.

To improve absorptive properties, the dried particles may be heat treated in accordance with the procedures set forth in WO 93/05080, and/or WO 94/20547. In particular, the dried particles are heated for a time sufficient to increase the modulus, centrifuge capacity, and/or the absorbency under load. An oxidizing agent, such as a bromate, chlorate, chlorite, or a mixture thereof, may be uniformly distributed within the water absorbent polymer prior to such heat treatment to enhance one or more of the preceding properties. Such heat treatment is preferably carried out at a temperature of at least 170°C, more preferably of at least 180°C, and most preferably of at least 190°C. Such heat treatment is preferably carried out at a temperature of less than 250°C, more preferably less than 240°C.

The time period for heat treatment should be sufficient to improve in absorptive properties. The exact times of heat treatment required will be affected by the equipment chosen, and can be determined empirically by examination of product properties. Preferably, the time is at least 3 minutes, and more preferably at least 5 minutes. If the time is too long, the process becomes uneconomical and a risk is run that the absorbent resin may be damaged. Preferably, the maximum time of heating is 150 minutes or less, more preferably 60 minutes or less.

The method of heat treatment is not critical. For example, forced-air ovens, fluidized bed heaters or heated screw conveyors, may be successfully employed. If desired, the heated polymer may be remoisturized for ease in handling. While such remoisturization may serve to decrease the amount of unassociated dust, it may lead to clumping of the polymer product.

Another way to improve absorptive properties of the polymer particles may be to surface crosslink the polymer particles. Procedures for surface crosslinking are well known in the art and described in, for example, DE 4244548, DE 4020780, EP 605150, U.S. 4,734,478, and U.S. 4,666,983. These procedures, like heat treatment, may increase the modulus, centrifuge capacity, and/or the absorbency under load of the polymer particles.

To reduce levels of unassociated dust and to inhibit the production of unassociated dust during handling of the polymer material, the dried and

optionally heat-treated or surface-crosslinked particles are contacted with an effective amount of a dedusting agent. The dedusting agent serves to adhere the dust together into larger clusters, to the larger polymer particles, or to the walls of the mixing vessel or container in which the polymer is retained during handling, all of which will translate to reduced levels of unassociated dust in the finished polymer product at the various stages of handling. Moreover, the application of the dedusting agent to the polymer does not substantially detrimentally affect the performance or properties of the polymer. Particularly, the surface tension of an aqueous fluid in equilibrium with the polymer and air is substantially maintained or increased.

As defined herein, the term "effective amount of a dedusting agent" means an amount of a hydrophobic material which, when applied to the polymer material, reduces the concentration of unassociated dust having a diameter of less than 10 microns by at least 80, preferably at least 90, more preferably by at least 95, and most preferably by at least 99 percent and/or which produces dedusted compositions comprising less than 2.5 ppm unassociated dust having a maximum diameter less than or equal to 10 microns.

Preferred dedusting agents are hydrophobic organic materials which do not substantially penetrate into the interior of the polymer particles, that is, the dedusting agent is present at the surface of the particles, even when provided in small amounts. Suitable dedusting agents do not substantially impede the absorption of aqueous fluids by the polymer and substantially maintain or increase the surface tension of aqueous fluids when they are in equilibrium with the composition and air as measured by the surface tension test disclosed herein.

For ease of contacting the hydrophobic dedusting agent with the polymer, it is preferred that the dedusting agent be a liquid with a viscosity such that the agent may be easily handled. Typically, the agent's viscosity should be below 12,500, preferably below 10,000, centipoise upon contact with the polymer. Likewise, the volatility and/or boiling point of the hydrophobic dedusting agents should not be so high that the agent evaporates from the surface of the particles upon shipping and handling.

Typically, the agent should not boil at more than 400°C and not less than 100°C, preferably not less than 150°C, especially if higher temperatures are to be employed at the time of contact to increase the speed of coating the polymer particles as described below.

5 Exemplary hydrophobic dedusting agents may include aliphatic hydrocarbon oils, such as mineral oil, and alkanes or alkenes having between 7 and 18 carbon atoms optionally substituted with OH, CO₂H or esters thereof. Natural oils such as castor, corn, cottonseed, olive, rapeseed, soybean, sunflower, other vegetable and animal oils, as well as esters, 10 alcohols, and acids of the oils are useful in the invention as well as silicone oils of similar viscosities. The above compounds may be employed in purified form, in solutions, or in mixtures.

As described above, an "effective amount" of hydrophobic dedusting agent is that amount which reduces the concentration of unassociated dust 15 having a diameter of less than 10 microns by at least 80, preferably at least 90, more preferably by at least 95, and most preferably by at least 99 percent and/or which produces dedusted compositions comprising less than 2.5 ppm unassociated dust having a maximum diameter less than or equal to 10 microns. This effective amount will vary based upon the amount of dust 20 initially present, the type of water-absorbent polymer, and the hydrophobic dedusting agent employed. Generally, the amount is at least 100, preferably at least 200, more preferably at least 300 ppm based on the weight of the polymer particles. The amount is generally, less than 6000, preferably less than 3000, more preferably less than 1000 ppm based on the weight of the 25 polymer particles.

Although it is not necessary to include solvents in the addition of the hydrophobic treatment to the dry polymer powder, solvents can be employed in amounts such that effective dedusting by the hydrophobic treatment is still observed. Typically, amounts of solvent up to 20 times the amount of the 30 hydrophobic treatment may be employed. When an organic solvent is employed, it may be desirable to utilize a solvent which is readily removed from the coated particles, for example, by evaporation. Especially suitable solvents include light hydrocarbons such as hexane, alcohols, and mixtures

thereof. One especially preferred embodiment may be to utilize the hydrophilic dedusting compounds of WO 94/22940, such as polyether polyols, as solvents in amounts which do not substantially affect the surface tension of an aqueous fluid in equilibrium with the polymer and air. By employing the hydrophilic dedusting agents as solvents, one may obtain an additive effect with respect to the dedusting tendency, yet may not have the problem of increased surface tension which occurs when the hydrophilic agents are used alone.

In some cases, it may be beneficial to disperse the hydrophobic dedusting agent in a liquid in order to facilitate the addition of the dedusting agent to the water-swellaable polymer particles. Many liquids, including water may be employed as the medium for the dispersion. It may be advantageous to employ a dispersing agent if the particular dedusting agent is difficult to disperse. Among useful dispersing agents are the hydrophilic dedusting agents disclosed in WO 94/22940. If a solvent, a dispersing medium, a dispersing agent, or any other additive is to be employed in conjunction with the hydrophobic dedusting agent, one must ensure that the additive does not substantially lower the surface tension of a fluid in equilibrium with the water-swellaable polymer. This is accomplished by utilizing the surface tension test disclosed herein.

The dried and optionally heat treated, surface crosslinked, or otherwise treated polymer particles and the dedusting agent should be contacted under conditions such that the particles can be coated with the dedusting agent. Preferably, such contacting will be conducted with some form of mechanical distribution, such that adequate distribution of the dedusting agent on the water-absorbent resin particles occurs. Examples of blending equipment/processes include simple tumbling of a jar, or blending in a conical dryer, ribbon blender, or drum tumbler. Moderate stirring, shaking, grinding or even conveying the particles a short distance in a screw-conveyer can be sufficient for such adequate distribution of the dedusting agent over the particles, particularly if the particles are at an elevated temperature.

The temperature of contacting is not critical and generally can be any temperature at which the dedusting agent does not evaporate, solidify,

become too viscous, or significantly react with the carboxyl moieties of the absorbent resin polymer. Such temperatures are typically from 20°C to 150°C, preferably from 20°C to 60°C. It should be noted that elevated temperatures, that is, those above ambient temperature, that is, above 25°C, improve the speed of coating of the particles.

While not necessary, the dedusted compositions may be further blended with a particulate flowability enhancer. When utilized, the particulate flowability enhancer should be provided in an amount such that the final composition has a concentration of unassociated dust, that is, particles having a maximum diameter less than or equal to 10 microns, that is, less than 20, preferably less than 10, more preferably less than 5, most preferably less than 1 percent of the amount of dust before treatment with the dedusting agent and/or comprises less than 2.5 ppm unassociated dust having a maximum diameter less than or equal to 10 microns. One such flowability enhancer is an ultra-microscopic silica having a BET surface area of at least 50 m²/g and a particle diameter less than or equal to 0.05 micron, such as AEROSIL™ R972 (available from Degussa Inc.). The amount of silica utilized is advantageously kept small because silica dust, as well as dust from the absorbent polymer, will contribute to the total dust. Generally, less than 10 weight percent, preferably less than 1 weight percent, more preferably less than 1000 ppm of silica based on the weight of the dedusted composition is employed.

The superabsorbent polymers of this invention are useful in the manufacture of moisture absorbent articles, such as disposable diapers, sanitary napkins, incontinence garments and bandages. The superabsorbent compositions of this invention are particularly useful in the manufacture of thin and ultra thin disposable diapers which have excellent moisture absorbance capacity, fluid distribution properties and reduced leakage.

The absorbent articles of the invention may comprise from 5 percent to 95 percent by weight of the superabsorbent polymers of the invention. In a typical absorbent article, the superabsorbent polymer of the invention may be dispersed in a fiber matrix in which the superabsorbent is present in an amount from 30 to 70 weight percent and the fiber matrix comprising 70 to 30 weight percent of the article. In another form of absorbent article, the

superabsorbent may be present in a containment structure in which the superabsorbent polymer is present in an amount of 30 to 95 percent by weight. Combinations of dispersed superabsorbent polymer and contained superabsorbent polymer are also known.

5 The superabsorbent polymers of this invention can be used in the manufacture of absorbent articles such as those described in U.S. Patent Nos. 3,669,103; 3,670,731; 4,654,039; 4,699,823; 4,430,086; 4,973,325; 4,892,598; 4,798,603; 4,500,315; 4,596,567; 4,676,784; 4,938,756; 4,537,590; 4,935,022; 4,673,402; 5,061,259; 5,147,343; 5,149,335; and
10 5,156,902.

 The process for measuring the amount of unassociated dust having a diameter less than a predetermined size present in a water-swellaable polymer composition is described below. In the case of the examples, the measurement process was used to determine the amount of unassociated
15 matter having a maximum size less than or equal to 10 microns. The process is applicable, however, to measure the amount of unassociated dust having a diameter less than other predetermined sizes, the predetermined sizes typically being consistent with either the manufacturer's or the purchaser's specifications. The process comprises:

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- (a) placing the composition into the sample holder of a pulsed jet disperser;
 - (b) blasting the composition with air-dried by passage through dehydration means; and
 - (c) determining the weight of particles in each of a plurality of size increments.

10 Dehydration means are suitable to reduce the amount of water present in the air to be used to blast the polymer composition. Suitable dehydration means include, for example, molecular sieve cartridges, dessicating materials, and membranes. An especially preferred dehydration means is a molecular sieve cartridge.

15 The dust levels of the coated samples may be measured as follows. Approximately 0.01 to 0.2 grams of the sample to be tested is placed in the sample holder of a pulsed jet disperser, for example, an AEROSIZER™ jet disperser available from Amherst Process Instruments of Hadley, Massachusetts. The pulsed jet disperser is fitted with a 250 micron screen to prevent particles greater than 250 microns in diameter from entering the detector. The air delivered to the pulsed jet disperser is filtered using the
20 factory supplied filter and is dried using a molecular sieve cartridge. The samples are blasted with the dried air, with the exhaust stream being directed to the detector and analyzed until the instantaneous count rate decays to less than 20 particles per second on the low sensitivity setting of the detector.

25 Measurements are made on separate portions of the samples and are averaged. For each portion, a determination is made of the total number of particles in each of 500 size increments evenly distributed logarithmically from 0.2 to 200 microns, the instrument exhibiting an approximate lower level of detection of 0.5 microns. The weight of material in each of these size increments is calculated using the following formula (1):

Weight = (number of particles in an increment)(density)(π)(particle diameter³)/6. (1)

For sodium polyacrylate superabsorbent materials, the density is assumed to be 1.60 g/cm³.

- 5 The aggregate weight of unassociated material less than 10 microns is designated weight_{dust}. This weight is compared to the weight of sample originally introduced into the disperser, that is, weight_{sample}. The percent dust is determined in accordance with equation (2):

Weight percent dust (%) = 100(weight_{dust})/(weight_{sample}). (2)

- 10 The following examples are provided for the purpose of explanation rather than limitation. The water-swellaable polymer samples are standard commercially available materials. The actual composition of these materials before treatment is not relevant to the present invention, that is, the invention would be expected to be applicable to any commercially available water-swellaable polymer materials.
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Example 1

- A test was conducted to compare the dustiness of water-swellaable polymers and the surface tension of a liquid in contact with said polymers which were treated with hydrophobic agents of the instant invention and polymers treated with a hydrophilic agent of WO 94/22940.
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- A water-swellaable polymer was obtained. The polymer was DRYTECH™ 2035 superabsorbent (available from The Dow Chemical Company), a 62 percent neutralized polyacrylate crosslinked with trimethylopropane triacrylate. Dedusting agents, as identified in Table I, were added dropwise to samples of the polymer at 25°C. The coated particles were then rolled for 30 minutes to distribute the dedusting agent on the particle surfaces. The amount of dust below 10 microns was measured as described in the test immediately preceding these examples and the results with respect to each sample are set forth in Table I.
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The surface tension of the liquid was measured using a Du Noüy tensiometer. The particular tensiometer employed was a Processor Tensiometer K12™ from Krüss. The preparation of an aqueous fluid to be measured, in equilibrium with the absorbent polymer and air, was substantially adapted from U.S. Patent No. 4,654,039. One gram samples of each of the above treated absorbent polymers, that is, the control (untreated) absorbent polymer, the absorbent polymers treated with various hydrophobic dedusting agents, and the comparative sample of absorbent polymer treated with hydrophilic dedusting agent of WO 94/22940, were shaken with 200 grams of a 0.9 weight percent NaCl solution to simulate a urine solution. The surface tension of this decanted fluid was then measured with a tensiometer. The results are summarized below in Table I.

TABLE I

Sample	Dedusting Agent	Weight Of Dust Below 10 microns (ppm)	Surface Tension (dynes/cm)
1	none (control)	27	69.2
1A	300 ppm LITTLE ONEST TM baby oil	0.85	66.7
1B	1000 ppm LITTLE ONEST TM baby oil	0.27	70.0
1C	1000 ppm CRISCO TM cooking oil	0.6	68.4
Comparative Sample	600 ppm VORANOL TM 2070 polyether polyol	0.39	62.1

5 Example 2

A test was conducted to compare dustiness of the polymers treated with hydrophobic agents (Samples 1, 1A, 1B, and 1C) before attrition and after attrition.

10 About 10 grams each of the untreated and hydrophobically treated polymers of Example 1 (Samples 1 to 1C) were added to an 8 ounce jar which was approximately half-filled with ceramic rod segments which were 7 millimeter (mm) long and 7 mm in diameter. The jar was capped, taped closed, and was rolled on a roll mill for 20 minutes. Upon completion of rolling, the rods were separated from the polymer sample using an 1/8 inch (3

15 mm) mesh screen. The amount of unassociated dust was measured as described above. The results are summarized in Table II below.

TABLE II

Sample	Dedusting Agent	Weight Of Dust Below 10 microns before attrition (ppm)	Weight Of Dust Below 10 microns after attrition (ppm)
1	none (control)	27	4700
1A	300 ppm LITTLE ONES™ baby oil	0.85	63
1B	1000 ppm LITTLE ONES™ baby oil	0.27	17
1C	1000 ppm CRISCO™ cooking oil	0.6	26

Example 3

5 A test was conducted to determine the centrifuge capacity (CC) and the 60 minute 0.3 pounds per square inch (21,000 dynes/cm²) Absorption Under Load (AUL), and 60 minute 0.6 pounds per square inch (42,000 dynes/cm²) AUL of Samples 1, 1A, 1B, and 1C.

10 Centrifuge capacity was determined as described in U.S. Patent No. 4,286,082, except that an absorption time of 30 minutes was employed rather than 3 to 5 minutes; 60 minute 0.3 pounds per square inch (21,000 dynes/cm²) AUL and 60 minute 0.6 pounds per square inch (42,000 dynes/cm²) AUL were measured as described in U.S. Patent No. 5,147,343. The results are shown in Table III.

TABLE III

Sample	Dedusting Agent	CC (g/g)	0.3 psi AUL (g/g)	0.6 psi AUL (g/g)
1	none (control)	27.5	29.2	23.0
1A	300 ppm LITTLE ONEST TM baby oil	25.4	30.2	21.3
1B	1000 ppm LITTLE ONEST TM baby oil	25.2	28.7	20.2
1C	1000 ppm CRISCO TM cooking oil	27.4	30.5	21.6

Example 4

5 A test was conducted to determine dustiness of water-swella-
polymers and surface tension of a liquid in contact with polymers treated with
various amounts of light mineral oil and heavy mineral oil.

10 Samples of the water-swella-
polymer as in Example 1,
DRYTECHTM 2035 from The Dow Chemical Company, were treated with
various amounts of both light mineral oil (LMO), that is, mineral oil having a
Saybolt viscosity of 162 minimum, available from Fisher Scientific *0121, and
heavy mineral oil (HMO), that is, mineral oil having a Saybolt viscosity of 158
maximum, available from Fisher Scientific *0122, in the same manner as in
Example 1. The samples were then tested in the same manner as in
15 Example 1 for amount of dust and surface tension. The data from these tests
are set forth in Table IV below.

*as product number

TABLE IV

Sample	Dedusting Agent	Weight Of Dust Below 10 microns (ppm)	Surface Tension (dynes/cm)
4	none (control)	4.3	71.7
4A	100 ppm LMO	1.9	71.4
4B	300 ppm LMO	0.25	71.6
4C	600 ppm LMO	0.225	71.9
4D	1000 ppm LMO	0.380	71.7
4E	3000 ppm LMO	0.265	71.7
4F	100 ppm HMO	0.955	72.0
4G	300 ppm HMO	0.640	71.8
4H	600 ppm HMO	0.270	71.5
4I	1000 ppm HMO	0.355	71.7
4J	3000 ppm HMO	0.140	71.4

5 In view of the description and examples, other embodiments will be readily ascertained by those skilled in the art. Accordingly, the scope of the invention shall be limited only by the claims.

CLAIMS:

1. A composition comprising water-absorbent water-insoluble polymer particles, the particles bearing on their surface a physical coating of an effective amount of a hydrophobic organic dedusting agent, wherein the composition comprises no more than 2.5 ppm unassociated dust having a maximum diameter less than or equal to 10 microns, and wherein the composition is characterized by a 60 minute 0.3 psi (21,000 dynes/cm²) Absorption Under Load greater than 20 grams/gram.
2. The composition of Claim 1 wherein the surface tension of an aqueous fluid that is in equilibrium with the composition and air is substantially maintained or increased as compared to said composition without a physical coating of the hydrophobic agent.
3. The composition of any of the preceding claims wherein the hydrophobic organic dedusting agent is: an alkane having between 7 and 18 carbon atoms; an alkene having between 7 and 18 carbon atoms; an alkane having between 7 and 18 carbon atoms substituted with OH or CO₂H; an alkene having between 7 and 18 carbon atoms substituted with OH or CO₂H; an aliphatic hydrocarbon oil; a natural oil; a silicone oil; an ester, alcohol, or acid of any of these; or mixtures thereof.
4. The composition of any of the preceding claims wherein the dedusting agent is mineral oil, baby oil, castor oil, corn oil, cottonseed oil, olive oil, rapeseed oil, soybean oil, sunflower oil, or an ester, alcohol, acid, or a mixture thereof.
5. The composition of any of the preceding claims wherein the dedusting agent is provided in an amount of from 100 ppm to 6000 ppm, based on the weight of the particles.



6. A process for the preparation of free-flowing water-absorbent lightly crosslinked, water-insoluble polymer particles comprising:

- 5 (a) preparing a water-swellaable hydrogel by gel polymerization;
- (b) drying and sizing the hydrogel to form a composition comprising dried and sized particles, the composition comprising a first amount of unassociated dust having a maximum diameter less than or equal to 10 microns; and
- 10 (c) contacting the composition with an effective amount of a hydrophobic organic dedusting agent to form a dedusted composition, wherein the dedusted composition is characterized by a 60 minute 0.3 psi (21,000 dynes/cm²) Absorption Under Load greater than 20 grams/gram and a
- 15 second amount of unassociated dust having a maximum diameter less than or equal to 10 microns, the second amount being less than 20 percent of the first amount.

7. The process of Claim 6 wherein the composition is characterized by the tendency to generate a third amount of unassociated dust having a maximum diameter less than or equal to 10 microns upon roll-milling of the

20 attrition resistant composition for 20 minutes, the third amount being less than or equal to the first amount.

8. The process of any of Claims 6-7 wherein the dedusting agent is an aliphatic hydrocarbon oil, an alkane having between 7 and 18 carbon atoms, an alkene having between 7 and 18 carbon atoms, an alkane having between

25 7 and 18 carbon atoms substituted with OH or CO₂H, an alkene having between 7 and 18 carbon atoms substituted with OH or CO₂H, a natural oil, a vegetable oil, an animal oil, a silicone oil, or an ester, alcohol, acid, or mixtures thereof.



9. The process of any of Claims 6-8 wherein the dedusting agent is mineral oil, baby oil, castor oil, corn oil, cottonseed oil, olive oil, rapeseed oil, soybean oil, sunflower oil, or an ester, alcohol, acid, or mixtures thereof.

5 10. An absorbent article comprising from 5 to 95 percent by weight of a superabsorbent polymer composition according to Claim 1 and 10 to 95 percent by weight of a hydrophilic fiber.

